Appendix 5.D, Quantitative Methods and Detailed Results for Effects Analysis of Chinook Salmon, Central Valley Steelhead, Green Sturgeon, and Killer Whale

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Acronyms and Abbreviations

°F	degrees Fahrenheit
7DADM	seven-day average daily maximum
ACID	Anderson-Cottonwood Irrigation District
AIC	Akaike's Information Criterion
BiOp	biological opinion
CCV	California Central Valley
cfs	cubic feet per second
cm	centimeter
CVI	Central Valley Index
CWT	coded wire tag
DCC	Delta Cross Channel
DPM	Delta Passage Model
DWR	California Department of Water Resources
FL	fork length
HSC	Habitat Suitability Criteria
I-E	inflow-export ratio
IEP	Interagency Ecological Program
IFIM	Instream Flow Incremental Methodology
km	kilometer
m	meter
m^3/sec	cubic meters per second
NAA	No Action Alternative
OMR	Old and Middle River
PA	Proposed Action
RBDD	Red Bluff Diversion Dam
Reclamation	Bureau of Reclamation
RM	River Mile
SL	Standard Length
taf	thousand acre-feet
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WUA	Weighted Usable Area
ZINB	zero-inflated negative binomial model

5.D Quantitative Methods and Detailed Results for Effects Analysis of Chinook Salmon, Central Valley Steelhead, Green Sturgeon, and Killer Whale

5.D.1 In-Delta Effects

5.D.1.1 Entrainment and Impingement

5.D.1.1.1 North Delta Exports

5.D.1.1.1.1 Screen Passage Time

Swanson et al. (2004) found that juvenile Chinook salmon mortality and injury rate in fish treadmill experiments were not statistically related to flow regime or screen contact rate. Although Swanson et al. (2004) provide equations to estimate screen contact rate for juvenile Chinook salmon, preliminary calculations for this effects analysis suggested that these equations did not perform well for the lengths of screen contemplated for the proposed NDD. Screen passage time is another useful measure of potential effects on Chinook salmon, with shorter passage times being desirable. To illustrate the potential passage time at the proposed north Delta intake screens, screen passage time for juvenile Chinook salmon of the smallest (4.4 centimeters [cm] SL [Standard Length]) and largest (7.9 cm SL) sizes examined by Swanson et al. (2004) was calculated by dividing screen length by screen passage velocity, based on Swanson et al.'s (2004) equation for the latter.

> Screen passage velocity (cm/s) = 30.94 – 11.87(day/night; day =1, night = 2) - 1.32(sweeping velocity, cm/s) + 0.72(swimming velocity, cm/s) – 0.39(orientation, degrees) + 0.27(sweeping velocity × day/night); n = 124, r^2 = 0.9064, SEE = 6.56

Swimming velocity and orientation for the above equation were calculated using other equations from Swanson et al. (2004):

> Swimming velocity (cm/s) = 27.35 – 12.85(day/night; day =1, night = 2) - 1.25(standard length, cm) + 0.21(resultant water velocity [cm/s] × day/night); n = 142, r^2 = 0.7517, SEE = 4.09

> Orientation (degrees) = 112.7 – 41.1(day/night, day = 1, night = 2) + 3.6(temperature, °C) – 1.4(resultant water velocity, cm/s) -1.1(swimming velocity, cm/s) – 0.3(flow angle, degrees) + 0.6(resultant water velocity × day/night); n = 124, r^2 = 0.4877, SEE = 18.8

In the above equations, resultant water velocity was calculated as the square root of (approach velocity^2 + sweeping velocity^2) and flow angle was calculated as the arctangent of (approach velocity)/(sweeping velocity), as described by Swanson et al. (2004).

5.D.1.1.2 South Delta Exports

Two methods were used to assess potential differences in south Delta entrainment between NAA and PA: the salvage-density method and salvage estimates based on Zeug and Cavallo (2014). Regardless of the method used to assess potential south Delta entrainment differences between NAA and PA, note that there is uncertainty regarding the population-level significance of south Delta entrainment losses for salmonids and green sturgeon. For example, incidental take of winter-run Chinook salmon juveniles as a percentage of the juvenile production estimate entering the Delta since implementation of the NMFS (2009) BiOp has averaged 0.55% of the JPE (range 0.0-1.3%) and although there is uncertainty in the method of estimating JPE, low levels of entrainment loss such as those seen in 2014 are unlikely to endanger winter-run Chinook salmon (Anderson et al. 2014).

5.D.1.1.2.1 Salvage-Density Method

The salvage-density method relies on salvage data and was used to estimate changes in entrainment at the SWP/CVP export facilities. The same basic method has been used in recent effects analyses (e.g., the DMC/California Aqueduct Intertie [Bureau of Reclamation 2009]), with refinements as necessary for the present analysis. ***Note that the method essentially functions as a description of changes in export flows weighted by seasonal changes in salvage density of covered species; although it generates estimates of numbers of fish lost, these estimates should only be used to compare one operational scenario to another (i.e., proposed action [PA] vs. no action alternative [NAA]) in order to get a sense of how south Delta exports differ during the period of Delta occurrence of NMFS-managed fishes[1].***

5.D.1.1.2.1.1 Preprocessing of Input Data

Historical monthly export data (acre-feet) for water years 1995–2009 were obtained from Reclamation's Central Valley Operations Total Tracy Pumping web page (http://www.usbr.gov/mp/cvo/vungvari/tracy_pump.pdf) and California Department of Water Resources' (DWR's) State Water Project Annual Reports of Operations (http://www.water.ca.gov/swp/operationscontrol/annual.cfm). Historical monthly salvage data for the water years 1995–2009 were provided by Sheila Greene (DWR) for all species (S. Greene pers. comm.). (Water year 2009 was excluded for some species because the data were not complete.) These data are expanded salvage data, i.e., the extrapolated estimates of the total number of fish salvaged based on a subsample that was actually identified, counted, and measured. These data provided the basic estimates of fish density (number of fish salvaged per volume of water exported) that were subsequently multiplied by simulated export data for the CALSIM modeling period (1922–2003) to assess differences between NAA and scenarios, as described in Appendix 5.B, *DSM Methods and Results*. It is acknowledged that expanded salvage estimates have inherent statistical error associated with the expansion of subsamples (Jahn 2011) but, consistent with typical analyses employing these data (e.g., Grimaldo et al. 2009), this statistical error has not been accounted for in the current salvage-density method. The salvage-density method does not account for spatial distribution of the fish populations, which could differ between NAA and PA because of other operational factors (e.g., north Delta diversions), and assumes a linear relationship between entrainment and export flows. The assumption of a linear relationship is made because of the lack of information on how salvage would increase with increasing flows. One study that examined entrainment in relation to export rate was that of Kimmerer (2008), who showed for hatchery-released Chinook salmon that percentage salvage or percentage entrainment loss was roughly linear up to total south Delta export flows of around 250–275 cubic meters/sec (approximately 8,800–9,700 cfs), depending on assumptions regarding prescreen losses (Kimmerer 2008: his Figures 9 and 10). For perspective on the current effects analysis modeling, the percentage of CALSIM-simulated months during the main entrainment

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[1] For this reason, various complex methodological refinements suggested by a scientific panel reviewing the method as part of the phase III review of the public draft Bay Delta Conservation Plan have not been implemented, as these would not be justified given the fairly coarse intent of the analysis.

period for Chinook salmon and other covered species (December–June) in which average total south Delta exports were below 8,800 cfs and 9,700 cfs were as follows.

- NAA: 83% < 8,800 cfs, 86% < 9,700 cfs.
- PA: 95% < 8,800 cfs, 98% < 9,700 cfs.

The majority of months were below export flows at which Kimmerer's (2008) study of Chinook salmon suggested considerable nonlinear percentage salvage or entrainment loss would occur. Kimmerer's (2008) study does not provide an indication of export flow rates at which nonlinearity may occur for the other species included in this analysis.

Juvenile Chinook salmon were divided into races based on fork length on the date of salvage, according to the Delta model of length at date (Brown et al. 1996). It should be noted that these divisions are not without considerable overlap between races, especially for juvenile spring-run and fall-run Chinook salmon; extrapolations of numbers of fish salvaged by race should be regarded cautiously, particularly given the relative abundance of the adult stocks from which the juveniles originate (e.g., fall-run are considerably more abundant than spring-run, and therefore the relative proportions salvaged should reflect such differences but may not when based on length criteria). Techniques such as such rapid, real-time DNA analysis are under development and may allow better classification of race in the future (Harvey et al. 2014). Data for juvenile Chinook salmon salvage were extrapolated into total entrainment losses to reflect prescreen losses (75% at SWP and 15% at CVP), louver efficiency (size-specific equations based on primary water velocity through the intake screens [California Department of Water Resources and California Department of Fish and Game 1986: Appendix A]), and losses during transport to the release site (2% for younger fish, 0% for larger fish [California Department of Water Resources and California Department of Fish and Game 1986: Appendix A]). In similar fashion, steelhead also had various entrainment losses applied: prescreen losses of 75% at SWP and 15% at CVP, and louver losses of 50%.

5.D.1.1.2.1.2 Normalization to Population Size

Winter-run Chinook salmon salvage and loss data for analysis were normalized, by measures of annual juvenile population abundance in the year of entrainment. This step aimed to adjust the salvage and loss to account for the abundance of the population (e.g., a relatively high number of fish would be expected to be entrained in a year of relatively high abundance). Normalization was undertaken by multiplying the raw monthly salvage or loss in a given month by a factor to account for the relative size of the population in that year compared to the average population size over the years from which salvage or loss data were available. The factor was the average population size in the years from which salvage data were available (1996–2009) divided by the juvenile population size appropriate to the year of salvage. Winter-run Chinook salmon estimates were normalized by the juvenile production estimate (National Marine Fisheries Service 2009). No normalization was undertaken for spring-run Chinook salmon, fall-/late fall-run Chinook salmon, steelhead, or green sturgeon because there are no suitable indices of juvenile annual abundance for these species.

5.D.1.1.2.1.3 Entrainment Index Calculation

For each species in each month at each facility, density (fish per thousand acre-foot [taf]) as entrainment loss or expanded salvage was simply calculated as the total loss or expanded salvage for the facility divided by the total volume of water exported in that month. It is acknowledged that the assumption of a linear relationship between entrainment and flow may be an oversimplification given the evidence for nonlinear relationships (e.g., Kimmerer 2008; see discussion above) and so, as previously described, ***<u>the method essentially functions as a description of changes in export flows weighted by seasonal changes in salvage density of covered species</u>***. The mean entrainment index in each month of each water-year type was calculated as follows: the salvage or loss density for a given month in a given water-year type was multiplied by the CALSIM-modeled export volume for the same month for all of the water years of that water-year type. For example, there were 5 wet years (1996–1999, 2006) in the data used to calculate salvage or loss densities and there were 26 wet years in the CALSIM modeling of 1922–2003. Using the month of January as an example, there were five unique wet January salvage or loss densities calculated. Each of these was then multiplied by each of the 26 wet January export volumes from CALSIM, giving a sample size of 130 from which to calculate means.

Although the salvage-density method does give estimates of entrainment loss or salvage in numbers of fish and there are a number of factors included in the calculations such as multipliers applied for prescreen loss and normalization to population size, ***<u>it is most appropriate to view the results comparatively, i.e., to compare relative differences between scenarios as opposed to examining the estimates of total number of fish lost to entrainment or salvaged</u>***. In essence, and as noted previously, the salvage-density method provides an entrainment index that reflects export pumping weighted by each covered species' seasonal pattern of abundance in the Delta, as reflected by historical salvage data.

5.D.1.1.2.1.4 Detailed Results

Presented below are detailed results tables from the salvage-density method for mean estimated entrainment loss by month for each water year type, grouped by facility (SWP and CVP) (Table 5.D-1 to Table 5.D-30). The results are discussed in Chapter 5, *Effects Analysis for Chinook Salmon, Central Valley Steelhead, Green Sturgeon, and Killer Whale*. Note that the results below also include fall-/late fall-run Chinook salmon, because of their consideration in the EFH analysis. As emphasized above, ***<u>it is most appropriate to view the results comparatively, i.e., to compare relative differences between scenarios as opposed to examining the estimates of total number of fish lost to entrainment or salvaged</u>***.

5.D.1.1.2.1.4.1 Winter-Run Chinook Salmon

Table 5.D-1. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Normalized Salvage Data) of Juvenile Winter-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Wet Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	423	397	-25 (-6%)		99	76	-23 (-23%)
January	2,834	1,260	-1,574 (-56%)		147	66	-81 (-55%)
February	704	162	-542 (-77%)		191	59	-132 (-69%)
March	5,756	1,566	-4,191 (-73%)		861	36	-825 (-96%)
April	909	145	-764 (-84%)		106	11	-95 (-90%)
May	2	0	-1 (-75%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	10,629	3,531	-7,097 (-67%)		1,404	248	-1,156 (-82%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the NAA (NAA).

Table 5.D-2. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Normalized Salvage Data) of Juvenile Winter-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Above Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	372	314	-58 (-16%)		19	17	-2 (-12%)
January	852	570	-282 (-33%)		50	22	-28 (-56%)
February	2,625	1,949	-676 (-26%)		178	44	-134 (-75%)
March	2,071	226	-1,845 (-89%)		311	38	-273 (-88%)
April	74	14	-60 (-81%)		50	11	-39 (-78%)
May	0	0	0 (0%)		3	1	-3 (-73%)
June	0	0	0 (0%)		1	1	0 (-36%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	5,995	3,073	-2,922 (-49%)		613	134	-479 (-78%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-3. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Normalized Salvage Data) of Juvenile Winter-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Below Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	112	93	-19 (-17%)		49	45	-4 (-9%)
January	394	181	-213 (-54%)		85	26	-59 (-70%)
February	2,014	1,399	-616 (-31%)		311	212	-100 (-32%)
March	3,063	1,718	-1,345 (-44%)		345	246	-99 (-29%)
April	20	14	-6 (-30%)		0	0	0 (0%)
May	52	29	-22 (-43%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	5,655	3,434	-2,221 (-39%)		790	529	-261 (-33%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-4. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Normalized Salvage Data) of Juvenile Winter-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Dry Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	241	216	-25 (-10%)		37	35	-2 (-6%)
January	147	104	-43 (-29%)		65	41	-24 (-37%)
February	844	739	-105 (-12%)		237	147	-91 (-38%)
March	2,011	1,657	-354 (-18%)		361	235	-126 (-35%)
April	83	59	-24 (-29%)		31	23	-8 (-25%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	3,327	2,775	-552 (-17%)		731	481	-250 (-34%)

Notes:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-5. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Normalized Salvage Data) of Juvenile Winter-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Critical Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	163	136	-27 (-17%)		38	30	-8 (-20%)
February	268	288	20 (7%)		91	56	-34 (-38%)
March	464	328	-136 (-29%)		173	154	-19 (-11%)
April	22	20	-2 (-9%)		3	3	0 (-13%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	917	772	-145 (-16%)		305	244	-62 (-20%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

5.D.1.1.2.1.4.2 Spring-Run Chinook Salmon

Table 5.D-6. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Spring-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Wet Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	7	2	-5 (-70%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	0	0	0 (0%)		0	0	0 (0%)
February	199	46	-153 (-77%)		28	9	-19 (-69%)
March	5,268	1,433	-3,835 (-73%)		3,831	158	-3,673 (-96%)
April	13,506	2,158	-11,348 (-84%)		6,525	673	-5,852 (-90%)
May	7,837	1,927	-5,910 (-75%)		3,058	238	-2,820 (-92%)
June	376	178	-198 (-53%)		158	48	-110 (-70%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	27,193	5,743	-21,449 (-79%)		13,600	1,125	-12,474 (-92%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-7. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Spring-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Above Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	5	4	-2 (-33%)		5	2	-3 (-56%)
February	57	42	-15 (-26%)		13	3	-10 (-75%)
March	4,920	536	-4,384 (-89%)		1,459	180	-1,279 (-88%)
April	9,692	1,816	-7,876 (-81%)		3,144	696	-2,449 (-78%)
May	2,165	439	-1,726 (-80%)		543	148	-395 (-73%)
June	74	34	-40 (-54%)		12	7	-4 (-36%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	9	2	-7 (-78%)		0	0	0 (0%)
Annual Mean	16,923	2,873	-14,049 (-83%)		5,176	1,035	-4,140 (-80%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-8. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Spring-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Below Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	11	5	-6 (-54%)		0	0	0 (0%)
February	27	18	-8 (-31%)		0	0	0 (0%)
March	1,818	1,020	-798 (-44%)		426	304	-122 (-29%)
April	2,269	1,580	-689 (-30%)		323	265	-58 (-18%)
May	766	437	-329 (-43%)		104	73	-31 (-30%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	4,892	3,061	-1,831 (-37%)		853	642	-211 (-25%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-9. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Spring-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Dry Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	0	0	0 (0%)		5	3	-2 (-37%)
February	0	0	0 (0%)		2	1	-1 (-38%)
March	1,104	910	-194 (-18%)		415	270	-144 (-35%)
April	5,799	4,104	-1,695 (-29%)		1,760	1,316	-445 (-25%)
May	4,033	2,365	-1,668 (-41%)		86	62	-24 (-28%)
June	0	0	0 (0%)		3	3	0 (-12%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	10,936	7,378	-3,557 (-33%)		2,271	1,655	-616 (-27%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-10. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Spring-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Critical Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	0	0	0 (0%)		0	0	0 (0%)
February	0	0	0 (0%)		0	0	0 (0%)
March	143	101	-42 (-29%)		72	64	-8 (-11%)
April	2,663	2,423	-240 (-9%)		1,160	1,006	-153 (-13%)
May	3,016	2,258	-758 (-25%)		758	705	-52 (-7%)
June	37	21	-15 (-42%)		2	2	0 (-12%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	5,859	4,804	-1,055 (-18%)		1,991	1,777	-214 (-11%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

5.D.1.1.2.1.4.3 Fall-Run Chinook Salmon

Table 5.D-11. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Fall-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Wet Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	6	2	-5 (-70%)		16	4	-12 (-76%)
November	75	29	-46 (-62%)		25	9	-16 (-64%)
December	7	6	0 (-6%)		6	4	-1 (-23%)
January	532	237	-296 (-56%)		5,599	2,516	-3,083 (-55%)
February	10,569	2,439	-8,130 (-77%)		10,913	3,362	-7,551 (-69%)
March	2,063	561	-1,502 (-73%)		1,622	67	-1,555 (-96%)
April	2,069	330	-1,738 (-84%)		1,496	154	-1,342 (-90%)
May	23,724	5,833	-17,890 (-75%)		8,588	668	-7,920 (-92%)
June	10,205	4,830	-5,375 (-53%)		8,027	2,417	-5,610 (-70%)
July	446	255	-191 (-43%)		101	47	-53 (-53%)
August	34	18	-15 (-46%)		6	2	-4 (-72%)
September	57	15	-43 (-75%)		3	1	-2 (-61%)
Annual Mean	49,787	14,556	-35,231 (-71%)		36,402	9,251	-27,150 (-75%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-12. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Fall-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Above Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		2	1	-1 (-69%)
November	0	0	0 (0%)		5	2	-2 (-53%)
December	12	10	-2 (-16%)		0	0	0 (0%)
January	16	11	-5 (-33%)		148	66	-82 (-56%)
February	5,492	4,077	-1,415 (-26%)		4,201	1,043	-3,158 (-75%)
March	2,553	278	-2,275 (-89%)		1,436	177	-1,259 (-88%)
April	1,921	360	-1,561 (-81%)		908	201	-707 (-78%)
May	7,685	1,559	-6,126 (-80%)		2,252	612	-1,640 (-73%)
June	4,441	2,050	-2,391 (-54%)		629	404	-225 (-36%)
July	76	25	-52 (-68%)		12	5	-7 (-59%)
August	27	10	-17 (-62%)		0	0	0 (0%)
September	631	142	-489 (-78%)		27	11	-16 (-60%)
Annual Mean	22,854	8,522	-14,332 (-63%)		9,619	2,521	-7,098 (-74%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-13. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Fall-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Below Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		6	1	-5 (-84%)
November	0	0	0 (0%)		7	2	-5 (-72%)
December	0	0	0 (0%)		0	0	0 (0%)
January	0	0	0 (0%)		10	3	-7 (-70%)
February	54	37	-16 (-31%)		143	98	-46 (-32%)
March	4,608	2,585	-2,023 (-44%)		5,417	3,868	-1,549 (-29%)
April	2,055	1,431	-624 (-30%)		419	344	-75 (-18%)
May	2,882	1,644	-1,238 (-43%)		1,097	768	-328 (-30%)
June	276	201	-75 (-27%)		113	82	-30 (-27%)
July	0	0	0 (0%)		7	2	-4 (-67%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	9,875	5,898	-3,977 (-40%)		7,218	5,168	-2,050 (-28%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-14. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Fall-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Dry Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	151	54	-97 (-64%)		4	1	-3 (-68%)
November	12	7	-6 (-47%)		2	1	-1 (-58%)
December	1	1	0 (-10%)		0	0	0 (0%)
January	12	9	-4 (-29%)		39	25	-15 (-37%)
February	24	21	-3 (-12%)		31	19	-12 (-38%)
March	840	692	-148 (-18%)		438	286	-152 (-35%)
April	7,101	5,025	-2,076 (-29%)		1,652	1,234	-417 (-25%)
May	18,329	10,750	-7,579 (-41%)		1,041	753	-288 (-28%)
June	68	36	-33 (-48%)		178	156	-22 (-12%)
July	0	0	0 (0%)		2	1	-1 (-59%)
August	9	7	-2 (-21%)		3	3	0 (13%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	26,548	16,601	-9,947 (-37%)		3,390	2,479	-911 (-27%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-15. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Fall-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Critical Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	0	0	0 (0%)		2	2	0 (-20%)
February	37	40	3 (7%)		22	14	-8 (-38%)
March	16	11	-5 (-29%)		16	14	-2 (-11%)
April	245	223	-22 (-9%)		234	203	-31 (-13%)
May	4,462	3,341	-1,121 (-25%)		2,005	1,866	-139 (-7%)
June	333	193	-140 (-42%)		53	46	-7 (-12%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	5,093	3,808	-1,285 (-25%)		2,333	2,146	-187 (-8%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

5.D.1.1.2.1.4.4 Late Fall-Run Chinook Salmon

Table 5.D-16. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Late Fall-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Wet Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	13	4	-9 (-70%)		1	0	-1 (-76%)
November	38	14	-23 (-62%)		15	6	-10 (-64%)
December	194	182	-12 (-6%)		21	16	-5 (-23%)
January	51	23	-28 (-56%)		14	6	-8 (-55%)
February	2	0	-1 (-77%)		0	0	0 (-69%)
March	0	0	0 (0%)		0	0	0 (0%)
April	0	0	0 (0%)		1	0	-1 (-90%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		1	0	-1 (-70%)
July	0	0	0 (0%)		0	0	0 (0%)
August	7	4	-3 (-46%)		0	0	0 (0%)
September	2	0	-1 (-75%)		0	0	0 (0%)
Annual Mean	306	228	-78 (-25%)		54	29	-25 (-47%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-17. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Late Fall-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Above Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	6	2	-4 (-71%)		2	1	-1 (-69%)
November	37	20	-17 (-45%)		14	7	-7 (-53%)
December	91	77	-14 (-16%)		18	16	-2 (-12%)
January	106	71	-35 (-33%)		10	5	-6 (-56%)
February	31	23	-8 (-26%)		0	0	0 (0%)
March	0	0	0 (0%)		0	0	0 (0%)
April	0	0	0 (0%)		0	0	0 (0%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		10	7	-4 (-36%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	9	2	-7 (-78%)		0	0	0 (0%)
Annual Mean	280	195	-85 (-30%)		54	34	-20 (-37%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-18. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Late Fall-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Below Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	23	11	-13 (-54%)		11	3	-8 (-70%)
February	0	0	0 (0%)		0	0	0 (-32%)
March	0	0	0 (0%)		0	0	0 (0%)
April	0	0	0 (0%)		0	0	0 (0%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	23	11	-13 (-54%)		12	4	-8 (-68%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-19. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Late Fall-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Dry Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	2	1	-2 (-64%)		0	0	0 (0%)
November	27	14	-13 (-47%)		6	3	-4 (-58%)
December	105	94	-11 (-10%)		25	24	-2 (-6%)
January	7	5	-2 (-29%)		0	0	0 (0%)
February	0	0	0 (0%)		0	0	0 (0%)
March	4	3	-1 (-18%)		0	0	0 (0%)
April	5	4	-2 (-29%)		0	0	0 (0%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	150	121	-29 (-20%)		32	26	-5 (-17%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-20. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Late Fall-Run Chinook Salmon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Critical Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		7	7	0 (0%)
January	28	24	-5 (-17%)		0	0	0 (0%)
February	12	13	1 (7%)		2	1	-1 (-38%)
March	0	0	0 (0%)		0	0	0 (0%)
April	0	0	0 (0%)		0	0	0 (0%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	41	37	-4 (-9%)		9	8	-1 (-8%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

5.D.1.1.2.1.4.5 Steelhead

Table 5.D-21. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Steelhead for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Wet Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	40	12	-28 (-70%)		0	0	0 (0%)
November	11	4	-7 (-62%)		3	1	-2 (-64%)
December	39	36	-2 (-6%)		5	4	-1 (-23%)
January	1,345	598	-747 (-56%)		172	77	-94 (-55%)
February	1,515	350	-1,165 (-77%)		235	72	-163 (-69%)
March	1,463	398	-1,065 (-73%)		402	17	-385 (-96%)
April	465	74	-390 (-84%)		109	11	-98 (-90%)
May	345	85	-260 (-75%)		48	4	-44 (-92%)
June	231	109	-121 (-53%)		46	14	-32 (-70%)
July	5	3	-2 (-43%)		26	12	-14 (-53%)
August	3	2	-1 (-46%)		0	0	0 (0%)
September	4	1	-3 (-75%)		0	0	0 (0%)
Annual Mean	5,464	1,671	-3,792 (-69%)		1,045	212	-833 (-80%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-22. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Steelhead for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Above Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	4	1	-3 (-71%)		0	0	0 (0%)
November	31	17	-14 (-45%)		7	3	-4 (-53%)
December	315	266	-49 (-16%)		29	25	-4 (-12%)
January	3,496	2,338	-1,157 (-33%)		775	345	-431 (-56%)
February	4,740	3,519	-1,221 (-26%)		572	142	-430 (-75%)
March	2,111	230	-1,881 (-89%)		351	43	-308 (-88%)
April	287	54	-233 (-81%)		57	13	-44 (-78%)
May	158	32	-126 (-80%)		36	10	-26 (-73%)
June	72	33	-39 (-54%)		6	4	-2 (-36%)
July	8	3	-6 (-68%)		2	1	-1 (-59%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	11,221	6,493	-4,729 (-42%)		1,834	585	-1,249 (-68%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-23. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Steelhead for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Below Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	115	96	-19 (-17%)		8	7	-1 (-9%)
January	397	182	-215 (-54%)		53	16	-37 (-70%)
February	5,193	3,605	-1,588 (-31%)		1,642	1,116	-526 (-32%)
March	2,594	1,455	-1,139 (-44%)		577	412	-165 (-29%)
April	44	31	-13 (-30%)		28	23	-5 (-18%)
May	68	39	-29 (-43%)		28	20	-8 (-30%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	8,413	5,409	-3,004 (-36%)		2,337	1,595	-742 (-32%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-24. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Steelhead for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Dry Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	2	1	-1 (-64%)		0	0	0 (0%)
November	41	22	-19 (-47%)		2	1	-1 (-58%)
December	99	89	-10 (-10%)		3	2	0 (-6%)
January	734	520	-214 (-29%)		61	39	-23 (-37%)
February	2,834	2,480	-354 (-12%)		582	360	-222 (-38%)
March	3,606	2,970	-635 (-18%)		786	513	-274 (-35%)
April	557	394	-163 (-29%)		170	127	-43 (-25%)
May	240	141	-99 (-41%)		15	11	-4 (-28%)
June	18	9	-9 (-48%)		5	5	-1 (-12%)
July	15	6	-9 (-59%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	8,147	6,633	-1,513 (-19%)		1,625	1,057	-568 (-35%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-25. Estimated Mean Monthly Entrainment Index (Number of Fish Lost, Based on Nonnormalized Salvage Data) of Juvenile Steelhead for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Critical Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	221	184	-37 (-17%)		194	154	-40 (-20%)
February	3,552	3,813	261 (7%)		490	305	-185 (-38%)
March	669	473	-196 (-29%)		107	95	-12 (-11%)
April	182	165	-16 (-9%)		40	35	-5 (-13%)
May	150	112	-38 (-25%)		7	7	-1 (-7%)
June	22	13	-9 (-42%)		0	0	0 (0%)
July	24	11	-13 (-54%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	4,819	4,771	-48 (-1%)		838	597	-242 (-29%)

Note:
[1] Negative values indicate lower entrainment loss under the proposed action (PA) than under the no action alternative (NAA).

5.D.1.1.2.1.4.6 Green Sturgeon

Table 5.D-26. Estimated Mean Monthly Entrainment Index (Number of Fish Salvaged, Based on Nonnormalized Salvage Data) of Juvenile Green Sturgeon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Wet Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	3	1	-2 (-70%)		8	2	-6 (-76%)
November	6	2	-3 (-62%)		4	1	-3 (-64%)
December	0	0	0 (0%)		9	7	-2 (-23%)
January	2	1	-1 (-56%)		0	0	0 (0%)
February	42	10	-32 (-77%)		0	0	0 (0%)
March	3	1	-2 (-73%)		0	0	0 (0%)
April	0	0	0 (-84%)		1	0	-1 (-90%)
May	0	0	0 (0%)		4	0	-4 (-92%)
June	2	1	-1 (-53%)		7	2	-5 (-70%)
July	1	1	-1 (-43%)		20	9	-11 (-53%)
August	32	17	-15 (-46%)		5	1	-4 (-72%)
September	18	4	-13 (-75%)		11	4	-7 (-61%)
Annual Mean	109	38	-71 (-65%)		69	28	-41 (-60%)

Note:
[1] Negative values indicate lower salvage loss under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-27. Estimated Mean Monthly Entrainment Index (Number of Fish Salvaged, Based on Nonnormalized Salvage Data) of Juvenile Green Sturgeon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Above Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	3	2	-1 (-33%)		0	0	0 (0%)
February	6	4	-1 (-26%)		0	0	0 (0%)
March	0	0	0 (0%)		0	0	0 (0%)
April	0	0	0 (0%)		0	0	0 (0%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	4	1	-3 (-68%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	12	7	-5 (-41%)		0	0	0 (0%)

Note:
[1] Negative values indicate lower salvage under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-28. Estimated Mean Monthly Entrainment Index (Number of Fish Salvaged, Based on Nonnormalized Salvage Data) of Juvenile Green Sturgeon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Below Normal Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	0	0	0 (0%)		0	0	0 (0%)
February	0	0	0 (0%)		0	0	0 (0%)
March	0	0	0 (0%)		0	0	0 (0%)
April	0	0	0 (0%)		0	0	0 (0%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	0	0	0 (0%)		0	0	0 (0%)

Note:
[1] Negative values indicate lower salvage under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-29. Estimated Mean Monthly Entrainment Index (Number of Fish Salvaged, Based on Nonnormalized Salvage Data) of Juvenile Green Sturgeon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Dry Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		18	6	-13 (-68%)
November	1	0	0 (-47%)		22	9	-13 (-58%)
December	17	15	-2 (-10%)		8	7	0 (-6%)
January	0	0	0 (0%)		3	2	-1 (-37%)
February	0	0	0 (0%)		0	0	0 (0%)
March	4	3	-1 (-18%)		0	0	0 (0%)
April	0	0	0 (0%)		0	0	0 (0%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	22	19	-3 (-13%)		51	24	-27 (-53%)

Note:
[1] Negative values indicate lower salvage under the proposed action (PA) than under the no action alternative (NAA).

Table 5.D-30. Estimated Mean Monthly Entrainment Index (Number of Fish Salvaged, Based on Nonnormalized Salvage Data) of Juvenile Green Sturgeon for NAA and PA Scenarios at the SWP and CVP Salvage Facilities for Critical Water Years

Month	State Water Project				Central Valley Project		
	NAA	PA	PA vs. NAA[1]		NAA	PA	PA vs. NAA[1]
October	0	0	0 (0%)		0	0	0 (0%)
November	0	0	0 (0%)		0	0	0 (0%)
December	0	0	0 (0%)		0	0	0 (0%)
January	0	0	0 (0%)		4	3	-1 (-20%)
February	0	0	0 (0%)		0	0	0 (0%)
March	0	0	0 (0%)		0	0	0 (0%)
April	0	0	0 (0%)		3	3	0 (-13%)
May	0	0	0 (0%)		0	0	0 (0%)
June	0	0	0 (0%)		0	0	0 (0%)
July	0	0	0 (0%)		0	0	0 (0%)
August	0	0	0 (0%)		0	0	0 (0%)
September	0	0	0 (0%)		0	0	0 (0%)
Annual Mean	0	0	0 (0%)		7	5	-1 (-17%)

Note:
[1]Negative values indicate lower salvage under the proposed action (PA) than under the no action alternative (NAA).

5.D.1.1.2.2 Salvage Based on Zeug and Cavallo (2014)

An analysis to evaluate differences in entrainment (salvage) at the south Delta export facilities between NAA and PA was done following the statistical models of salvage of marked (coded-wire tags) hatchery-reared Chinook salmon published by Zeug and Cavallo (2014). The analysis focused on winter-run Chinook salmon; spring-run Chinook salmon were not included because very few marked individuals were salvaged and so the statistical models could not be fit successfully (Zeug and Cavallo 2014). Several modifications to the methods of Zeug and Cavallo (2014) were employed to focus on relevant model predictors. First, statistical models of the empirical data were constructed using only releases of winter-run Chinook salmon raised at the Livingston Stone Hatchery. Second, salvage at the CVP and SWP south Delta export facilities was combined and combined exports were used as a predictor rather than modeling each facility separately. This was done because the range of south Delta export flows from the individual facilities during the 82-year CalSim-II period exceeded the range of the observed data. However, when both south Delta export facilities are combined, the ranges of modeled and observed data almost completely overlap. Third, some variables were excluded from the statistical models because they were not significant in the original analysis or they were not relevant in this context. For example, the original analysis used the variable “distance of release from the facilities”. However, winter-run Chinook salmon were only released from a single location, making this predictor irrelevant. Finally, to determine which hydrologic variables were the best predictors of salvage, a model selection exercise was performed using the original data from Zeug and Cavallo (2014).

The model selection exercise included five potential hydrologic predictor variables including; Old and Middle River flows (OMR), inflow-export ratio (I-E)[2], total south Delta exports, San Joaquin River flow, Sacramento River flow and one biological variable (mean fork length at release). Most of these variables were strongly correlated so models were constructed only with variables that had correlation coefficients <0.70 to avoid unacceptable multicolinearity. Table 5.D-31 contains a list of candidate models examined in this exercise. A zero-inflated negative binomial model (ZINB) was fit based only on winter run releases (178 release groups, > 1 million individuals) for each candidate model with standardized predictors for both the count and zero-inflation portion of the models and the log number of fish released as an offset variable in the count portion of the model.

To select the best approximating model, Akaike’s Information Criterion (AIC) was calculated for each model. The model with the lowest AIC value was identified as the best approximating model. The AIC value of all other models was subtracted from the value of the best approximating model to calculate the ΔAIC. Any model that had a ΔAIC value ≤ 2.0 was considered a competing model with the best approximating model.

[2] Note that is based on the original data from Zeug and Cavallo (2014), and therefore only includes south Delta exports.

Table 5.D-31. Six candidate models of salvage evaluated to determine which hydrologic variables were the best predictors of winter run salvage.

	Length	Sac Flow	SJ Flow	Exports	OMR	I:E Ratio	AICc
Model 1	X	X		X			462.3
Model 2	X	X			X		468.1
Model 3	X	X	X				485.3
Model 4	X	X				X	480.1
Model 5	X	X	X	X			465.1
Model 6	X	X					490.5

A single best model of salvage was selected with no other model having a ΔAIC <2.8. This model had three predictor variables for the count model and zero inflation models including mean fork length of fish at release, Sacramento River flow, and total exports (Table 5.D-32). The final count model indicated that non-zero salvage was greater when fish were released at a larger size, flow in the Sacramento River was higher, and exports were higher (Table 5.D-32). For the zero inflation model, coefficients indicated zero salvage was more likely when fish were released at a smaller size, Sacramento River flow was higher, and exports were lower (Table 5.D-32).

Table 5.D-32. Parameter estimates from the best approximating model of winter run salvage.

Model Parameter	Count model		Zero Inflation Model	
	Coefficient	p-value	Coefficient	p-value
Fork length	0.709	< 0.001	-0.776	<0.001
Sacramento River flow	0.155	0.707	0.610	0.140
Total exports	0.350	0.006	-0.957	<0.001

To predict salvage under the NAA and PA, daily flow and export data from DSM2 output was aggregated into 7-day running means and standardized to the same scale as the empirical data. This was done to mimic the way data were aggregated in the original publication (7-day means) and the winter-run specific models described above. A 7-day mean was used because an acoustic tagging study revealed that was the approximate mean time Chinook salmon smolts spent transiting through the Delta (Zeug and Cavallo 2014). The total number of fish entering the Delta in a season was then multiplied by the daily entry proportion defined by the same distribution used in the Delta Passage Model. The log-transformed product of this calculation was used as the offset on each day. The distribution did not weight the result but simply distributed the fish over time.

The values described above (DSM2 data, offset, fish fork length) are used as inputs in the ZINB model to predict the mean salvage for each day. The size of fish entering the delta was set as the midpoint size on the 15th of each month using the Delta length-at-date model (Table 5.D-33). After January, the midpoint value was higher than the observed sizes at release and the model was set to the maximum observed fork length from February–June (95 mm). However, it should be noted that the statistical model uses size at release in the Sacramento River near Redding, CA and fish are assumed to grow between release and the salvage facilities. The mean daily salvage values were then summarized by month and reported as the proportion of total annual salvage observed in each month. Additionally, the annual predicted value of salvage in each of the 82 water years was plotted for the NAA and the PA.

Table 5.D-33. Winter run size (mm fork length) predicted by the Delta model (midpoint of range on the 15th of each month) and the size of fish used in the model based on observed data.

	Delta Model	Value Used
October	56.5	56.5
November	72.5	72.5
December	93	93
January	119	95
February	153.5	95
March	193.5	95
April	218	95
May	237	95
June	262	95

5.D.1.2 Indirect Mortality Within the Delta (Through-Delta Survival)

5.D.1.2.1 Delta Hydrodynamics (DSM2-HYDRO Velocity and Flow Routing at Junctions)

An examination of differences in Delta hydrodynamics was undertaken based on outputs from DSM2-HYDRO modeling (see Appendix 5.B, *DSM Methods and Results*, for overview of this modeling). The analysis included assessments of differences in velocity (overall velocity, negative velocity, and proportion of time with negative velocity) and flow routing at junctions.

5.D.1.2.1.1 Methods

5.D.1.2.1.1.1 Velocity

Velocity is superior variable than flow for examining potential effects on fish because its effects do not vary with channel size and it has a direct relationship with bioenergetics. Negative (upstream) velocity may potentially affect migrating juvenile salmonids by delaying migration, or causing fish to move back and forth in front of junctions leading to lower survival routes, increasing the chance of entering those routes. If fish require more time to transit the Delta, mortality may increase if mortality is a function of time or a function of both time and distance. Ideally, changes in velocity should be linked to species characteristics or thresholds to evaluate potential effects (e.g., in terms of fish energetics), although for this analysis there was no such linkage undertaken.

The analysis of velocity examined three metrics: magnitude of channel velocity (i.e., overall velocity, including positive, zero, and negative velocity); magnitude of negative velocity measurements; and daily proportion of time velocity is negative. Ten DSM2 channels were examined based on hypothesized biological relevance (Table 5.D-34). Overall velocity statistics were based on 15-min DSM2-HYDRO measurements for the 82-year time simulation period. The proportion of negative velocity measurements (15 min-increments) was calculated for each day (one proportion for each day). Summary statistics (boxplots) were constructed for each month and each water year-type from October through June where the unit is the daily proportion of negative velocity calculated from the 15-min increment data. Similar to the estimates of overall velocity, the magnitude of negative velocity was also calculated from the 15-minute DSM2 data for each of the channels listed above.

For each metric, box plots were constructed from the 15-minute (overall velocity and negative velocity) and 1-day (proportion of negative velocity) data for each month and water year-type.

For channels where the difference in the median proportion of negative velocities between NAA and PA in any month was ≥ 5%, the results were discussed in detail. Similarly, if the median magnitude of negative velocities was ≥ 0.10 ft/s in any month at any channel, greater detail will be provided. The detail provided included a description of how descriptive statistics varied between scenarios including minimum values, maximum values, 25th quantile, 75th quantile, and median values.

Table 5.D-34. Channels used in the analysis of velocity under the NAA and the PA.

DSM2 Channel	Description	Hypothesized importance
21	San Joaquin River downstream of the head of Old River.	Fish in this region have avoided entering the interior Delta at Head of Old River and are in a potentially higher survival route, where survival may be influenced by river flow (velocity).
45	San Joaquin River near the confluence with the Mokelumne River.	Fish entering the San Joaquin River from the Sacramento River via Georgiana Slough and the DCC experience this area.
94	Old River downstream of the south Delta export facilities.	Fish attempting to move north from the south Delta experience are within the hydrodynamic footprint of the south Delta export facilities and are particularly susceptible to entrainment.
212	Old River upstream of the south Delta export facilities.	Fish moving through Old River experience conditions in this channel as they approach the facilities.
418	Sacramento River downstream of proposed NDD.	Fish moving down the Sacramento River could experience operational effects in this region (flow-survival relationships).
421	Sacramento River upstream of Georgiana Slough.	This region is where fish may enter the interior Delta from the Sacramento River, and there may be flow-survival relationships.
423	Sacramento River downstream of Georgiana Slough.	This region is where fish may enter the interior Delta from the Sacramento River, and river flow (velocity) may affect survival (i.e., there is a significant flow-survival relationship; Perry 2010).
DCC	Delta Cross Channel	Fish from the Sacramento River may enter the interior Delta through this channel.
379	Steamboat Slough	Fish using this route are not exposed to entrainment into Georgiana Slough and the DCC, and river flow (velocity) may affect survival (i.e., there is a significant flow-survival relationship; Perry 2010)
383	Sutter Slough	Fish using this route are not exposed to entrainment into Georgiana Slough and the DCC, and river flow (velocity) may affect survival (i.e., there is a significant flow-survival relationship; Perry 2010)

5.D.1.2.1.1.2 Flow Routing at Junctions

Many routes can potentially be used by fish migrating through the Delta and survival through these routes can be significantly different (Newman 2008; Perry et al. 2010). Thus, routing of fish at junctions and how routing could be affected by project operations has the potential to influence through-Delta survival. In general, routes that keep fish in the mainstem Sacramento and San Joaquin Rivers are superior to routes leading into the interior Delta (Hankin et al. 2010;

Perry et al. 2010), although some recent findings for the San Joaquin River have not supported this generality (Buchanan et al. 2013). Perry (2010) found that the routing of fish into the interior delta through the combined junction of Georgiana Slough and the Delta Cross Channel was a function of the total flow entering the interior delta through both of those junctions. This is the function represented in Figure 6.7 within Perry (2010). This function indicated that the slope of the relationship was less than 1.

Cavallo et al. (2015) performed a meta-analysis of routing at 6 Delta junctions and found that the proportion of flow entering a junction explained 70% of the variation in routing. Similar to the Perry (2010) study, the slope of this relationship was less than 1 suggesting fish move into junctions at a rate less than the proportion of flow. Both of these studies present strong evidence that routing at junctions is a function of flow into that junction.

For the present effects analysis of the PA, flow routing into junctions was based on the proportion of flow entering a junction away from the main stem, from DSM2-HYDRO outputs. Fifteen-minute data were used to calculate the daily proportion of flow that enters the junction, following the methods of Cavallo et al. (2015). Similar to the analysis of velocity described previously, the daily value calculated from the 15-minute data will be used to calculate summary statistics (box plots) for each month (December–June) and water year-type. If the median entrainment values under NAA and PA differed by ≥ 5% for any month, greater detail in the description of results was provided, based on a comparison of minimum values, maximum values, 25th quantile, 75th quantile, and median values.

Flow into seven junctions was analyzed using this metric: junctions from the Sacramento River included Sutter-Steamboat Sloughs, Delta Cross Channel, and Georgiana Slough; junctions from the San Joaquin River included head of Old River, Turner Cut, Columbia Cut, Middle River, and the mouth of Old River.

The combined evidence from the literature strongly indicates routing is a function of flow. Thus, it can be assumed routing of fish toward the interior delta will increase as the proportion of flow entering the junction increases. However, the slope of the relationship will be less than 1.

5.D.1.2.1.2 Results

5.D.1.2.1.2.1 Velocity

5.D.1.2.1.2.1.1 Overall Velocity

5.D.1.2.1.2.1.1.1 Channel 21, San Joaquin River downstream of the head of Old River

Wet Water Years

In the month of January during wet water years, the median water velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.378 for the NAA and 0.433 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.065 and 0.047 for the PA while the 75th percentile value was 0.589 and 0.655 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.625 and -0.603 for the PA while the maximum value was 2.757 and 2.755 for the PA (Figure 5.D-1).

In the month of February during wet water years, the median water velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.473 for the NAA and 0.533 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was 0.075 and 0.18 for the PA while the 75th percentile value was 0.704 and 0.755 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.612 and -0.559 for the PA while the maximum value was 2.006 and 2.002 for the PA (Figure 5.D-1).

In the month of March during wet water years, the median water velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.482 for the NAA and 0.548 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was 0.113 and 0.213 for the PA while the 75th percentile value was 0.719 and 0.769 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.644 and -0.594 for the PA while the maximum value was 1.798 and 1.799 for the PA (Figure 5.D-1).

In the month of April during wet water years, the median water velocity was predicted to be 15% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.428 for the NAA and 0.493 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was 0.067 and 0.157 for the PA while the 75th percentile value was 0.621 and 0.681 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.543 and -0.462 for the PA while the maximum value was 1.313 and 1.314 for the PA (Figure 5.D-1).

In the month of May during wet water years, the median water velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.407 for the NAA and 0.462 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was 0.036 and 0.121 for the PA while the 75th percentile value was 0.606 and 0.662 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.537 and -0.459 for the PA while the maximum value was 1.222 and 1.22 for the PA (Figure 5.D-1).

In the month of June during wet water years, the median water velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.33 for the NAA and 0.355 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.065 and -0.017 for the PA while the 75th percentile value was 0.543 and 0.569 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.578 and -0.582 for the PA while the maximum value was 1.185 and 1.181 for the PA (Figure 5.D-1).

Above Normal Water Years

In the month of January during above normal water years, the median water velocity was predicted to be 23% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.239 for the NAA and 0.295 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.219 and -0.129 for the PA while the 75th percentile value was 0.464 and 0.511 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.659 and -0.626 for the PA while the maximum value was 1.209 and 1.199 for the PA (Figure 5.D-1).

In the month of February during above normal water years, the median water velocity was predicted to be 21% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.308 for the NAA and 0.371 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.148 and -0.037 for the PA while the 75th percentile value was 0.515 and 0.571 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.651 and -0.642 for the PA while the maximum value was 1.297 and 1.29 for the PA (Figure 5.D-1).

In the month of March during above normal water years, the median water velocity was predicted to be 25% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.295 for the NAA and 0.368 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.114 and 0.01 for the PA while the 75th percentile value was 0.507 and 0.568 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.634 and -0.588 for the PA while the maximum value was 1.172 and 1.174 for the PA (Figure 5.D-1).

In the month of April during above normal water years, the median water velocity was predicted to be 30% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.271 for the NAA and 0.351 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.128 and -0.011 for the PA while the 75th percentile value was 0.488 and 0.557 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.592 and -0.551 for the PA while the maximum value was 0.939 and 0.94 for the PA (Figure 5.D-1).

In the month of May during above normal water years, the median water velocity was predicted to be 31% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.254 for the NAA and 0.331 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.156 and -0.041 for the PA while the 75th percentile value was 0.486 and 0.546 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.571 and -0.517 for the PA while the maximum value was 1.005 and 0.995 for the PA (Figure 5.D-1).

In the month of June during above normal water years, the median water velocity was predicted to be 30% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.152 for the NAA and 0.196 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.235 and -0.2 for the PA while the 75th percentile value was 0.439 and 0.461 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.583 and -0.587 for the PA while the maximum value was 0.799 and 0.93 for the PA (Figure 5.D-1).

Below Normal Water Years

In the month of January during below normal water years, the median water velocity was predicted to be 54% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.131 for the NAA and 0.202 for the PA (Figure 5.D-1).

The 25th percentile value of water velocity (ft/s) for the NAA was -0.284 and -0.204 for the PA while the 75th percentile value was 0.423 and 0.465 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.621 and -0.598 for the PA while the maximum value was 0.939 and 1.067 for the PA (Figure 5.D-1).

In the month of February during below normal water years, the median water velocity was predicted to be 20% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.265 for the NAA and 0.318 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.212 and -0.121 for the PA while the 75th percentile value was 0.472 and 0.515 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.642 and -0.619 for the PA while the maximum value was 1.122 and 1.106 for the PA (Figure 5.D-1).

In the month of March during below normal water years, the median water velocity was predicted to be 49% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.169 for the NAA and 0.251 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.225 and -0.127 for the PA while the 75th percentile value was 0.441 and 0.487 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.661 and -0.635 for the PA while the maximum value was 0.844 and 0.979 for the PA (Figure 5.D-1).

In the month of April during below normal water years, the median water velocity was predicted to be 44% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.199 for the NAA and 0.286 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.191 and -0.089 for the PA while the 75th percentile value was 0.46 and 0.51 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.582 and -0.532 for the PA while the maximum value was 0.777 and 0.904 for the PA (Figure 5.D-1).

In the month of May during below normal water years, the median water velocity was predicted to be 47% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.166 for the NAA and 0.245 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.221 and -0.124 for the PA while the 75th percentile value was 0.448 and 0.492 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.57 and -0.523 for the PA while the maximum value was 0.768 and 0.887 for the PA (Figure 5.D-1).

In the month of June during below normal water years, the median water velocity was predicted to be 22% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.097 for the NAA and 0.118 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.283 and -0.265 for the PA while the 75th percentile value was 0.402 and 0.418 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.584 and -0.584 for the PA while the maximum value was 0.684 and 0.737 for the PA (Figure 5.D-1).

Dry Water Years

In the month of January during dry water years, the median water velocity was predicted to be 52% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.112 for the NAA and 0.171 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.3 and -0.227 for the PA while the 75th percentile value was 0.417 and 0.457 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.72 and -0.684 for the PA while the maximum value was 0.722 and 0.789 for the PA (Figure 5.D-1).

In the month of February during dry water years, the median water velocity was predicted to be 34% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.167 for the NAA and 0.223 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.276 and -0.202 for the PA while the 75th percentile value was 0.435 and 0.472 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.641 and -0.605 for the PA while the maximum value was 1.312 and 1.312 for the PA (Figure 5.D-1).

In the month of March during dry water years, the median water velocity was predicted to be 32% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.172 for the NAA and 0.228 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.278 and -0.207 for the PA while the 75th percentile value was 0.427 and 0.462 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.638 and -0.603 for the PA while the maximum value was 1.011 and 1.007 for the PA (Figure 5.D-1).

In the month of April during dry water years, the median water velocity was predicted to be 40% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.167 for the NAA and 0.234 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.244 and -0.166 for the PA while the 75th percentile value was 0.435 and 0.472 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.641 and -0.612 for the PA while the maximum value was 0.814 and 0.938 for the PA (Figure 5.D-1).

In the month of May during dry water years, the median water velocity was predicted to be 39% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.155 for the NAA and 0.217 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.261 and -0.186 for the PA while the 75th percentile value was 0.432 and 0.469 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.644 and -0.612 for the PA while the maximum value was 1.03 and 1.03 for the PA (Figure 5.D-1).

In the month of June during dry water years, the median water velocity was predicted to be 22% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.09 for the NAA and 0.11 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.297 and -0.282 for the PA while the 75th percentile value was 0.391 and 0.405 for the PA (Figure 5.D-1). The minimum value of water

velocity (ft/s) for the NAA was -0.651 and -0.645 for the PA while the maximum value was 0.683 and 0.787 for the PA (Figure 5.D-1).

Critical Water Years

In the month of January during critical water years, the median water velocity was predicted to be 47% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.087 for the NAA and 0.128 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.329 and -0.273 for the PA while the 75th percentile value was 0.398 and 0.435 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.686 and -0.641 for the PA while the maximum value was 0.629 and 0.706 for the PA (Figure 5.D-1).

In the month of February during critical water years, the median water velocity was predicted to be 40% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.12 for the NAA and 0.167 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.297 and -0.233 for the PA while the 75th percentile value was 0.415 and 0.451 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.624 and -0.587 for the PA while the maximum value was 0.766 and 0.839 for the PA (Figure 5.D-1).

In the month of March during critical water years, the median water velocity was predicted to be 37% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.104 for the NAA and 0.142 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.311 and -0.261 for the PA while the 75th percentile value was 0.402 and 0.43 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.763 and -0.738 for the PA while the maximum value was 0.67 and 0.735 for the PA (Figure 5.D-1).

In the month of April during critical water years, the median water velocity was predicted to be 35% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.099 for the NAA and 0.134 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.314 and -0.268 for the PA while the 75th percentile value was 0.399 and 0.424 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.658 and -0.636 for the PA while the maximum value was 0.674 and 0.76 for the PA (Figure 5.D-1).

In the month of May during critical water years, the median water velocity was predicted to be 38% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.092 for the NAA and 0.128 for the PA (Figure 5.D-1). The 25th percentile value of water velocity (ft/s) for the NAA was -0.311 and -0.262 for the PA while the 75th percentile value was 0.402 and 0.428 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.619 and -0.597 for the PA while the maximum value was 0.657 and 0.74 for the PA (Figure 5.D-1).

In the month of June during critical water years, the median water velocity was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-1). Median water velocity (ft/s) was 0.076 for the NAA and 0.083 for the PA (Figure 5.D-1). The 25th percentile

value of water velocity (ft/s) for the NAA was -0.309 and -0.304 for the PA while the 75th percentile value was 0.373 and 0.383 for the PA (Figure 5.D-1). The minimum value of water velocity (ft/s) for the NAA was -0.597 and -0.595 for the PA while the maximum value was 0.618 and 0.68 for the PA (Figure 5.D-1).

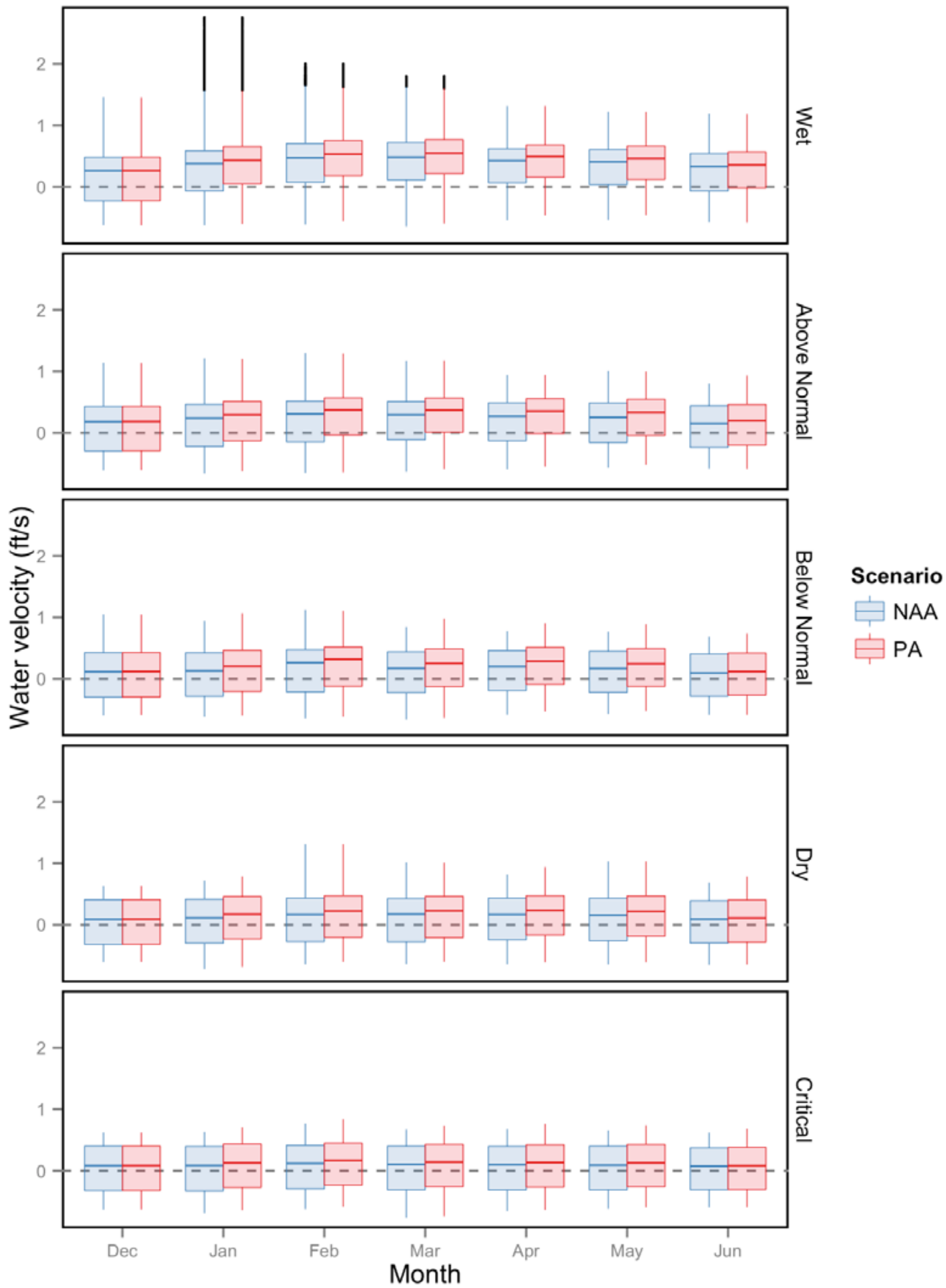


Figure 5.D-1. Velocity of flow entering the interior delta at channel 21, the San Joaquin River downstream of the head of Old River, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.1.2 Channel 45, San Joaquin River near the confluence with the Mokelumne River

Wet Water Years

In the month of January during wet water years, the median water velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.432 for the NAA and 0.488 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.097 and -1.058 for the PA while the 75th percentile value was 1.311 and 1.352 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.136 and -2.091 for the PA while the maximum value was 2.169 and 2.215 for the PA (Figure 5.D-2).

In the month of February during wet water years, the median water velocity was predicted to be 18% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.471 for the NAA and 0.554 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.022 and -0.953 for the PA while the 75th percentile value was 1.33 and 1.389 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.14 and -2.07 for the PA while the maximum value was 2.052 and 2.112 for the PA (Figure 5.D-2).

In the month of March during wet water years, the median water velocity was predicted to be 22% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.452 for the NAA and 0.55 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.081 and -1.002 for the PA while the 75th percentile value was 1.364 and 1.427 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.154 and -2.114 for the PA while the maximum value was 1.94 and 1.979 for the PA (Figure 5.D-2).

In the month of April during wet water years, the median water velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.439 for the NAA and 0.474 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.102 and -1.075 for the PA while the 75th percentile value was 1.4 and 1.423 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.067 and -2.059 for the PA while the maximum value was 2.014 and 2.047 for the PA (Figure 5.D-2).

In the month of May during wet water years, the median water velocity was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.394 for the NAA and 0.43 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.137 and -1.109 for the PA while the 75th percentile value was 1.382 and 1.405 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.058 and -2.048 for the PA while the maximum value was 2.073 and 2.103 for the PA (Figure 5.D-2).

In the month of June during wet water years, the median water velocity was predicted to be 27% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.232 for the NAA and 0.293 for the PA (Figure 5.D-2). The 25th percentile

value of water velocity (ft/s) for the NAA was -1.247 and -1.203 for the PA while the 75th percentile value was 1.29 and 1.328 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.069 and -2.062 for the PA while the maximum value was 2.098 and 2.124 for the PA (Figure 5.D-2).

Above Normal Water Years

In the month of December during above normal water years, the median water velocity was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.14 for the NAA and 0.155 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.314 and -1.299 for the PA while the 75th percentile value was 1.233 and 1.244 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.141 and -2.13 for the PA while the maximum value was 2.042 and 2.084 for the PA (Figure 5.D-2).

In the month of January during above normal water years, the median water velocity was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.269 for the NAA and 0.3 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.224 and -1.202 for the PA while the 75th percentile value was 1.292 and 1.313 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.161 and -2.144 for the PA while the maximum value was 1.996 and 2.065 for the PA (Figure 5.D-2).

In the month of February during above normal water years, the median water velocity was predicted to be 10% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.334 for the NAA and 0.368 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.178 and -1.149 for the PA while the 75th percentile value was 1.322 and 1.345 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.167 and -2.136 for the PA while the maximum value was 1.964 and 2.015 for the PA (Figure 5.D-2).

In the month of March during above normal water years, the median water velocity was predicted to be 31% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.293 for the NAA and 0.385 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.204 and -1.139 for the PA while the 75th percentile value was 1.326 and 1.384 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.144 and -2.093 for the PA while the maximum value was 1.872 and 1.912 for the PA (Figure 5.D-2).

In the month of April during above normal water years, the median water velocity was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.298 for the NAA and 0.324 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.217 and -1.201 for the PA while the 75th percentile value was 1.365 and 1.378 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.133 and -2.128 for the PA while the maximum value was 1.917 and 1.953 for the PA (Figure 5.D-2).

In the month of May during above normal water years, the median water velocity was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.247 for the NAA and 0.27 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.254 and -1.239 for the PA while the 75th percentile value was 1.337 and 1.348 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.07 and -2.063 for the PA while the maximum value was 1.963 and 1.986 for the PA (Figure 5.D-2).

In the month of June during above normal water years, the median water velocity was predicted to be 21% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.142 for the NAA and 0.171 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.313 and -1.299 for the PA while the 75th percentile value was 1.263 and 1.289 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.076 and -2.068 for the PA while the maximum value was 1.932 and 1.952 for the PA (Figure 5.D-2).

Below Normal Water Years

In the month of December during below normal water years, the median water velocity was predicted to be 34% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.061 for the NAA and 0.081 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.364 and -1.349 for the PA while the 75th percentile value was 1.214 and 1.224 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.155 and -2.139 for the PA while the maximum value was 1.891 and 1.904 for the PA (Figure 5.D-2).

In the month of January during below normal water years, the median water velocity was predicted to be 45% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.131 for the NAA and 0.191 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.316 and -1.275 for the PA while the 75th percentile value was 1.255 and 1.292 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.111 and -2.094 for the PA while the maximum value was 1.92 and 1.973 for the PA (Figure 5.D-2).

In the month of February during below normal water years, the median water velocity was predicted to be 10% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.237 for the NAA and 0.26 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.248 and -1.228 for the PA while the 75th percentile value was 1.32 and 1.333 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.175 and -2.166 for the PA while the maximum value was 1.929 and 1.973 for the PA (Figure 5.D-2).

In the month of March during below normal water years, the median water velocity was predicted to be 17% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.168 for the NAA and 0.197 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.294 and -1.27 for the PA while the 75th percentile value was 1.303 and 1.321 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.129 and -2.11 for the PA while the maximum value was 1.84 and 1.85 for the PA (Figure 5.D-2).

In the month of May during below normal water years, the median water velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.172 for the NAA and 0.186 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.281 and -1.275 for the PA while the 75th percentile value was 1.318 and 1.323 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.107 and -2.105 for the PA while the maximum value was 1.926 and 1.936 for the PA (Figure 5.D-2).

In the month of June during below normal water years, the median water velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.13 for the NAA and 0.139 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.308 and -1.304 for the PA while the 75th percentile value was 1.262 and 1.271 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.119 and -2.112 for the PA while the maximum value was 1.913 and 1.912 for the PA (Figure 5.D-2).

Dry Water Years

In the month of December during dry water years, the median water velocity was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.068 for the NAA and 0.076 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.358 and -1.35 for the PA while the 75th percentile value was 1.22 and 1.224 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.092 and -2.106 for the PA while the maximum value was 1.914 and 1.918 for the PA (Figure 5.D-2).

In the month of January during dry water years, the median water velocity was predicted to be 27% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.118 for the NAA and 0.149 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.326 and -1.305 for the PA while the 75th percentile value was 1.252 and 1.271 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.215 and -2.2 for the PA while the maximum value was 1.945 and 1.968 for the PA (Figure 5.D-2).

In the month of February during dry water years, the median water velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.184 for the NAA and 0.198 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.3 and -1.288 for the PA while the 75th percentile value was 1.302 and 1.311 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.145 and -2.139 for the PA while the maximum value was 1.954 and 1.973 for the PA (Figure 5.D-2).

In the month of March during dry water years, the median water velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.192 for the NAA and 0.203 for the PA (Figure 5.D-2). The 25th percentile

value of water velocity (ft/s) for the NAA was -1.289 and -1.276 for the PA while the 75th percentile value was 1.323 and 1.328 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.202 and -2.172 for the PA while the maximum value was 1.867 and 1.862 for the PA (Figure 5.D-2).

In the month of April during dry water years, the median water velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.195 for the NAA and 0.208 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.275 and -1.269 for the PA while the 75th percentile value was 1.33 and 1.335 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.146 and -2.145 for the PA while the maximum value was 1.87 and 1.895 for the PA (Figure 5.D-2).

In the month of May during dry water years, the median water velocity was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.158 for the NAA and 0.172 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.294 and -1.286 for the PA while the 75th percentile value was 1.303 and 1.311 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.12 and -2.119 for the PA while the maximum value was 1.991 and 1.993 for the PA (Figure 5.D-2).

In the month of June during dry water years, the median water velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.134 for the NAA and 0.143 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.312 and -1.308 for the PA while the 75th percentile value was 1.268 and 1.277 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.132 and -2.125 for the PA while the maximum value was 1.933 and 1.929 for the PA (Figure 5.D-2).

Critical Water Years

In the month of January during critical water years, the median water velocity was predicted to be 21% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.092 for the NAA and 0.111 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.334 and -1.324 for the PA while the 75th percentile value was 1.251 and 1.262 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.099 and -2.09 for the PA while the maximum value was 1.925 and 1.929 for the PA (Figure 5.D-2).

In the month of March during critical water years, the median water velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-2). Median water velocity (ft/s) was 0.152 for the NAA and 0.161 for the PA (Figure 5.D-2). The 25th percentile value of water velocity (ft/s) for the NAA was -1.306 and -1.302 for the PA while the 75th percentile value was 1.321 and 1.324 for the PA (Figure 5.D-2). The minimum value of water velocity (ft/s) for the NAA was -2.202 and -2.201 for the PA while the maximum value was 1.821 and 1.825 for the PA (Figure 5.D-2).

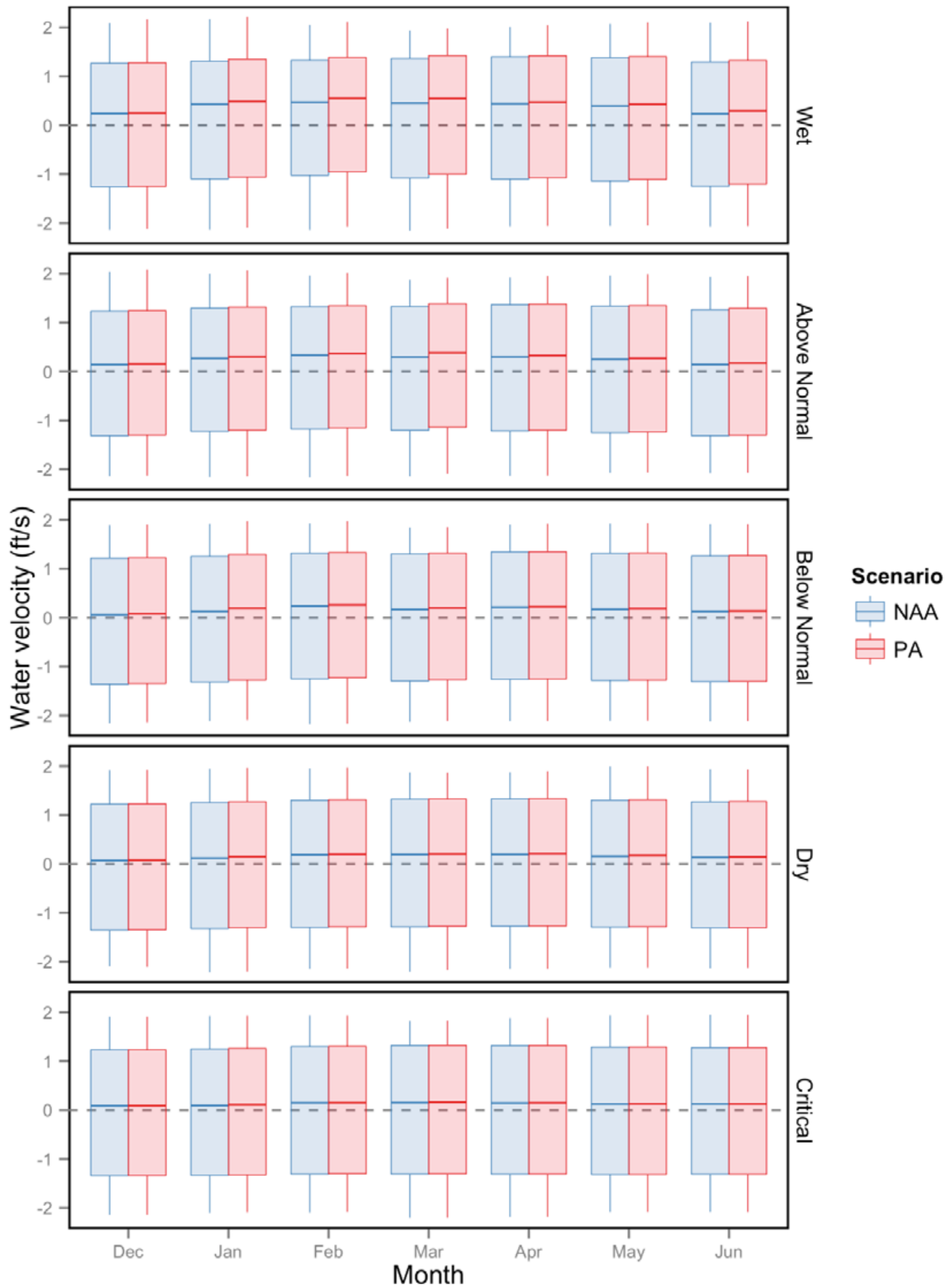


Figure 5.D-2. Velocity of flow entering the interior at delta channel 45, the San Joaquin River near the confluence with the Mokelumne River, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.1.3 Channel 94, Old River downstream of the facilities

Wet Water Years

In the month of December during wet water years, the median water velocity was predicted to be 30% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.25 for the NAA and -0.175 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -1.033 and -1.007 for the PA while the 75th percentile value was 0.406 and 0.47 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.558 and -1.54 for the PA while the maximum value was 1.425 and 1.658 for the PA (Figure 5.D-3).

In the month of January during wet water years, the median water velocity was predicted to be 5831% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.004 for the NAA and 0.227 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.894 and -0.778 for the PA while the 75th percentile value was 0.595 and 0.826 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.515 and -1.409 for the PA while the maximum value was 2.405 and 2.666 for the PA (Figure 5.D-3).

In the month of February during wet water years, the median water velocity was predicted to be 1138% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.036 for the NAA and 0.448 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.844 and -0.602 for the PA while the 75th percentile value was 0.575 and 0.93 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.52 and -1.381 for the PA while the maximum value was 1.664 and 1.945 for the PA (Figure 5.D-3).

In the month of March during wet water years, the median water velocity was predicted to be 877% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.052 for the NAA and 0.505 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.853 and -0.542 for the PA while the 75th percentile value was 0.604 and 0.994 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.461 and -1.276 for the PA while the maximum value was 1.904 and 2.022 for the PA (Figure 5.D-3).

In the month of April during wet water years, the median water velocity was predicted to be 39% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.35 for the NAA and 0.486 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.636 and -0.568 for the PA while the 75th percentile value was 0.927 and 1.008 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.34 and -1.29 for the PA while the maximum value was 1.667 and 1.808 for the PA (Figure 5.D-3).

In the month of May during wet water years, the median water velocity was predicted to be 53% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.296 for the NAA and 0.453 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.668 and -0.584 for the PA while the 75th

percentile value was 0.88 and 0.987 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.261 and -1.253 for the PA while the maximum value was 1.511 and 1.717 for the PA (Figure 5.D-3).

In the month of June during wet water years, the median water velocity was predicted to be 255% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.11 for the NAA and 0.17 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.939 and -0.776 for the PA while the 75th percentile value was 0.515 and 0.773 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.436 and -1.297 for the PA while the maximum value was 1.498 and 1.691 for the PA (Figure 5.D-3).

Above Normal Water Years

In the month of December during above normal water years, the median water velocity was predicted to be 24% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.358 for the NAA and -0.272 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -1.071 and -1.034 for the PA while the 75th percentile value was 0.322 and 0.417 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.545 and -1.485 for the PA while the maximum value was 1.11 and 1.34 for the PA (Figure 5.D-3).

In the month of January during above normal water years, the median water velocity was predicted to be 107% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.121 for the NAA and 0.008 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.946 and -0.883 for the PA while the 75th percentile value was 0.557 and 0.697 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.375 and -1.374 for the PA while the maximum value was 1.191 and 1.357 for the PA (Figure 5.D-3).

In the month of February during above normal water years, the median water velocity was predicted to be 240% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.062 for the NAA and 0.087 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.926 and -0.847 for the PA while the 75th percentile value was 0.582 and 0.723 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.479 and -1.432 for the PA while the maximum value was 1.521 and 1.64 for the PA (Figure 5.D-3).

In the month of March during above normal water years, the median water velocity was predicted to be 282% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.146 for the NAA and 0.265 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.961 and -0.762 for the PA while the 75th percentile value was 0.507 and 0.908 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.464 and -1.299 for the PA while the maximum value was 1.461 and 1.554 for the PA (Figure 5.D-3).

In the month of April during above normal water years, the median water velocity was predicted to be 22% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.189 for the NAA and 0.23 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.791 and -0.802 for the PA while the 75th percentile value was 0.888 and 0.915 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.307 and -1.317 for the PA while the maximum value was 1.247 and 1.359 for the PA (Figure 5.D-3).

In the month of May during above normal water years, the median water velocity was predicted to be 20% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.164 for the NAA and 0.197 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.79 and -0.803 for the PA while the 75th percentile value was 0.853 and 0.882 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.259 and -1.275 for the PA while the maximum value was 1.309 and 1.341 for the PA (Figure 5.D-3).

In the month of June during above normal water years, the median water velocity was predicted to be 66% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.181 for the NAA and -0.061 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.99 and -0.937 for the PA while the 75th percentile value was 0.493 and 0.642 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.346 and -1.341 for the PA while the maximum value was 1.029 and 1.099 for the PA (Figure 5.D-3).

Below Normal Water Years

In the month of December during below normal water years, the median water velocity was predicted to be 19% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.446 for the NAA and -0.363 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -1.114 and -1.074 for the PA while the 75th percentile value was 0.236 and 0.336 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.587 and -1.517 for the PA while the maximum value was 1.072 and 1.082 for the PA (Figure 5.D-3).

In the month of January during below normal water years, the median water velocity was predicted to be 101% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.2 for the NAA and 0.003 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.989 and -0.887 for the PA while the 75th percentile value was 0.519 and 0.754 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.41 and -1.33 for the PA while the maximum value was 1.128 and 1.252 for the PA (Figure 5.D-3).

In the month of February during below normal water years, the median water velocity was predicted to be 53% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.108 for the NAA and -0.051 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.941 and -0.899 for the PA while the 75th percentile value was 0.59 and 0.681 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.393 and -1.421 for the PA while the maximum value was 1.239 and 1.336 for the PA (Figure 5.D-3).

In the month of March during below normal water years, the median water velocity was predicted to be 42% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.171 for the NAA and -0.1 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.967 and -0.93 for the PA while the 75th percentile value was 0.562 and 0.67 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.374 and -1.338 for the PA while the maximum value was 1.073 and 1.194 for the PA (Figure 5.D-3).

In the month of April during below normal water years, the median water velocity was predicted to be 44% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.109 for the NAA and 0.061 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.828 and -0.866 for the PA while the 75th percentile value was 0.863 and 0.832 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.312 and -1.317 for the PA while the maximum value was 1.204 and 1.234 for the PA (Figure 5.D-3).

In the month of May during below normal water years, the median water velocity was predicted to be 30% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.088 for the NAA and 0.061 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.83 and -0.857 for the PA while the 75th percentile value was 0.824 and 0.807 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.288 and -1.315 for the PA while the maximum value was 1.2 and 1.216 for the PA (Figure 5.D-3).

In the month of June during below normal water years, the median water velocity was predicted to be 41% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.131 for the NAA and -0.077 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.951 and -0.936 for the PA while the 75th percentile value was 0.59 and 0.644 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.282 and -1.305 for the PA while the maximum value was 1.057 and 1.091 for the PA (Figure 5.D-3).

Dry Water Years

In the month of December during dry water years, the median water velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.368 for the NAA and -0.321 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -1.072 and -1.051 for the PA while the 75th percentile value was 0.339 and 0.399 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.548 and -1.472 for the PA while the maximum value was 1.123 and 1.135 for the PA (Figure 5.D-3).

In the month of January during dry water years, the median water velocity was predicted to be 37% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.213 for the NAA and -0.134 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -1 and -0.954 for the PA while the 75th percentile value was 0.504 and 0.613 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.447 and -1.42 for the PA while the maximum value was 1.124 and 1.234 for the PA (Figure 5.D-3).

In the month of February during dry water years, the median water velocity was predicted to be 35% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.133 for the NAA and -0.086 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.959 and -0.935 for the PA while the 75th percentile value was 0.6 and 0.645 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.416 and -1.372 for the PA while the maximum value was 1.345 and 1.571 for the PA (Figure 5.D-3).

In the month of March during dry water years, the median water velocity was predicted to be 24% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.097 for the NAA and -0.074 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.944 and -0.925 for the PA while the 75th percentile value was 0.647 and 0.683 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.46 and -1.446 for the PA while the maximum value was 1.147 and 1.303 for the PA (Figure 5.D-3).

In the month of April during dry water years, the median water velocity was predicted to be 30% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.067 for the NAA and 0.047 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.855 and -0.874 for the PA while the 75th percentile value was 0.829 and 0.814 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.313 and -1.326 for the PA while the maximum value was 1.188 and 1.242 for the PA (Figure 5.D-3).

In the month of May during dry water years, the median water velocity was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.039 for the NAA and 0.043 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.845 and -0.859 for the PA while the 75th percentile value was 0.786 and 0.785 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.307 and -1.322 for the PA while the maximum value was 1.441 and 1.455 for the PA (Figure 5.D-3).

In the month of June during dry water years, the median water velocity was predicted to be 61% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.112 for the NAA and -0.043 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.947 and -0.924 for the PA while the 75th percentile value was 0.603 and 0.67 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.317 and -1.305 for the PA while the maximum value was 1.062 and 1.079 for the PA (Figure 5.D-3).

Critical Water Years

In the month of December during critical water years, the median water velocity was predicted to be 16% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.266 for the NAA and -0.222 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.999 and -0.989 for the PA while the 75th percentile value was 0.517 and 0.544 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.543 and -1.46 for the PA while the maximum value was 1.176 and 1.15 for the PA (Figure 5.D-3).

In the month of January during critical water years, the median water velocity was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.214 for the NAA and -0.19 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.991 and -0.976 for the PA while the 75th percentile value was 0.523 and 0.565 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.392 and -1.39 for the PA while the maximum value was 1.152 and 1.206 for the PA (Figure 5.D-3).

In the month of March during critical water years, the median water velocity was predicted to be 16% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was -0.019 for the NAA and -0.016 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.899 and -0.907 for the PA while the 75th percentile value was 0.768 and 0.772 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.346 and -1.321 for the PA while the maximum value was 1.145 and 1.138 for the PA (Figure 5.D-3).

In the month of April during critical water years, the median water velocity was predicted to be 39% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.056 for the NAA and 0.034 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.879 and -0.891 for the PA while the 75th percentile value was 0.836 and 0.811 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.321 and -1.322 for the PA while the maximum value was 1.179 and 1.176 for the PA (Figure 5.D-3).

In the month of May during critical water years, the median water velocity was predicted to be 35% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.045 for the NAA and 0.029 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.86 and -0.875 for the PA while the 75th percentile value was 0.801 and 0.781 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.27 and -1.281 for the PA while the maximum value was 1.183 and 1.178 for the PA (Figure 5.D-3).

In the month of June during critical water years, the median water velocity was predicted to be 48% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-3). Median water velocity (ft/s) was 0.035 for the NAA and 0.052 for the PA (Figure 5.D-3). The 25th percentile value of water velocity (ft/s) for the NAA was -0.894 and -0.891 for the PA while the 75th percentile value was 0.75 and 0.759 for the PA (Figure 5.D-3). The minimum value of water velocity (ft/s) for the NAA was -1.265 and -1.233 for the PA while the maximum value was 1.077 and 1.078 for the PA (Figure 5.D-3).

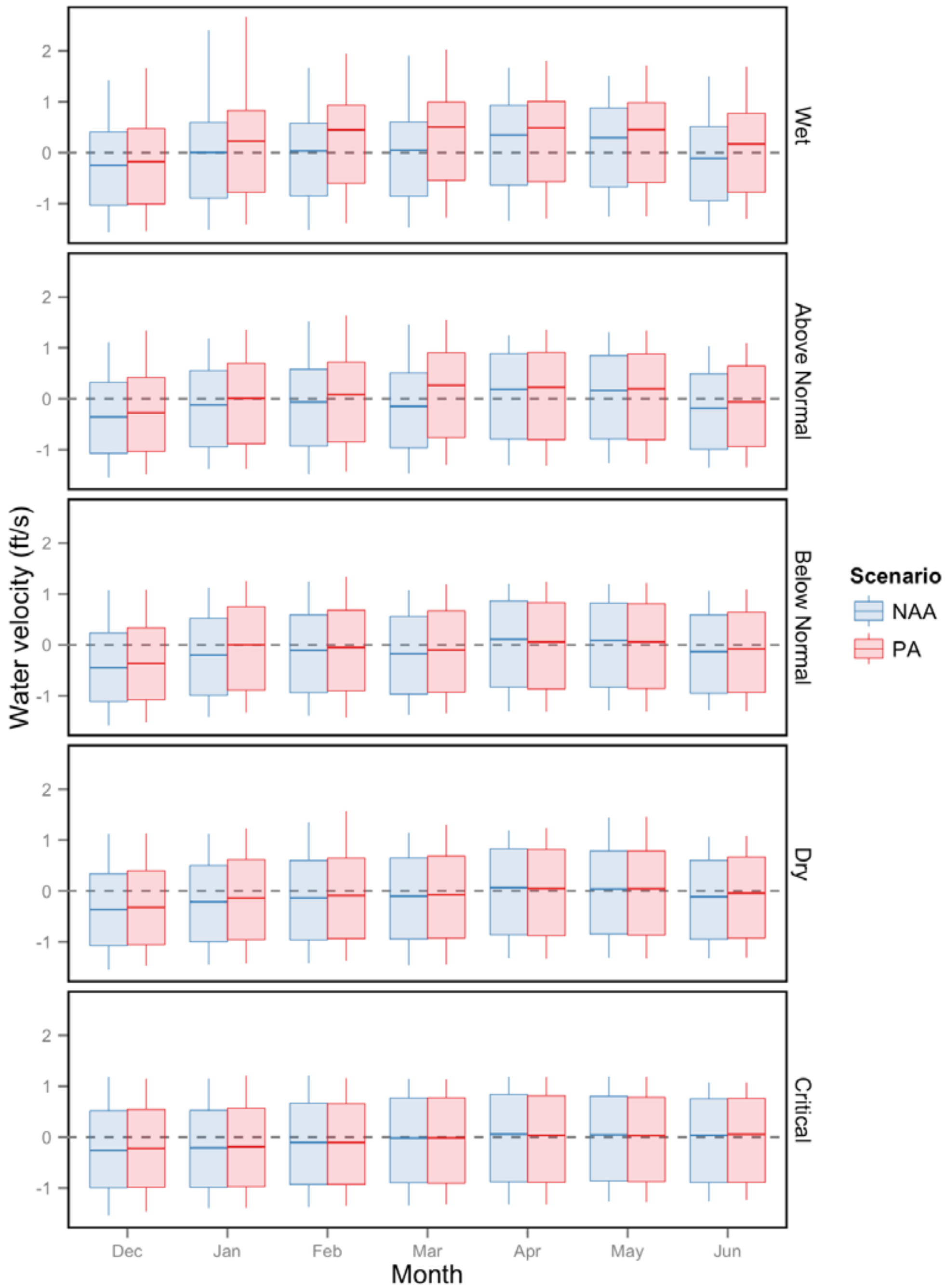


Figure 5.D-3. Velocity of flow entering the interior delta at channel 94, Old River downstream of the facilities, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.1.4 Channel 212, Old River upstream of the facilities

Wet Water Years

In the month of January during wet water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.946 for the NAA and 0.867 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was 0.066 and -0.32 for the PA while the 75th percentile value was 1.31 and 1.193 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.116 and -1.305 for the PA while the maximum value was 4.836 and 4.537 for the PA (Figure 5.D-4).

In the month of February during wet water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 1.12 for the NAA and 1.036 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was 0.446 and 0.034 for the PA while the 75th percentile value was 1.636 and 1.586 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.056 and -1.258 for the PA while the maximum value was 4.135 and 3.795 for the PA (Figure 5.D-4).

In the month of March during wet water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 1.199 for the NAA and 1.075 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was 0.559 and 0.233 for the PA while the 75th percentile value was 1.714 and 1.63 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.055 and -1.239 for the PA while the maximum value was 3.601 and 3.479 for the PA (Figure 5.D-4).

In the month of April during wet water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 1.171 for the NAA and 1.074 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was 0.392 and 0.066 for the PA while the 75th percentile value was 1.526 and 1.47 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.009 and -1.24 for the PA while the maximum value was 3.274 and 3.146 for the PA (Figure 5.D-4).

In the month of May during wet water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 1.161 for the NAA and 1.069 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was 0.314 and -0.024 for the PA while the 75th percentile value was 1.593 and 1.527 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.07 and -1.269 for the PA while the maximum value was 3.225 and 3.032 for the PA (Figure 5.D-4).

In the month of June during wet water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.666 for the NAA and 0.621 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was 0.075 and -0.109 for the PA while the 75th

percentile value was 1.084 and 1.01 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -0.87 and -1.155 for the PA while the maximum value was 3.094 and 2.871 for the PA (Figure 5.D-4).

Above Normal Water Years

In the month of January during above normal water years, the median water velocity was predicted to be 18% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.705 for the NAA and 0.578 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.264 and -0.557 for the PA while the 75th percentile value was 1.11 and 1.041 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.168 and -1.329 for the PA while the maximum value was 2.677 and 2.568 for the PA (Figure 5.D-4).

In the month of February during above normal water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.794 for the NAA and 0.689 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.08 and -0.472 for the PA while the 75th percentile value was 1.18 and 1.058 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.167 and -1.312 for the PA while the maximum value was 2.878 and 2.859 for the PA (Figure 5.D-4).

In the month of March during above normal water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.818 for the NAA and 0.754 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was 0.047 and -0.541 for the PA while the 75th percentile value was 1.201 and 1.12 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.083 and -1.268 for the PA while the maximum value was 2.842 and 2.79 for the PA (Figure 5.D-4).

In the month of April during above normal water years, the median water velocity was predicted to be 21% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.814 for the NAA and 0.64 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.203 and -0.635 for the PA while the 75th percentile value was 1.211 and 1.122 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.045 and -1.252 for the PA while the maximum value was 2.11 and 2.052 for the PA (Figure 5.D-4).

In the month of May during above normal water years, the median water velocity was predicted to be 24% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.805 for the NAA and 0.612 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.286 and -0.698 for the PA while the 75th percentile value was 1.221 and 1.125 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.118 and -1.303 for the PA while the maximum value was 2.383 and 2.384 for the PA (Figure 5.D-4).

In the month of June during above normal water years, the median water velocity was predicted to be 47% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.301 for the NAA and 0.159 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.221 and -0.323 for the PA while the 75th percentile value was 0.708 and 0.69 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -0.881 and -1.134 for the PA while the maximum value was 1.464 and 1.405 for the PA (Figure 5.D-4).

Below Normal Water Years

In the month of December during below normal water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.493 for the NAA and 0.465 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.256 and -0.303 for the PA while the 75th percentile value was 1.025 and 1.03 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.163 and -1.119 for the PA while the maximum value was 1.69 and 1.724 for the PA (Figure 5.D-4).

In the month of January during below normal water years, the median water velocity was predicted to be 28% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.503 for the NAA and 0.362 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.36 and -0.686 for the PA while the 75th percentile value was 1.043 and 1.006 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.125 and -1.253 for the PA while the maximum value was 1.806 and 1.704 for the PA (Figure 5.D-4).

In the month of February during below normal water years, the median water velocity was predicted to be 22% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.713 for the NAA and 0.555 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.229 and -0.513 for the PA while the 75th percentile value was 1.13 and 1.045 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.18 and -1.255 for the PA while the maximum value was 2.729 and 2.769 for the PA (Figure 5.D-4).

In the month of March during below normal water years, the median water velocity was predicted to be 40% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.583 for the NAA and 0.35 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.252 and -0.604 for the PA while the 75th percentile value was 1.087 and 1.004 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.127 and -1.264 for the PA while the maximum value was 1.816 and 1.854 for the PA (Figure 5.D-4).

In the month of April during below normal water years, the median water velocity was predicted to be 41% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.657 for the NAA and 0.387 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.366 and -0.686 for the PA while the 75th percentile value was 1.144 and 1.063 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.048 and -1.234 for the PA while the maximum value was 1.622 and 1.356 for the PA (Figure 5.D-4).

In the month of May during below normal water years, the median water velocity was predicted to be 44% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.589 for the NAA and 0.327 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.459 and -0.747 for the PA while the 75th percentile value was 1.13 and 1.053 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.106 and -1.278 for the PA while the maximum value was 1.636 and 1.465 for the PA (Figure 5.D-4).

In the month of June during below normal water years, the median water velocity was predicted to be 64% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.132 for the NAA and 0.047 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.344 and -0.389 for the PA while the 75th percentile value was 0.651 and 0.629 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.003 and -1.13 for the PA while the maximum value was 1.37 and 1.093 for the PA (Figure 5.D-4).

Dry Water Years

In the month of January during dry water years, the median water velocity was predicted to be 36% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.452 for the NAA and 0.287 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.383 and -0.634 for the PA while the 75th percentile value was 1.033 and 0.978 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.152 and -1.281 for the PA while the maximum value was 1.519 and 1.376 for the PA (Figure 5.D-4).

In the month of February during dry water years, the median water velocity was predicted to be 30% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.541 for the NAA and 0.378 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.396 and -0.625 for the PA while the 75th percentile value was 1.056 and 0.98 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.136 and -1.258 for the PA while the maximum value was 3.274 and 3.088 for the PA (Figure 5.D-4).

In the month of March during dry water years, the median water velocity was predicted to be 33% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.575 for the NAA and 0.387 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.424 and -0.649 for the PA while the 75th percentile value was 1.066 and 0.994 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.147 and -1.253 for the PA while the maximum value was 2.159 and 2.048 for the PA (Figure 5.D-4).

In the month of April during dry water years, the median water velocity was predicted to be 38% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.584 for the NAA and 0.363 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.455 and -0.705 for the PA while the 75th percentile value was 1.098 and 1.042 for the PA (Figure 5.D-4). The minimum value of water

velocity (ft/s) for the NAA was -1.145 and -1.259 for the PA while the maximum value was 1.79 and 1.757 for the PA (Figure 5.D-4).

In the month of May during dry water years, the median water velocity was predicted to be 37% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.546 for the NAA and 0.346 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.489 and -0.723 for the PA while the 75th percentile value was 1.094 and 1.042 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.17 and -1.282 for the PA while the maximum value was 2.517 and 2.503 for the PA (Figure 5.D-4).

In the month of June during dry water years, the median water velocity was predicted to be 67% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.113 for the NAA and 0.037 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.38 and -0.425 for the PA while the 75th percentile value was 0.625 and 0.613 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.084 and -1.142 for the PA while the maximum value was 1.334 and 1.119 for the PA (Figure 5.D-4).

Critical Water Years

In the month of December during critical water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.418 for the NAA and 0.394 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.442 and -0.452 for the PA while the 75th percentile value was 1.005 and 1.002 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.18 and -1.133 for the PA while the maximum value was 1.753 and 1.82 for the PA (Figure 5.D-4).

In the month of January during critical water years, the median water velocity was predicted to be 37% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.393 for the NAA and 0.248 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.456 and -0.643 for the PA while the 75th percentile value was 1.003 and 0.961 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.112 and -1.261 for the PA while the maximum value was 1.438 and 1.313 for the PA (Figure 5.D-4).

In the month of February during critical water years, the median water velocity was predicted to be 36% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.467 for the NAA and 0.3 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.469 and -0.649 for the PA while the 75th percentile value was 1.032 and 0.963 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.087 and -1.221 for the PA while the maximum value was 1.494 and 1.314 for the PA (Figure 5.D-4).

In the month of March during critical water years, the median water velocity was predicted to be 39% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.41 for the NAA and 0.251 for the PA (Figure 5.D-4). The 25th percentile

value of water velocity (ft/s) for the NAA was -0.602 and -0.755 for the PA while the 75th percentile value was 1.023 and 1.002 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.153 and -1.277 for the PA while the maximum value was 1.334 and 1.231 for the PA (Figure 5.D-4).

In the month of April during critical water years, the median water velocity was predicted to be 38% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.378 for the NAA and 0.235 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.67 and -0.792 for the PA while the 75th percentile value was 1.033 and 1.012 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.175 and -1.281 for the PA while the maximum value was 1.388 and 1.276 for the PA (Figure 5.D-4).

In the month of May during critical water years, the median water velocity was predicted to be 44% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.359 for the NAA and 0.2 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.665 and -0.796 for the PA while the 75th percentile value was 1.047 and 1.023 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.216 and -1.281 for the PA while the maximum value was 1.56 and 1.438 for the PA (Figure 5.D-4).

In the month of June during critical water years, the median water velocity was predicted to be 229% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-4). Median water velocity (ft/s) was 0.009 for the NAA and -0.011 for the PA (Figure 5.D-4). The 25th percentile value of water velocity (ft/s) for the NAA was -0.472 and -0.491 for the PA while the 75th percentile value was 0.61 and 0.596 for the PA (Figure 5.D-4). The minimum value of water velocity (ft/s) for the NAA was -1.087 and -1.18 for the PA while the maximum value was 1.084 and 1.081 for the PA (Figure 5.D-4).

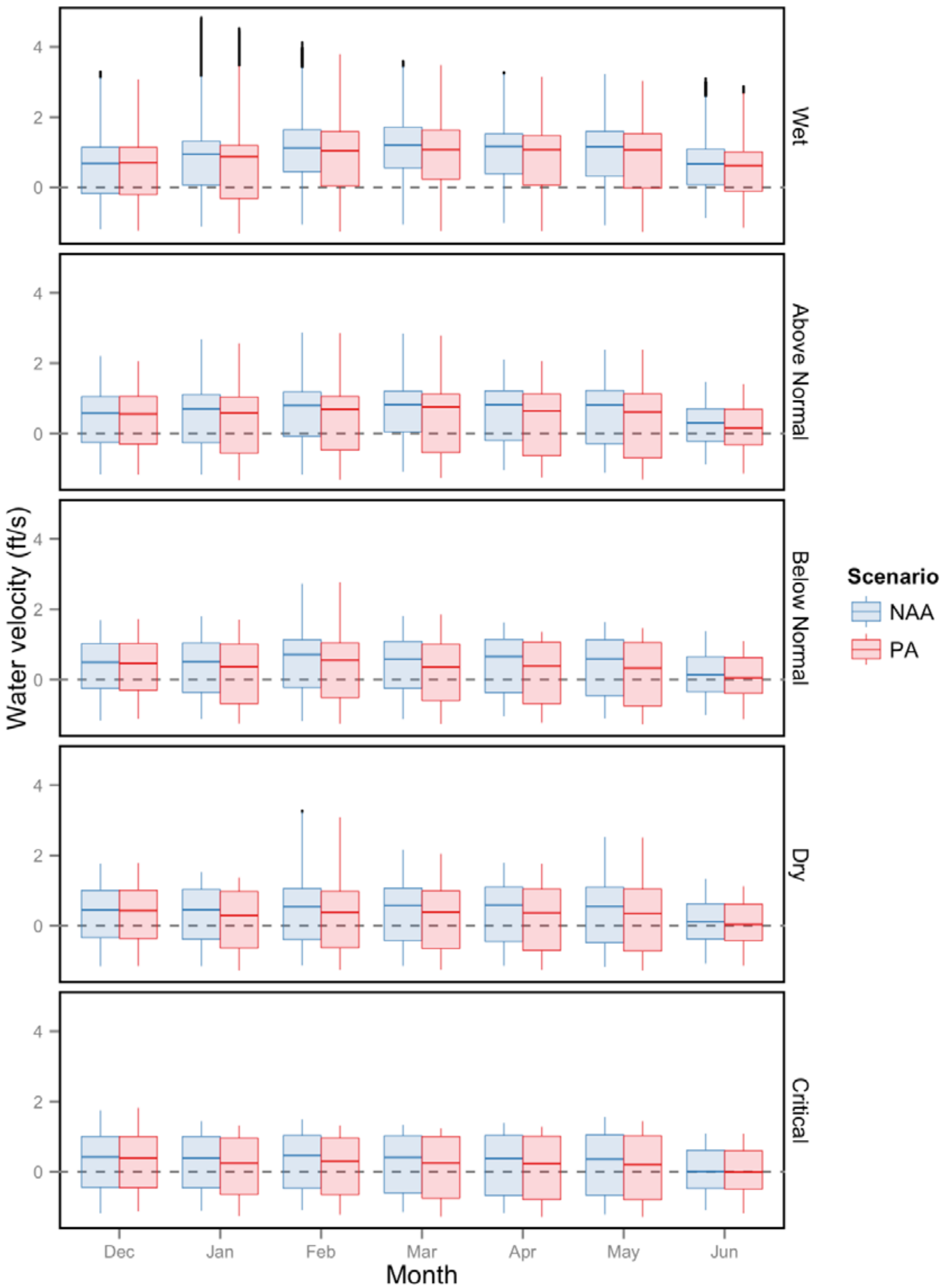


Figure 5.D-4. Velocity of flow entering the interior delta at channel 212, Old River upstream of the facilities, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.1.5 Channel 365, Delta Cross Channel

Wet Water Years

In the month of June during wet water years, the median water velocity was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-5). Median water velocity (ft/s) was 0.422 for the NAA and 0.471 for the PA (Figure 5.D-5). The 25th percentile value of water velocity (ft/s) for the NAA was 0.03 and 0.046 for the PA while the 75th percentile value was 0.869 and 0.84 for the PA (Figure 5.D-5). The minimum value of water velocity (ft/s) for the NAA was -0.833 and -0.877 for the PA while the maximum value was 1.743 and 1.662 for the PA (Figure 5.D-5).

Above Normal Water Years

In the month of December during above normal water years, the median water velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-5). Median water velocity (ft/s) was 0.025 for the NAA and 0.027 for the PA (Figure 5.D-5). The 25th percentile value of water velocity (ft/s) for the NAA was -0.044 and -0.043 for the PA while the 75th percentile value was 0.052 and 0.052 for the PA (Figure 5.D-5). The minimum value of water velocity (ft/s) for the NAA was -0.761 and -0.766 for the PA while the maximum value was 2.578 and 2.653 for the PA (Figure 5.D-5).

In the month of June during above normal water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-5). Median water velocity (ft/s) was 0.662 for the NAA and 0.576 for the PA (Figure 5.D-5). The 25th percentile value of water velocity (ft/s) for the NAA was 0.274 and 0.205 for the PA while the 75th percentile value was 0.98 and 0.902 for the PA (Figure 5.D-5). The minimum value of water velocity (ft/s) for the NAA was -0.775 and -0.742 for the PA while the maximum value was 1.682 and 1.578 for the PA (Figure 5.D-5).

Below Normal Water Years

In the month of June during below normal water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-5). Median water velocity (ft/s) was 0.667 for the NAA and 0.613 for the PA (Figure 5.D-5). The 25th percentile value of water velocity (ft/s) for the NAA was 0.294 and 0.228 for the PA while the 75th percentile value was 0.975 and 0.942 for the PA (Figure 5.D-5). The minimum value of water velocity (ft/s) for the NAA was -0.593 and -0.674 for the PA while the maximum value was 1.584 and 1.602 for the PA (Figure 5.D-5).

Dry Water Years

In the month of June during dry water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-5). Median water velocity (ft/s) was 0.675 for the NAA and 0.609 for the PA (Figure 5.D-5). The 25th percentile value of water velocity (ft/s) for the NAA was 0.298 and 0.215 for the PA while the 75th percentile value was 0.979 and 0.931 for the PA (Figure 5.D-5). The minimum value of water velocity (ft/s) for the NAA was -0.677 and -0.719 for the PA while the maximum value was 1.608 and 1.632 for the PA (Figure 5.D-5).

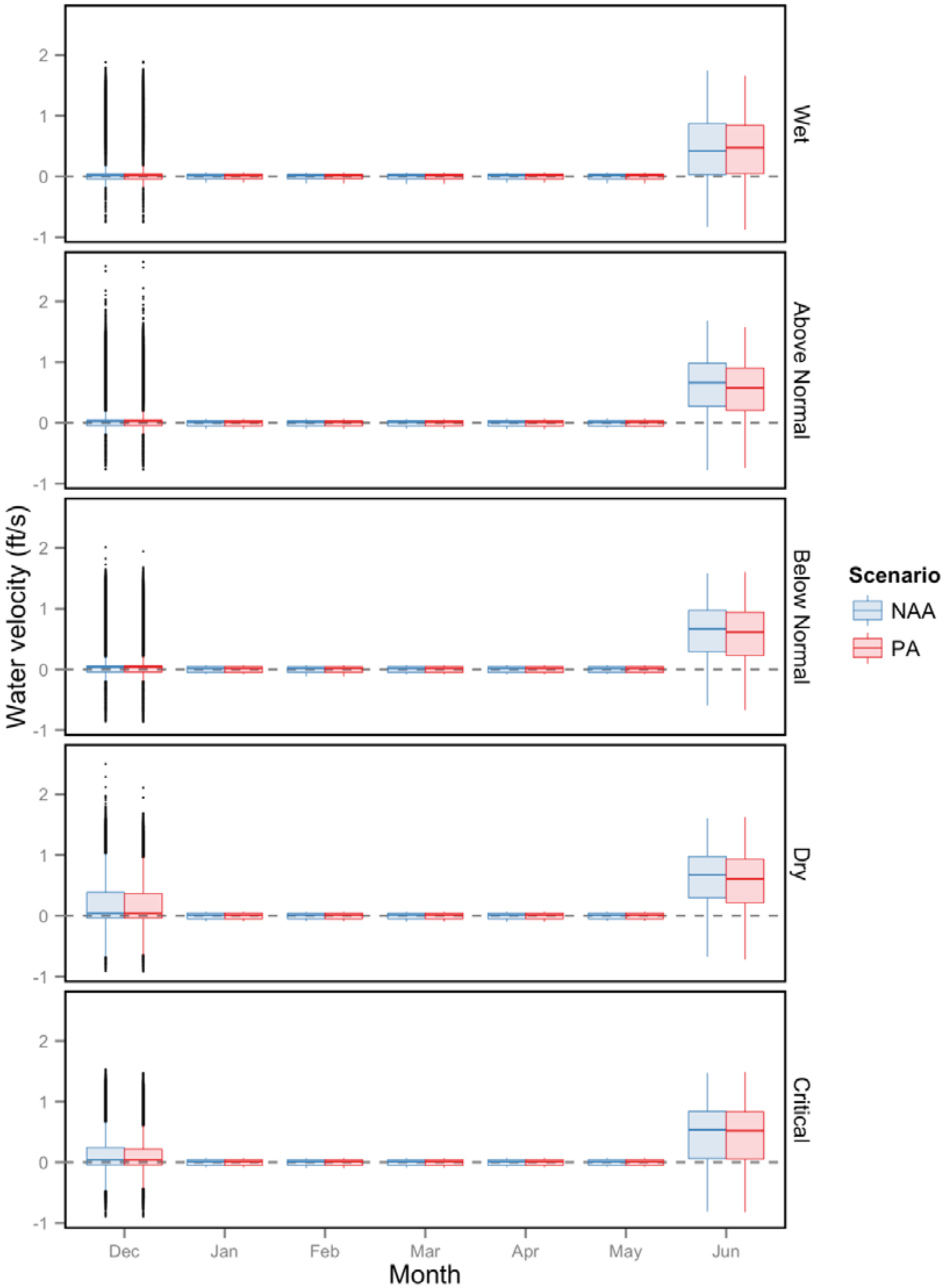


Figure 5.D-5. Velocity of flow entering the interior delta at channel 365, the Delta Cross Channel, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.1.6 Channel 379, Steamboat Slough

Wet Water Years

In the month of December during wet water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.691 for the NAA and 1.478 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 1.187 and 1.068 for the PA while the 75th percentile value was 2.611 and 2.579 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.68 and -0.686 for the PA while the maximum value was 3.639 and 3.694 for the PA (Figure 5.D-6).

In the month of January during wet water years, the median water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 2.573 for the NAA and 2.27 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 1.553 and 1.287 for the PA while the 75th percentile value was 3.265 and 3.001 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.392 and -0.393 for the PA while the maximum value was 3.605 and 3.674 for the PA (Figure 5.D-6).

In the month of February during wet water years, the median water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 3.045 for the NAA and 2.765 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 2.111 and 1.826 for the PA while the 75th percentile value was 3.281 and 3.015 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.033 and -0.057 for the PA while the maximum value was 3.641 and 3.664 for the PA (Figure 5.D-6).

In the month of March during wet water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 2.536 for the NAA and 2.208 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 1.63 and 1.255 for the PA while the 75th percentile value was 3.163 and 2.884 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was 0.327 and 0.048 for the PA while the maximum value was 3.652 and 3.644 for the PA (Figure 5.D-6).

In the month of April during wet water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.763 for the NAA and 1.648 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 1.255 and 1.175 for the PA while the 75th percentile value was 2.564 and 2.44 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.514 and -0.523 for the PA while the maximum value was 3.643 and 3.649 for the PA (Figure 5.D-6).

In the month of May during wet water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.687 for the NAA and 1.543 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 1.09 and 1.027 for the PA while the 75th

percentile value was 2.229 and 2.047 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.467 and -0.475 for the PA while the maximum value was 3.228 and 3.228 for the PA (Figure 5.D-6).

In the month of June during wet water years, the median water velocity was predicted to be 22% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.036 for the NAA and 0.807 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.694 and 0.435 for the PA while the 75th percentile value was 1.533 and 1.078 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.69 and -0.672 for the PA while the maximum value was 3.152 and 3.219 for the PA (Figure 5.D-6).

Above Normal Water Years

In the month of December during above normal water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.101 for the NAA and 1.012 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.789 and 0.691 for the PA while the 75th percentile value was 1.534 and 1.415 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.752 and -0.76 for the PA while the maximum value was 3.639 and 3.773 for the PA (Figure 5.D-6).

In the month of January during above normal water years, the median water velocity was predicted to be 15% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.866 for the NAA and 1.578 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 1.3 and 1.118 for the PA while the 75th percentile value was 2.828 and 2.542 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.188 and -0.206 for the PA while the maximum value was 3.643 and 3.733 for the PA (Figure 5.D-6).

In the month of February during above normal water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 2.564 for the NAA and 2.305 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 1.526 and 1.139 for the PA while the 75th percentile value was 3.118 and 2.864 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.773 and -0.784 for the PA while the maximum value was 3.622 and 3.685 for the PA (Figure 5.D-6).

In the month of March during above normal water years, the median water velocity was predicted to be 14% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 2.052 for the NAA and 1.769 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 1.559 and 1.173 for the PA while the 75th percentile value was 2.84 and 2.622 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was 0.102 and -0.067 for the PA while the maximum value was 3.597 and 3.551 for the PA (Figure 5.D-6).

In the month of April during above normal water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median

water velocity (ft/s) was 1.345 for the NAA and 1.27 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 1.01 and 0.931 for the PA while the 75th percentile value was 1.728 and 1.71 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.56 and -0.556 for the PA while the maximum value was 3.392 and 3.412 for the PA (Figure 5.D-6).

In the month of May during above normal water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.022 for the NAA and 0.958 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.694 and 0.568 for the PA while the 75th percentile value was 1.276 and 1.233 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.61 and -0.617 for the PA while the maximum value was 3.06 and 3.121 for the PA (Figure 5.D-6).

In the month of June during above normal water years, the median water velocity was predicted to be 18% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 0.799 for the NAA and 0.656 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.398 and 0.295 for the PA while the 75th percentile value was 1.013 and 0.882 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.716 and -0.598 for the PA while the maximum value was 1.988 and 1.677 for the PA (Figure 5.D-6).

Below Normal Water Years

In the month of December during below normal water years, the median water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 0.996 for the NAA and 0.902 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.684 and 0.565 for the PA while the 75th percentile value was 1.235 and 1.152 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.765 and -0.772 for the PA while the maximum value was 2.08 and 2.199 for the PA (Figure 5.D-6).

In the month of January during below normal water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.079 for the NAA and 1.015 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.782 and 0.69 for the PA while the 75th percentile value was 1.446 and 1.318 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.715 and -0.663 for the PA while the maximum value was 2.395 and 2.383 for the PA (Figure 5.D-6).

In the month of February during below normal water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.327 for the NAA and 1.192 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.965 and 0.83 for the PA while the 75th percentile value was 2.384 and 2.028 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.697 and -0.702 for the PA while the maximum value was 3.548 and 3.298 for the PA (Figure 5.D-6).

In the month of March during below normal water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.146 for the NAA and 0.992 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.855 and 0.673 for the PA while the 75th percentile value was 1.466 and 1.219 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.396 and -0.423 for the PA while the maximum value was 3.221 and 3.001 for the PA (Figure 5.D-6).

In the month of June during below normal water years, the median water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 0.763 for the NAA and 0.681 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.345 and 0.339 for the PA while the 75th percentile value was 0.98 and 0.915 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.514 and -0.546 for the PA while the maximum value was 1.608 and 1.401 for the PA (Figure 5.D-6).

Dry Water Years

In the month of December during dry water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 0.875 for the NAA and 0.823 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.539 and 0.445 for the PA while the 75th percentile value was 1.111 and 1.062 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.8 and -0.799 for the PA while the maximum value was 2.062 and 2.256 for the PA (Figure 5.D-6).

In the month of January during dry water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.008 for the NAA and 0.939 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.679 and 0.599 for the PA while the 75th percentile value was 1.282 and 1.193 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.626 and -0.639 for the PA while the maximum value was 3.232 and 2.906 for the PA (Figure 5.D-6).

In the month of February during dry water years, the median water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.202 for the NAA and 1.09 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.896 and 0.761 for the PA while the 75th percentile value was 1.61 and 1.423 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.544 and -0.538 for the PA while the maximum value was 3.415 and 3.16 for the PA (Figure 5.D-6).

In the month of March during dry water years, the median water velocity was predicted to be 15% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.236 for the NAA and 1.052 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.927 and 0.74 for the PA while the 75th percentile value was 1.583 and 1.303 for the PA (Figure 5.D-6). The minimum value of water

velocity (ft/s) for the NAA was -0.481 and -0.482 for the PA while the maximum value was 3.317 and 3.111 for the PA (Figure 5.D-6).

In the month of June during dry water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 0.758 for the NAA and 0.659 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.339 and 0.288 for the PA while the 75th percentile value was 0.976 and 0.906 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.586 and -0.614 for the PA while the maximum value was 1.379 and 1.446 for the PA (Figure 5.D-6).

Critical Water Years

In the month of December during critical water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 0.766 for the NAA and 0.721 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.283 and 0.208 for the PA while the 75th percentile value was 1.006 and 0.967 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.749 and -0.764 for the PA while the maximum value was 1.799 and 1.927 for the PA (Figure 5.D-6).

In the month of February during critical water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 1.006 for the NAA and 0.909 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.71 and 0.566 for the PA while the 75th percentile value was 1.224 and 1.153 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.616 and -0.639 for the PA while the maximum value was 2.571 and 2.591 for the PA (Figure 5.D-6).

In the month of May during critical water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 0.649 for the NAA and 0.607 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.131 and 0.106 for the PA while the 75th percentile value was 0.899 and 0.907 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.761 and -0.765 for the PA while the maximum value was 1.48 and 1.487 for the PA (Figure 5.D-6).

In the month of June during critical water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-6). Median water velocity (ft/s) was 0.61 for the NAA and 0.562 for the PA (Figure 5.D-6). The 25th percentile value of water velocity (ft/s) for the NAA was 0.048 and 0.036 for the PA while the 75th percentile value was 0.862 and 0.858 for the PA (Figure 5.D-6). The minimum value of water velocity (ft/s) for the NAA was -0.79 and -0.794 for the PA while the maximum value was 1.307 and 1.326 for the PA (Figure 5.D-6).

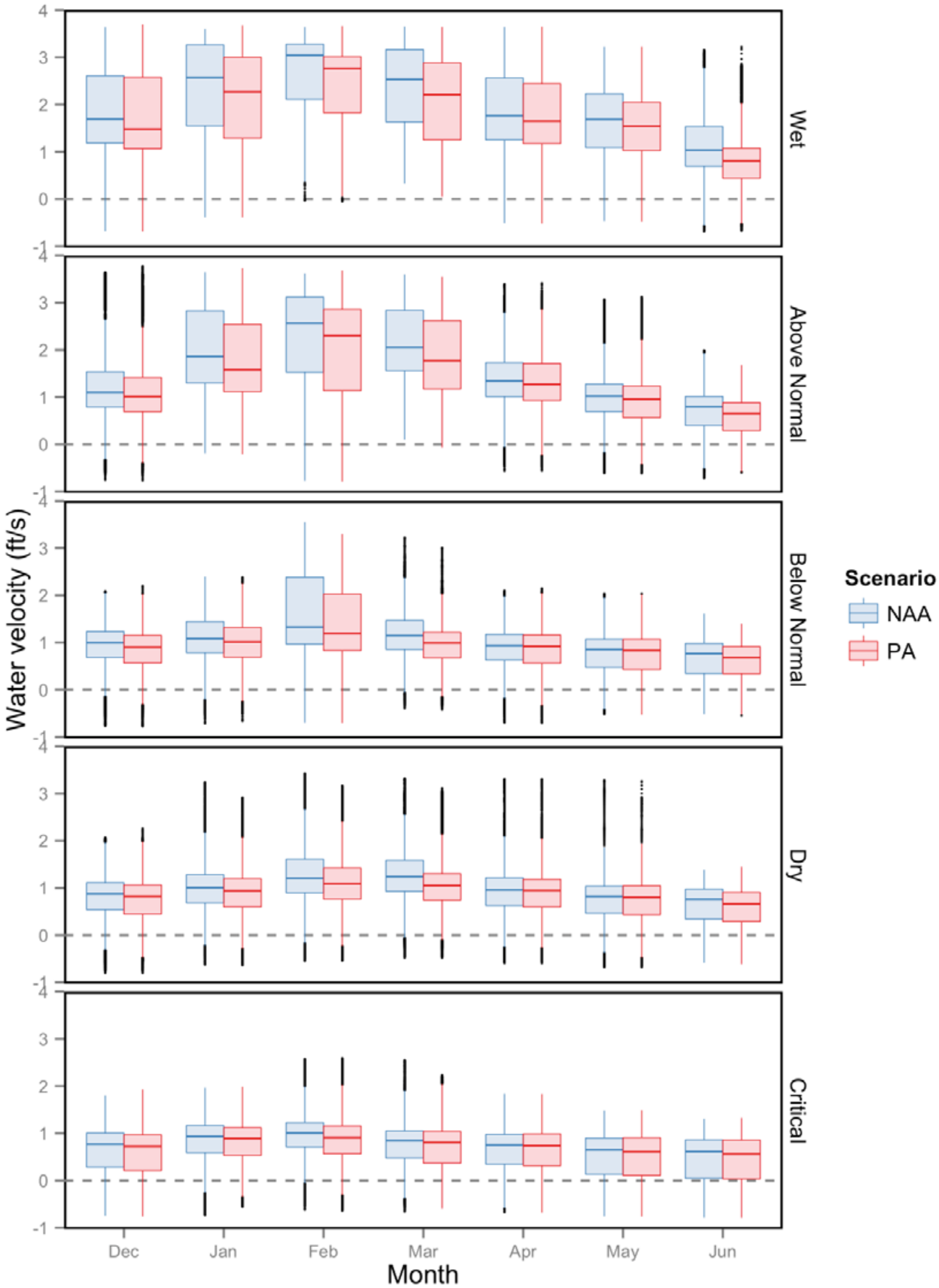


Figure 5.D-6. Velocity of flow entering the interior delta at channel 379, Steamboat Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.1.7 Channel 383, Sutter Slough

Wet Water Years

In the month of December during wet water years, the median water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.972 for the NAA and 1.789 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 1.38 and 1.227 for the PA while the 75th percentile value was 2.98 and 2.871 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.389 and -1.396 for the PA while the maximum value was 4.199 and 4.166 for the PA (Figure 5.D-7).

In the month of January during wet water years, the median water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 2.932 for the NAA and 2.617 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 1.805 and 1.574 for the PA while the 75th percentile value was 3.737 and 3.438 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -0.945 and -0.965 for the PA while the maximum value was 4.196 and 4.117 for the PA (Figure 5.D-7).

In the month of February during wet water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 3.448 for the NAA and 3.12 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 2.41 and 2.067 for the PA while the 75th percentile value was 3.769 and 3.471 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -0.803 and -1.03 for the PA while the maximum value was 4.172 and 4.136 for the PA (Figure 5.D-7).

In the month of March during wet water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 2.868 for the NAA and 2.495 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 1.88 and 1.502 for the PA while the 75th percentile value was 3.612 and 3.299 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -0.574 and -0.869 for the PA while the maximum value was 4.187 and 4.042 for the PA (Figure 5.D-7).

In the month of April during wet water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 2.021 for the NAA and 1.903 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 1.453 and 1.354 for the PA while the 75th percentile value was 2.909 and 2.766 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.112 and -1.123 for the PA while the maximum value was 4.122 and 4.022 for the PA (Figure 5.D-7).

In the month of May during wet water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.888 for the NAA and 1.742 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 1.306 and 1.2 for the PA while the 75th percentile value was 2.545 and 2.315 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.091 and -1.217 for the PA while the maximum value was 3.728 and 3.699 for the PA (Figure 5.D-7).

In the month of June during wet water years, the median water velocity was predicted to be 15% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.346 for the NAA and 1.14 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.544 and 0.013 for the PA while the 75th percentile value was 1.765 and 1.463 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.384 and -1.418 for the PA while the maximum value was 3.582 and 3.388 for the PA (Figure 5.D-7).

Above Normal Water Years

In the month of December during above normal water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.394 for the NAA and 1.313 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.729 and 0.556 for the PA while the 75th percentile value was 1.842 and 1.766 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.401 and -1.408 for the PA while the maximum value was 4.19 and 4.195 for the PA (Figure 5.D-7).

In the month of January during above normal water years, the median water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 2.161 for the NAA and 1.916 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 1.505 and 1.308 for the PA while the 75th percentile value was 3.229 and 2.879 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -0.867 and -0.955 for the PA while the maximum value was 4.212 and 4.119 for the PA (Figure 5.D-7).

In the month of February during above normal water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 2.937 for the NAA and 2.632 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 1.729 and 1.439 for the PA while the 75th percentile value was 3.559 and 3.274 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.302 and -1.312 for the PA while the maximum value was 4.162 and 4.07 for the PA (Figure 5.D-7).

In the month of March during above normal water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 2.346 for the NAA and 2.042 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 1.743 and 1.389 for the PA while the 75th percentile value was 3.239 and 2.969 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -0.642 and -0.921 for the PA while the maximum value was 4.118 and 4.04 for the PA (Figure 5.D-7).

In the month of May during above normal water years, the median water velocity was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median

water velocity (ft/s) was 1.275 for the NAA and 1.206 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.522 and 0.382 for the PA while the 75th percentile value was 1.63 and 1.574 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.245 and -1.288 for the PA while the maximum value was 3.521 and 3.513 for the PA (Figure 5.D-7).

In the month of June during above normal water years, the median water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.026 for the NAA and 0.93 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was -0.159 and -0.327 for the PA while the 75th percentile value was 1.418 and 1.305 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.337 and -1.328 for the PA while the maximum value was 2.412 and 1.904 for the PA (Figure 5.D-7).

Below Normal Water Years

In the month of December during below normal water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.235 for the NAA and 1.156 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.445 and 0.222 for the PA while the 75th percentile value was 1.599 and 1.512 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.426 and -1.431 for the PA while the maximum value was 2.508 and 2.544 for the PA (Figure 5.D-7).

In the month of January during below normal water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.362 for the NAA and 1.276 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.707 and 0.538 for the PA while the 75th percentile value was 1.743 and 1.658 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.357 and -1.311 for the PA while the maximum value was 2.852 and 2.676 for the PA (Figure 5.D-7).

In the month of February during below normal water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.631 for the NAA and 1.518 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 1.058 and 0.877 for the PA while the 75th percentile value was 2.726 and 2.334 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.227 and -1.234 for the PA while the maximum value was 4.117 and 3.849 for the PA (Figure 5.D-7).

In the month of March during below normal water years, the median water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.397 for the NAA and 1.239 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.833 and 0.503 for the PA while the 75th percentile value was 1.725 and 1.571 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -0.96 and -1.028 for the PA while the maximum value was 3.716 and 3.474 for the PA (Figure 5.D-7).

Dry Water Years

In the month of January during dry water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.272 for the NAA and 1.196 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.531 and 0.37 for the PA while the 75th percentile value was 1.636 and 1.579 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.214 and -1.229 for the PA while the maximum value was 3.745 and 3.397 for the PA (Figure 5.D-7).

In the month of February during dry water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.493 for the NAA and 1.384 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.915 and 0.696 for the PA while the 75th percentile value was 1.921 and 1.77 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.073 and -1.067 for the PA while the maximum value was 3.93 and 3.652 for the PA (Figure 5.D-7).

In the month of March during dry water years, the median water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.483 for the NAA and 1.307 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.953 and 0.612 for the PA while the 75th percentile value was 1.863 and 1.647 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -0.966 and -0.995 for the PA while the maximum value was 3.824 and 3.529 for the PA (Figure 5.D-7).

Critical Water Years

In the month of December during critical water years, the median water velocity was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 0.987 for the NAA and 0.936 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was -0.208 and -0.3 for the PA while the 75th percentile value was 1.405 and 1.362 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.431 and -1.442 for the PA while the maximum value was 2.206 and 2.209 for the PA (Figure 5.D-7).

In the month of February during critical water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.249 for the NAA and 1.143 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.517 and 0.28 for the PA while the 75th percentile value was 1.586 and 1.534 for the PA (Figure 5.D-7). The minimum value of water velocity (ft/s) for the NAA was -1.12 and -1.19 for the PA while the maximum value was 3.09 and 3.11 for the PA (Figure 5.D-7).

In the month of March during critical water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-7). Median water velocity (ft/s) was 1.083 for the NAA and 1.019 for the PA (Figure 5.D-7). The 25th percentile value of water velocity (ft/s) for the NAA was 0.066 and -0.028 for the PA while the 75th percentile value was 1.441 and 1.439 for the PA (Figure 5.D-7). The minimum value of water

velocity (ft/s) for the NAA was -1.275 and -1.221 for the PA while the maximum value was 3.019 and 2.676 for the PA (Figure 5.D-7).

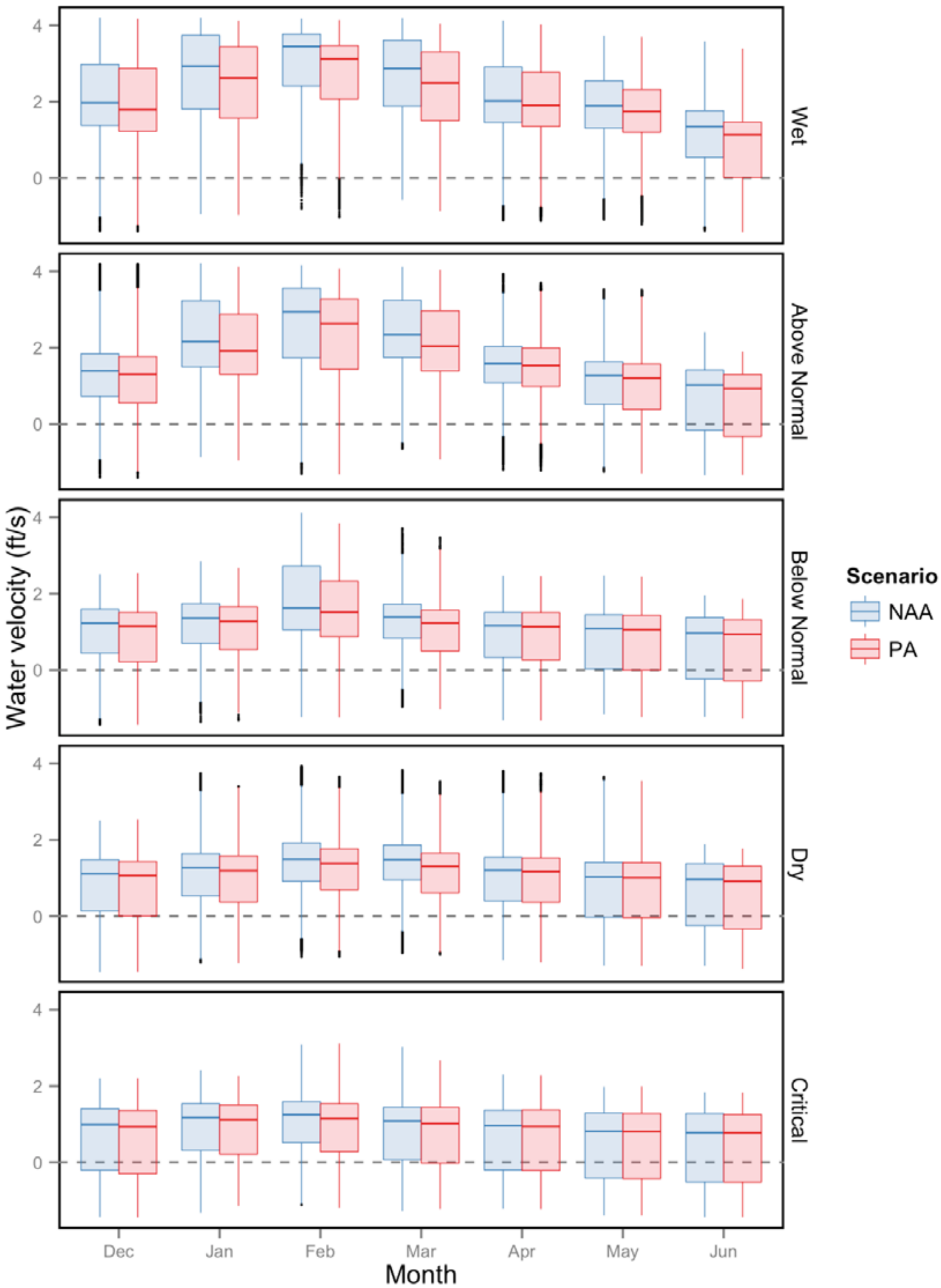


Figure 5.D-7. Velocity of flow entering the interior delta at channel 383, Sutter Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.1.8 Channel 418, Sacramento River downstream of proposed diversions

Wet Water Years

In the month of December during wet water years, the median water velocity was predicted to be 15% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 2.224 for the NAA and 1.901 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.584 and 1.384 for the PA while the 75th percentile value was 3.456 and 3.244 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.801 and -0.793 for the PA while the maximum value was 4.907 and 4.603 for the PA (Figure 5.D-8).

In the month of January during wet water years, the median water velocity was predicted to be 16% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 3.416 for the NAA and 2.884 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 2.058 and 1.668 for the PA while the 75th percentile value was 4.399 and 3.822 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.347 and -0.342 for the PA while the maximum value was 4.895 and 4.54 for the PA (Figure 5.D-8).

In the month of February during wet water years, the median water velocity was predicted to be 14% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 4.052 for the NAA and 3.484 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 2.782 and 2.305 for the PA while the 75th percentile value was 4.432 and 3.846 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was 0.044 and -0.089 for the PA while the maximum value was 4.899 and 4.57 for the PA (Figure 5.D-8).

In the month of March during wet water years, the median water velocity was predicted to be 17% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 3.347 for the NAA and 2.775 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 2.131 and 1.602 for the PA while the 75th percentile value was 4.22 and 3.641 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was 0.351 and 0 for the PA while the maximum value was 4.917 and 4.468 for the PA (Figure 5.D-8).

In the month of April during wet water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 2.305 for the NAA and 2.07 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.637 and 1.496 for the PA while the 75th percentile value was 3.377 and 3.065 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.643 and -0.65 for the PA while the maximum value was 4.89 and 4.457 for the PA (Figure 5.D-8).

In the month of May during wet water years, the median water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 2.191 for the NAA and 1.939 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.429 and 1.309 for the PA while the 75th

percentile value was 2.912 and 2.553 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.557 and -0.613 for the PA while the maximum value was 4.303 and 4.06 for the PA (Figure 5.D-8).

In the month of June during wet water years, the median water velocity was predicted to be 24% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.524 for the NAA and 1.162 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.038 and 0.71 for the PA while the 75th percentile value was 2.066 and 1.523 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.898 and -0.891 for the PA while the maximum value was 4.168 and 3.863 for the PA (Figure 5.D-8).

Above Normal Water Years

In the month of December during above normal water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.494 for the NAA and 1.351 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.069 and 0.923 for the PA while the 75th percentile value was 2.022 and 1.825 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.956 and -0.943 for the PA while the maximum value was 4.911 and 4.646 for the PA (Figure 5.D-8).

In the month of January during above normal water years, the median water velocity was predicted to be 18% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 2.473 for the NAA and 2.019 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.711 and 1.455 for the PA while the 75th percentile value was 3.771 and 3.22 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.143 and -0.167 for the PA while the maximum value was 4.923 and 4.585 for the PA (Figure 5.D-8).

In the month of February during above normal water years, the median water velocity was predicted to be 14% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 3.409 for the NAA and 2.918 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.998 and 1.466 for the PA while the 75th percentile value was 4.177 and 3.628 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.933 and -0.916 for the PA while the maximum value was 4.892 and 4.549 for the PA (Figure 5.D-8).

In the month of March during above normal water years, the median water velocity was predicted to be 17% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 2.7 for the NAA and 2.24 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 2.035 and 1.497 for the PA while the 75th percentile value was 3.759 and 3.298 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was 0.168 and -0.056 for the PA while the maximum value was 4.819 and 4.487 for the PA (Figure 5.D-8).

In the month of April during above normal water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median

water velocity (ft/s) was 1.752 for the NAA and 1.615 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.318 and 1.189 for the PA while the 75th percentile value was 2.258 and 2.156 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.669 and -0.667 for the PA while the maximum value was 4.54 and 4.16 for the PA (Figure 5.D-8).

In the month of May during above normal water years, the median water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.343 for the NAA and 1.225 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.9 and 0.716 for the PA while the 75th percentile value was 1.674 and 1.568 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.76 and -0.772 for the PA while the maximum value was 4.066 and 3.857 for the PA (Figure 5.D-8).

In the month of June during above normal water years, the median water velocity was predicted to be 19% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.206 for the NAA and 0.982 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.714 and 0.583 for the PA while the 75th percentile value was 1.515 and 1.281 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.879 and -0.756 for the PA while the maximum value was 2.628 and 2.093 for the PA (Figure 5.D-8).

Below Normal Water Years

In the month of December during below normal water years, the median water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.365 for the NAA and 1.219 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.921 and 0.744 for the PA while the 75th percentile value was 1.68 and 1.522 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -1.051 and -1.041 for the PA while the maximum value was 2.782 and 2.641 for the PA (Figure 5.D-8).

In the month of January during below normal water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.432 for the NAA and 1.312 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.032 and 0.886 for the PA while the 75th percentile value was 1.905 and 1.693 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.857 and -0.763 for the PA while the maximum value was 3.178 and 2.871 for the PA (Figure 5.D-8).

In the month of February during below normal water years, the median water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.744 for the NAA and 1.538 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.269 and 1.075 for the PA while the 75th percentile value was 3.16 and 2.581 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.854 and -0.848 for the PA while the maximum value was 4.794 and 4.197 for the PA (Figure 5.D-8).

In the month of March during below normal water years, the median water velocity was predicted to be 15% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.508 for the NAA and 1.279 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.128 and 0.852 for the PA while the 75th percentile value was 1.915 and 1.566 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.454 and -0.487 for the PA while the maximum value was 4.294 and 3.787 for the PA (Figure 5.D-8).

In the month of May during below normal water years, the median water velocity was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.14 for the NAA and 1.081 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.578 and 0.528 for the PA while the 75th percentile value was 1.422 and 1.38 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.612 and -0.613 for the PA while the maximum value was 2.691 and 2.561 for the PA (Figure 5.D-8).

In the month of June during below normal water years, the median water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.157 for the NAA and 1.017 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.654 and 0.626 for the PA while the 75th percentile value was 1.469 and 1.339 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.598 and -0.595 for the PA while the maximum value was 2.158 and 1.925 for the PA (Figure 5.D-8).

Dry Water Years

In the month of December during dry water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.222 for the NAA and 1.131 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.735 and 0.611 for the PA while the 75th percentile value was 1.528 and 1.432 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -1.099 and -1.083 for the PA while the maximum value was 2.765 and 2.743 for the PA (Figure 5.D-8).

In the month of January during dry water years, the median water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.349 for the NAA and 1.227 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.898 and 0.768 for the PA while the 75th percentile value was 1.704 and 1.551 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.733 and -0.738 for the PA while the maximum value was 4.331 and 3.69 for the PA (Figure 5.D-8).

In the month of February during dry water years, the median water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.594 for the NAA and 1.411 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.183 and 0.979 for the PA while the 75th percentile value was 2.122 and 1.821 for the PA (Figure 5.D-8). The minimum value of water

velocity (ft/s) for the NAA was -0.64 and -0.611 for the PA while the maximum value was 4.58 and 4.002 for the PA (Figure 5.D-8).

In the month of March during dry water years, the median water velocity was predicted to be 17% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.623 for the NAA and 1.353 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 1.218 and 0.94 for the PA while the 75th percentile value was 2.074 and 1.67 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.547 and -0.551 for the PA while the maximum value was 4.436 and 3.852 for the PA (Figure 5.D-8).

In the month of May during dry water years, the median water velocity was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.096 for the NAA and 1.041 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.573 and 0.538 for the PA while the 75th percentile value was 1.378 and 1.349 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.851 and -0.847 for the PA while the maximum value was 4.361 and 4.095 for the PA (Figure 5.D-8).

In the month of June during dry water years, the median water velocity was predicted to be 14% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.149 for the NAA and 0.992 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.648 and 0.576 for the PA while the 75th percentile value was 1.465 and 1.327 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.667 and -0.645 for the PA while the maximum value was 2.12 and 1.865 for the PA (Figure 5.D-8).

Critical Water Years

In the month of December during critical water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.081 for the NAA and 0.993 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.445 and 0.35 for the PA while the 75th percentile value was 1.393 and 1.313 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -1.029 and -1.018 for the PA while the maximum value was 2.372 and 2.307 for the PA (Figure 5.D-8).

In the month of January during critical water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.245 for the NAA and 1.163 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.762 and 0.679 for the PA while the 75th percentile value was 1.554 and 1.453 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.921 and -0.637 for the PA while the maximum value was 2.625 and 2.381 for the PA (Figure 5.D-8).

In the month of February during critical water years, the median water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.333 for the NAA and 1.182 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.922 and 0.717 for the PA while the 75th percentile value was 1.623 and 1.49 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.646 and -0.732 for the PA while the maximum value was 3.442 and 3.312 for the PA (Figure 5.D-8).

In the month of March during critical water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 1.134 for the NAA and 1.059 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.601 and 0.485 for the PA while the 75th percentile value was 1.401 and 1.354 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.812 and -0.721 for the PA while the maximum value was 3.395 and 2.839 for the PA (Figure 5.D-8).

In the month of May during critical water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 0.885 for the NAA and 0.814 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.186 and 0.155 for the PA while the 75th percentile value was 1.207 and 1.186 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -0.991 and -0.969 for the PA while the maximum value was 1.977 and 1.932 for the PA (Figure 5.D-8).

In the month of June during critical water years, the median water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-8). Median water velocity (ft/s) was 0.928 for the NAA and 0.826 for the PA (Figure 5.D-8). The 25th percentile value of water velocity (ft/s) for the NAA was 0.307 and 0.286 for the PA while the 75th percentile value was 1.296 and 1.257 for the PA (Figure 5.D-8). The minimum value of water velocity (ft/s) for the NAA was -1.031 and -1.007 for the PA while the maximum value was 1.765 and 1.756 for the PA (Figure 5.D-8).

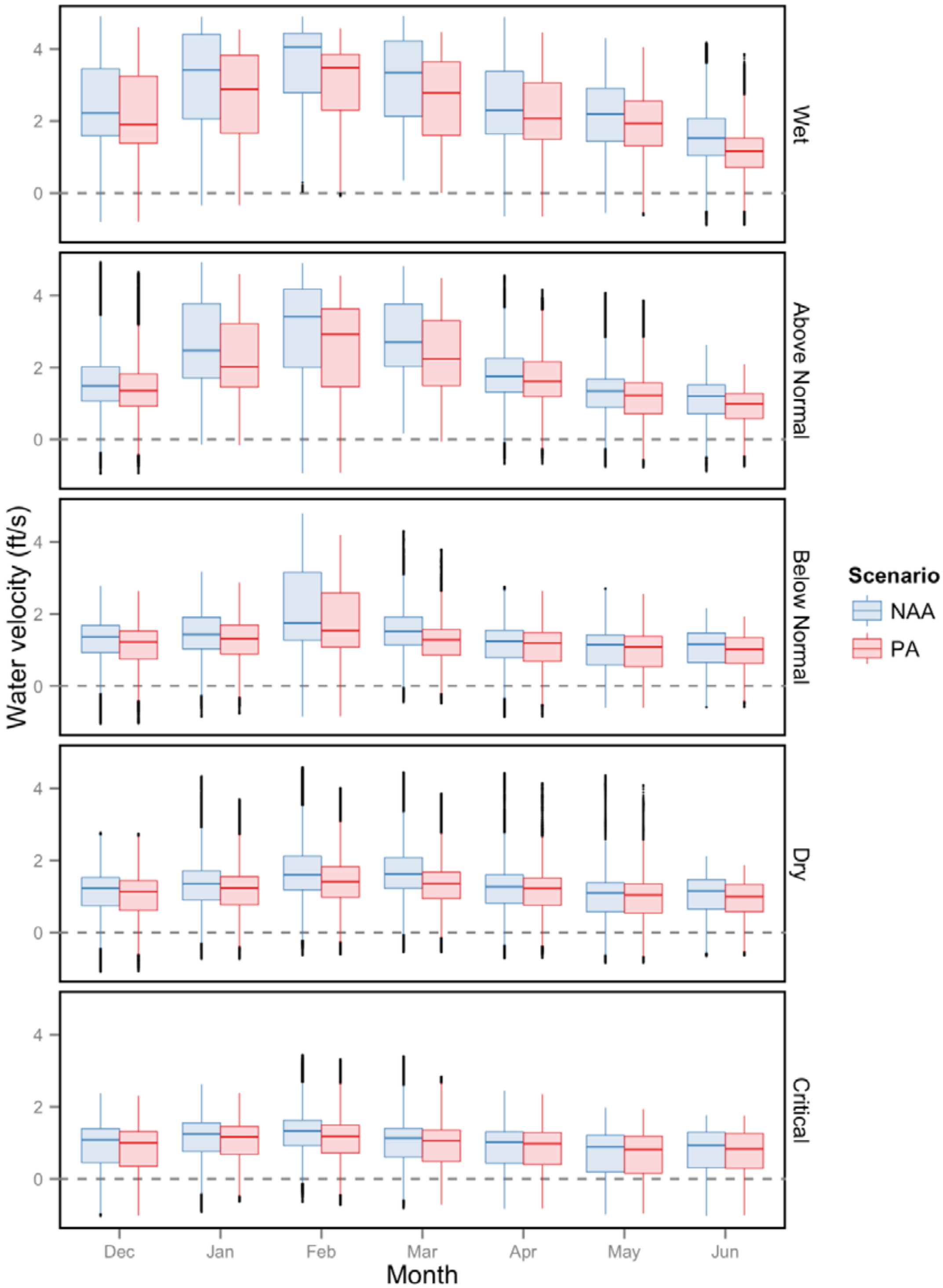


Figure 5.D-8. Velocity of flow entering the interior delta at channel 418, the Sacramento River downstream of proposed diversions, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.1.9 Channel 421, Sacramento River upstream of Georgiana Slough

Wet Water Year

In the month of December during wet water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.858 for the NAA and 1.672 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 1.346 and 1.206 for the PA while the 75th percentile value was 2.777 and 2.693 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.682 and -0.697 for the PA while the maximum value was 3.869 and 3.854 for the PA (Figure 5.D-9).

In the month of January during wet water years, the median water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 2.737 for the NAA and 2.445 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 1.709 and 1.46 for the PA while the 75th percentile value was 3.434 and 3.172 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.202 and -0.21 for the PA while the maximum value was 3.863 and 3.807 for the PA (Figure 5.D-9).

In the month of February during wet water years, the median water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 3.191 for the NAA and 2.903 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 2.268 and 1.953 for the PA while the 75th percentile value was 3.457 and 3.194 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was 0.026 and -0.302 for the PA while the maximum value was 3.847 and 3.789 for the PA (Figure 5.D-9).

In the month of March during wet water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 2.679 for the NAA and 2.337 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 1.771 and 1.393 for the PA while the 75th percentile value was 3.326 and 3.047 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was 0.207 and -0.156 for the PA while the maximum value was 3.862 and 3.695 for the PA (Figure 5.D-9).

In the month of April during wet water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.897 for the NAA and 1.773 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 1.38 and 1.292 for the PA while the 75th percentile value was 2.711 and 2.58 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.527 and -0.554 for the PA while the maximum value was 3.798 and 3.716 for the PA (Figure 5.D-9).

In the month of May during wet water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.786 for the NAA and 1.637 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 1.217 and 1.129 for the PA while the 75th

percentile value was 2.363 and 2.159 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.442 and -0.567 for the PA while the maximum value was 3.473 and 3.456 for the PA (Figure 5.D-9).

In the month of June during wet water years, the median water velocity was predicted to be 21% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.407 for the NAA and 1.115 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.928 and 0.699 for the PA while the 75th percentile value was 1.808 and 1.472 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.814 and -0.843 for the PA while the maximum value was 3.341 and 3.149 for the PA (Figure 5.D-9).

Above Normal Water Years

In the month of December during above normal water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.322 for the NAA and 1.241 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.895 and 0.781 for the PA while the 75th percentile value was 1.744 and 1.645 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.834 and -0.856 for the PA while the maximum value was 3.861 and 3.849 for the PA (Figure 5.D-9).

In the month of January during above normal water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 2.031 for the NAA and 1.773 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 1.427 and 1.258 for the PA while the 75th percentile value was 3.012 and 2.699 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.088 and -0.251 for the PA while the maximum value was 3.864 and 3.809 for the PA (Figure 5.D-9).

In the month of February during above normal water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 2.736 for the NAA and 2.467 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 1.644 and 1.306 for the PA while the 75th percentile value was 3.281 and 3.029 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.745 and -0.758 for the PA while the maximum value was 3.843 and 3.756 for the PA (Figure 5.D-9).

In the month of March during above normal water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 2.21 for the NAA and 1.921 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 1.67 and 1.303 for the PA while the 75th percentile value was 3.009 and 2.772 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was 0.114 and -0.246 for the PA while the maximum value was 3.795 and 3.722 for the PA (Figure 5.D-9).

In the month of May during above normal water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median

water velocity (ft/s) was 1.154 for the NAA and 1.074 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.709 and 0.604 for the PA while the 75th percentile value was 1.463 and 1.412 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.622 and -0.701 for the PA while the maximum value was 3.318 and 3.312 for the PA (Figure 5.D-9).

In the month of June during above normal water years, the median water velocity was predicted to be 14% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.114 for the NAA and 0.955 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.685 and 0.606 for the PA while the 75th percentile value was 1.461 and 1.269 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.774 and -0.663 for the PA while the maximum value was 2.265 and 2.137 for the PA (Figure 5.D-9).

Below Normal Water Years

In the month of December during below normal water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.194 for the NAA and 1.113 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.762 and 0.64 for the PA while the 75th percentile value was 1.501 and 1.421 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.991 and -1.012 for the PA while the maximum value was 2.377 and 2.363 for the PA (Figure 5.D-9).

In the month of January during below normal water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.251 for the NAA and 1.167 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.834 and 0.718 for the PA while the 75th percentile value was 1.611 and 1.504 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.675 and -0.622 for the PA while the maximum value was 2.674 and 2.51 for the PA (Figure 5.D-9).

In the month of February during below normal water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.501 for the NAA and 1.374 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 1.064 and 0.918 for the PA while the 75th percentile value was 2.547 and 2.181 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.73 and -0.751 for the PA while the maximum value was 3.792 and 3.549 for the PA (Figure 5.D-9).

In the month of March during below normal water years, the median water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.295 for the NAA and 1.139 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.934 and 0.699 for the PA while the 75th percentile value was 1.606 and 1.417 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.338 and -0.395 for the PA while the maximum value was 3.446 and 3.234 for the PA (Figure 5.D-9).

In the month of June during below normal water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.067 for the NAA and 0.98 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.637 and 0.643 for the PA while the 75th percentile value was 1.414 and 1.324 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.489 and -0.487 for the PA while the maximum value was 2.109 and 2.023 for the PA (Figure 5.D-9).

Dry Water Years

In the month of January during dry water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.173 for the NAA and 1.099 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.721 and 0.622 for the PA while the 75th percentile value was 1.487 and 1.41 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.566 and -0.598 for the PA while the maximum value was 3.48 and 3.171 for the PA (Figure 5.D-9).

In the month of February during dry water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.372 for the NAA and 1.263 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.978 and 0.817 for the PA while the 75th percentile value was 1.787 and 1.619 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.497 and -0.49 for the PA while the maximum value was 3.664 and 3.421 for the PA (Figure 5.D-9).

In the month of March during dry water years, the median water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.381 for the NAA and 1.198 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 1.009 and 0.772 for the PA while the 75th percentile value was 1.742 and 1.497 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.427 and -0.46 for the PA while the maximum value was 3.562 and 3.302 for the PA (Figure 5.D-9).

In the month of June during dry water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.058 for the NAA and 0.955 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.639 and 0.602 for the PA while the 75th percentile value was 1.415 and 1.314 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.551 and -0.596 for the PA while the maximum value was 2.136 and 1.914 for the PA (Figure 5.D-9).

Critical Water Years

In the month of December during critical water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 0.956 for the NAA and 0.902 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.373 and 0.302 for the PA while the 75th percentile value was 1.296 and 1.256 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.959 and -0.976 for the PA while the maximum value was 2.079 and 2.031 for the PA (Figure 5.D-9).

In the month of February during critical water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-9). Median water velocity (ft/s) was 1.147 for the NAA and 1.053 for the PA (Figure 5.D-9). The 25th percentile value of water velocity (ft/s) for the NAA was 0.723 and 0.567 for the PA while the 75th percentile value was 1.425 and 1.359 for the PA (Figure 5.D-9). The minimum value of water velocity (ft/s) for the NAA was -0.508 and -0.591 for the PA while the maximum value was 2.859 and 2.878 for the PA (Figure 5.D-9).

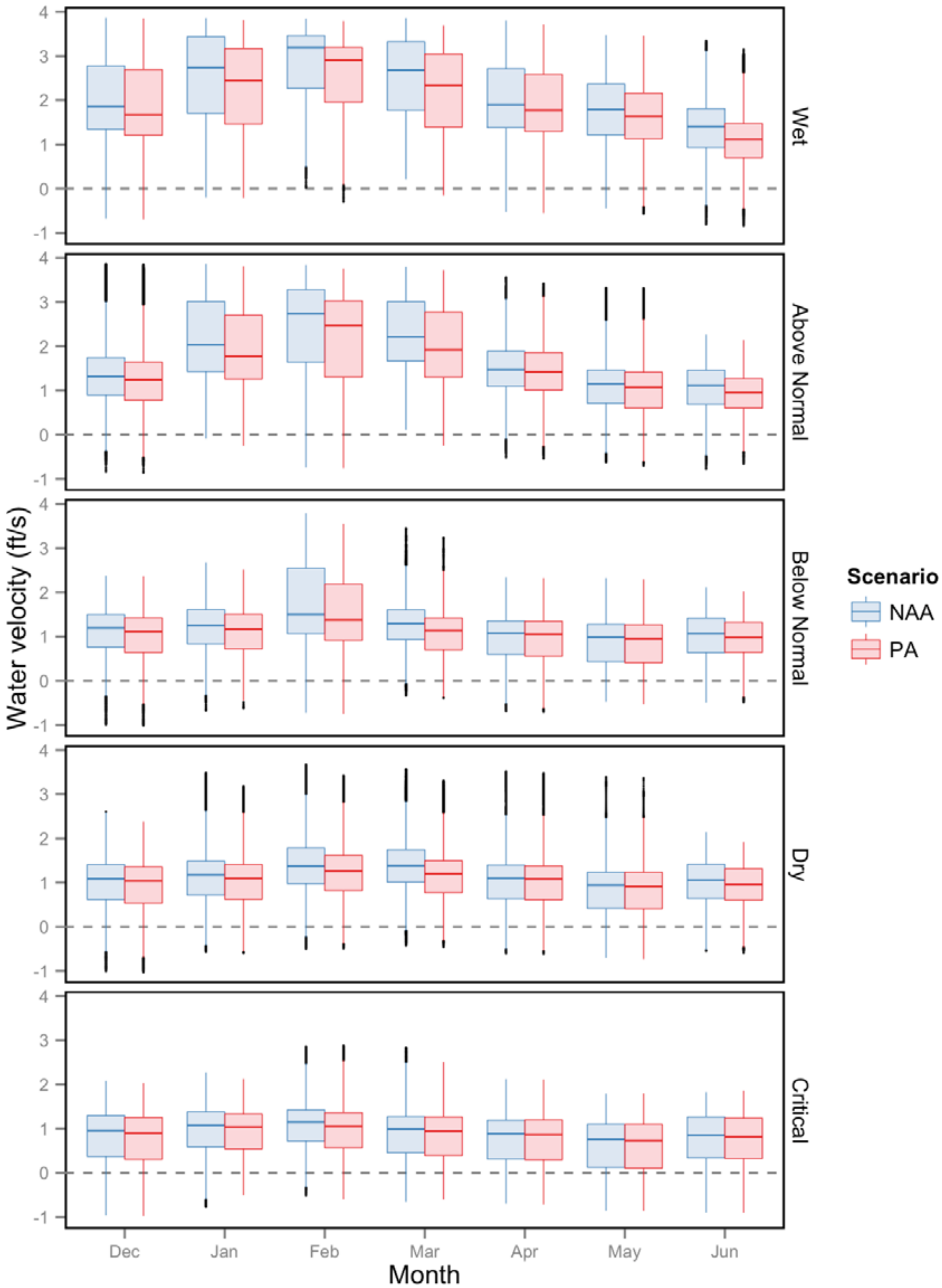


Figure 5.D-9. Velocity of flow entering the interior delta at channel 421, the Sacramento River upstream of Georgiana Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.1.10 Channel 423, Sacramento River downstream of Georgiana Slough

Wet Water Years

In the month of December during wet water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.713 for the NAA and 1.578 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 1.169 and 1.025 for the PA while the 75th percentile value was 2.515 and 2.403 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.334 and -1.341 for the PA while the maximum value was 3.543 and 3.521 for the PA (Figure 5.D-10).

In the month of January during wet water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 2.467 for the NAA and 2.211 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 1.564 and 1.382 for the PA while the 75th percentile value was 3.096 and 2.858 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -0.931 and -0.954 for the PA while the maximum value was 3.544 and 3.473 for the PA (Figure 5.D-10).

In the month of February during wet water years, the median water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 2.857 for the NAA and 2.593 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 2.061 and 1.774 for the PA while the 75th percentile value was 3.13 and 2.893 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -0.786 and -1.074 for the PA while the maximum value was 3.53 and 3.458 for the PA (Figure 5.D-10).

In the month of March during wet water years, the median water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 2.429 for the NAA and 2.129 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 1.629 and 1.328 for the PA while the 75th percentile value was 3.024 and 2.774 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -0.575 and -0.918 for the PA while the maximum value was 3.528 and 3.358 for the PA (Figure 5.D-10).

In the month of May during wet water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.623 for the NAA and 1.522 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 1.119 and 1.016 for the PA while the 75th percentile value was 2.174 and 1.998 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.072 and -1.227 for the PA while the maximum value was 3.202 and 3.178 for the PA (Figure 5.D-10).

In the month of June during wet water years, the median water velocity was predicted to be 15% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.147 for the NAA and 0.975 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.23 and -0.184 for the PA while the 75th

percentile value was 1.532 and 1.314 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.313 and -1.344 for the PA while the maximum value was 3.065 and 2.84 for the PA (Figure 5.D-10).

Above Normal Water Years

In the month of December during above normal water years, the median water velocity was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.229 for the NAA and 1.161 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.52 and 0.366 for the PA while the 75th percentile value was 1.652 and 1.591 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.312 and -1.318 for the PA while the maximum value was 3.534 and 3.537 for the PA (Figure 5.D-10Figure 5.D-10).

In the month of January during above normal water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.857 for the NAA and 1.68 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 1.296 and 1.12 for the PA while the 75th percentile value was 2.701 and 2.406 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -0.859 and -0.993 for the PA while the maximum value was 3.554 and 3.457 for the PA (Figure 5.D-10).

In the month of February during above normal water years, the median water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 2.463 for the NAA and 2.205 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 1.504 and 1.273 for the PA while the 75th percentile value was 2.973 and 2.75 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.218 and -1.227 for the PA while the maximum value was 3.501 and 3.419 for the PA (Figure 5.D-10).

In the month of March during above normal water years, the median water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 2.015 for the NAA and 1.764 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 1.504 and 1.206 for the PA while the 75th percentile value was 2.711 and 2.501 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -0.64 and -0.988 for the PA while the maximum value was 3.449 and 3.38 for the PA (Figure 5.D-10).

In the month of June during above normal water years, the median water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 0.824 for the NAA and 0.739 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was -0.32 and -0.418 for the PA while the 75th percentile value was 1.25 and 1.176 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.269 and -1.321 for the PA while the maximum value was 2.144 and 1.741 for the PA (Figure 5.D-10).

Below Normal Water Years

In the month of December during below normal water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.063 for the NAA and 0.993 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.255 and 0.078 for the PA while the 75th percentile value was 1.428 and 1.361 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.359 and -1.361 for the PA while the maximum value was 2.225 and 2.252 for the PA (Figure 5.D-10).

In the month of January during below normal water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.199 for the NAA and 1.121 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.524 and 0.378 for the PA while the 75th percentile value was 1.554 and 1.489 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.295 and -1.252 for the PA while the maximum value was 2.503 and 2.362 for the PA (Figure 5.D-10).

In the month of February during below normal water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.458 for the NAA and 1.359 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.869 and 0.701 for the PA while the 75th percentile value was 2.28 and 1.996 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.184 and -1.188 for the PA while the maximum value was 3.494 and 3.283 for the PA (Figure 5.D-10).

In the month of March during below normal water years, the median water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.235 for the NAA and 1.091 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.632 and 0.344 for the PA while the 75th percentile value was 1.54 and 1.429 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -0.943 and -1.087 for the PA while the maximum value was 3.172 and 2.98 for the PA (Figure 5.D-10).

Dry Water Years

In the month of January during dry water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.12 for the NAA and 1.055 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.379 and 0.237 for the PA while the 75th percentile value was 1.484 and 1.436 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.164 and -1.175 for the PA while the maximum value was 3.202 and 2.93 for the PA (Figure 5.D-10).

In the month of February during dry water years, the median water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.328 for the NAA and 1.228 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.717 and 0.517 for the PA while the 75th percentile value was 1.701 and 1.59 for the PA (Figure 5.D-10). The minimum value of water

velocity (ft/s) for the NAA was -1.027 and -1.025 for the PA while the maximum value was 3.353 and 3.133 for the PA (Figure 5.D-10).

In the month of March during dry water years, the median water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.313 for the NAA and 1.15 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.747 and 0.437 for the PA while the 75th percentile value was 1.646 and 1.49 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -0.944 and -1.051 for the PA while the maximum value was 3.274 and 3.043 for the PA (Figure 5.D-10).

Critical Water Years

In the month of December during critical water years, the median water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 0.829 for the NAA and 0.784 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was -0.233 and -0.298 for the PA while the 75th percentile value was 1.273 and 1.237 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.355 and -1.365 for the PA while the maximum value was 1.99 and 1.993 for the PA (Figure 5.D-10).

In the month of February during critical water years, the median water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 1.095 for the NAA and 0.999 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.357 and 0.166 for the PA while the 75th percentile value was 1.444 and 1.398 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.068 and -1.144 for the PA while the maximum value was 2.688 and 2.704 for the PA (Figure 5.D-10).

In the month of March during critical water years, the median water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-10). Median water velocity (ft/s) was 0.945 for the NAA and 0.883 for the PA (Figure 5.D-10). The 25th percentile value of water velocity (ft/s) for the NAA was 0.002 and -0.062 for the PA while the 75th percentile value was 1.332 and 1.33 for the PA (Figure 5.D-10). The minimum value of water velocity (ft/s) for the NAA was -1.237 and -1.206 for the PA while the maximum value was 2.628 and 2.352 for the PA (Figure 5.D-10).

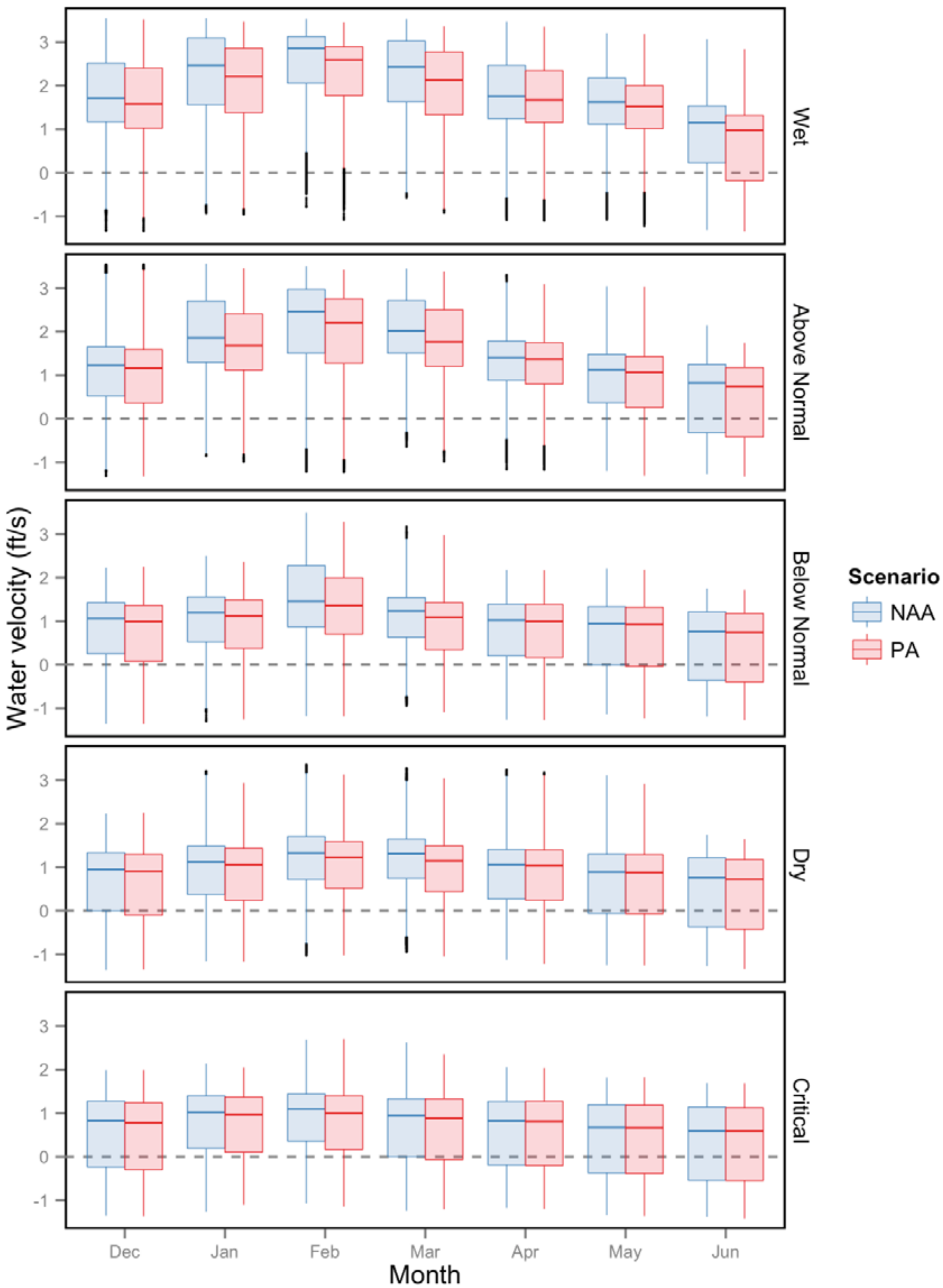


Figure 5.D-10. Velocity of flow entering the interior delta at channel 423, the Sacramento River downstream of Georgiana Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.2 Negative Velocity

5.D.1.2.1.2.1.2.1 Channel 21, San Joaquin River downstream of the head of Old River

Wet Water Years

In the month of January during wet water years, the median negative water velocity was predicted to be 21% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.246 for the NAA and -0.194 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.351 and -0.301 for the PA while the 75th percentile value was -0.132 and -0.099 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.625 and -0.603 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of February during wet water years, the median negative water velocity was predicted to be 27% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.182 for the NAA and -0.133 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.282 and -0.216 for the PA while the 75th percentile value was -0.086 and -0.066 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.612 and -0.559 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of March during wet water years, the median negative water velocity was predicted to be 27% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.166 for the NAA and -0.121 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.264 and -0.216 for the PA while the 75th percentile value was -0.081 and -0.055 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.644 and -0.594 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of April during wet water years, the median negative water velocity was predicted to be 33% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.154 for the NAA and -0.104 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.244 and -0.184 for the PA while the 75th percentile value was -0.079 and -0.048 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.543 and -0.462 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of May during wet water years, the median negative water velocity was predicted to be 34% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.187 for the NAA and -0.124 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.283 and -0.207 for the PA while the 75th percentile value was -0.1 and -0.06 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.537 and -0.459 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of June during wet water years, the median negative water velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.222 for the NAA and -0.205 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.331 and -0.315 for the PA while the 75th percentile value was -0.118 and -0.107 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.578 and -0.582 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

Above Normal Water Years

In the month of January during above normal water years, the median negative water velocity was predicted to be 18% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.284 for the NAA and -0.233 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.384 and -0.339 for the PA while the 75th percentile value was -0.171 and -0.128 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.659 and -0.626 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of February during above normal water years, the median negative water velocity was predicted to be 24% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.246 for the NAA and -0.187 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.349 and -0.296 for the PA while the 75th percentile value was -0.14 and -0.097 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.651 and -0.642 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of March during above normal water years, the median negative water velocity was predicted to be 25% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.225 for the NAA and -0.17 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.327 and -0.263 for the PA while the 75th percentile value was -0.119 and -0.087 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.634 and -0.588 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of April during above normal water years, the median negative water velocity was predicted to be 32% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.194 for the NAA and -0.132 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.292 and -0.225 for the PA while the 75th percentile value was -0.114 and -0.062 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.592 and -0.551 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of May during above normal water years, the median negative water velocity was predicted to be 31% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.215 for the NAA and -0.149 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.31 and -0.236 for the PA while the 75th percentile value was -0.125 and -0.076 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.571 and -0.517 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of June during above normal water years, the median negative water velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.267 for the NAA and -0.249 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.368 and -0.352 for the PA while the 75th percentile value was -0.165 and -0.148 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.583 and -0.587 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

Below Normal Water Years

In the month of January during below normal water years, the median negative water velocity was predicted to be 19% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.309 for the NAA and -0.251 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.396 and -0.346 for the PA while the 75th percentile value was -0.198 and -0.147 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.621 and -0.598 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of February during below normal water years, the median negative water velocity was predicted to be 22% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.281 for the NAA and -0.22 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.366 and -0.314 for the PA while the 75th percentile value was -0.178 and -0.123 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.642 and -0.619 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of March during below normal water years, the median negative water velocity was predicted to be 23% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.258 for the NAA and -0.198 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.353 and -0.3 for the PA while the 75th percentile value was -0.16 and -0.11 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.661 and -0.635 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of April during below normal water years, the median negative water velocity was predicted to be 27% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.229 for the NAA and -0.167 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.321 and -0.256 for the PA while the 75th percentile value was -0.139 and -0.092 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.582 and -0.532 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of May during below normal water years, the median negative water velocity was predicted to be 24% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.249 for the NAA and -0.19 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.346 and -0.284 for the PA while the 75th percentile value was -0.156 and -0.104 for the PA

(Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.57 and -0.523 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

Dry Water Years

In the month of January during dry water years, the median negative water velocity was predicted to be 19% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.318 for the NAA and -0.259 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.399 and -0.35 for the PA while the 75th percentile value was -0.21 and -0.159 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.72 and -0.684 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of February during dry water years, the median negative water velocity was predicted to be 18% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.306 for the NAA and -0.25 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.386 and -0.336 for the PA while the 75th percentile value was -0.203 and -0.151 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.641 and -0.605 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of March during dry water years, the median negative water velocity was predicted to be 18% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.309 for the NAA and -0.254 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.387 and -0.337 for the PA while the 75th percentile value was -0.21 and -0.163 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.638 and -0.603 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of April during dry water years, the median negative water velocity was predicted to be 18% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.277 for the NAA and -0.226 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.366 and -0.32 for the PA while the 75th percentile value was -0.17 and -0.134 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.641 and -0.612 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of May during dry water years, the median negative water velocity was predicted to be 18% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.291 for the NAA and -0.239 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.383 and -0.336 for the PA while the 75th percentile value was -0.187 and -0.143 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.644 and -0.612 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

Critical Water Years

In the month of January during critical water years, the median negative water velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure

5.D-11). Median negative water velocity (ft/s) was -0.341 for the NAA and -0.294 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.416 and -0.377 for the PA while the 75th percentile value was -0.231 and -0.19 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.686 and -0.641 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of February during critical water years, the median negative water velocity was predicted to be 16% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.317 for the NAA and -0.266 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.395 and -0.35 for the PA while the 75th percentile value was -0.213 and -0.165 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.624 and -0.587 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of March during critical water years, the median negative water velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.324 for the NAA and -0.282 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.403 and -0.364 for the PA while the 75th percentile value was -0.232 and -0.189 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.763 and -0.738 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of April during critical water years, the median negative water velocity was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.327 for the NAA and -0.288 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.408 and -0.375 for the PA while the 75th percentile value was -0.23 and -0.194 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.658 and -0.636 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

In the month of May during critical water years, the median negative water velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-11). Median negative water velocity (ft/s) was -0.325 for the NAA and -0.284 for the PA (Figure 5.D-11). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.412 and -0.38 for the PA while the 75th percentile value was -0.226 and -0.187 for the PA (Figure 5.D-11). The minimum value of negative water velocity (ft/s) for the NAA was -0.619 and -0.597 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-11).

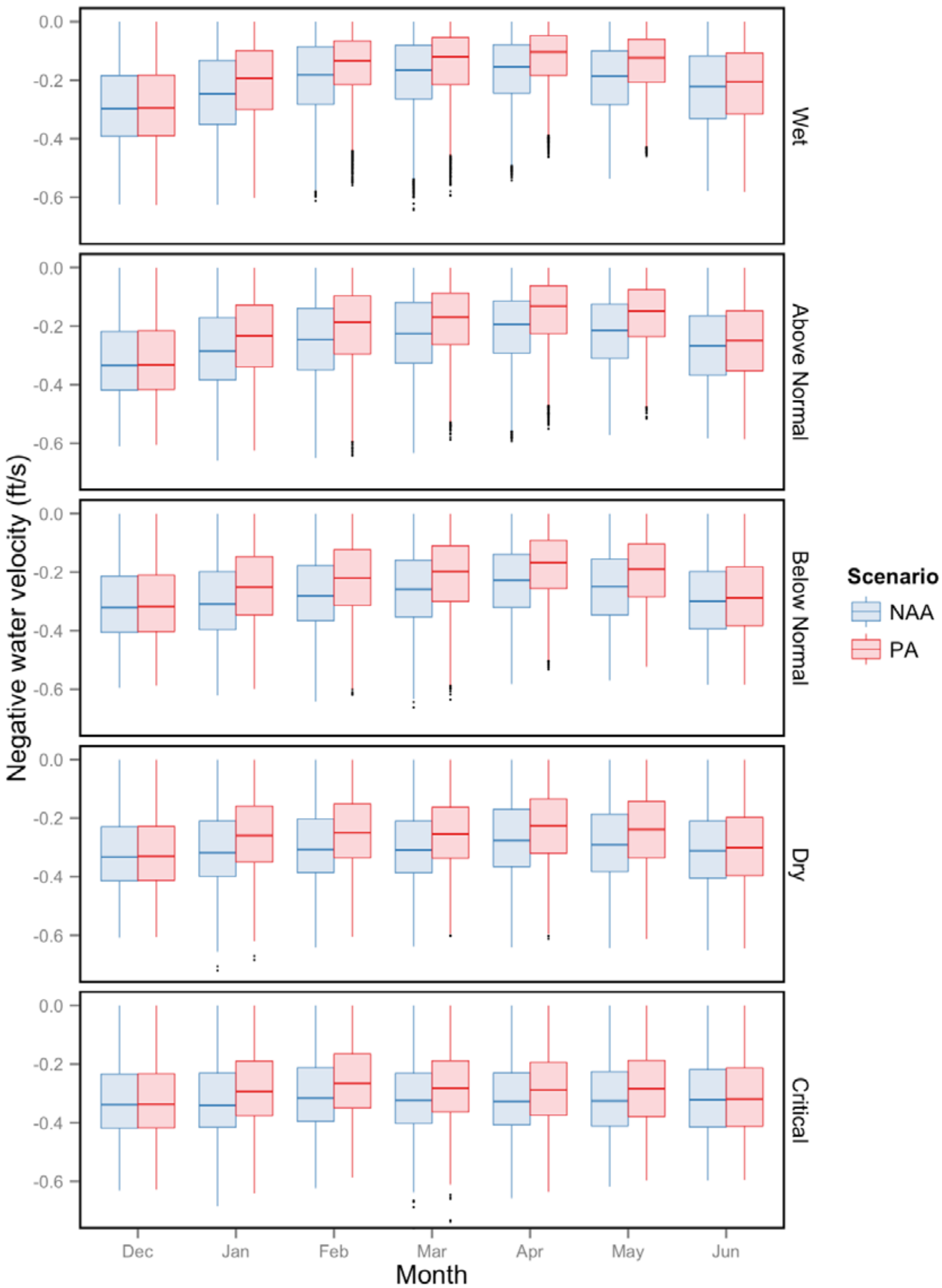


Figure 5.D-11. Velocity of flow entering the interior delta at channel 21, San Joaquin River downstream of the head of Old River, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.2.2 *Channel 45, San Joaquin River near the confluence with the Mokelumne River*

All Water Years

In all months of all years, the median daily proportion of negative velocity was predicted to be less than 5% different between the NAA and the PA over the 82 water years (Figure 5.D-12).

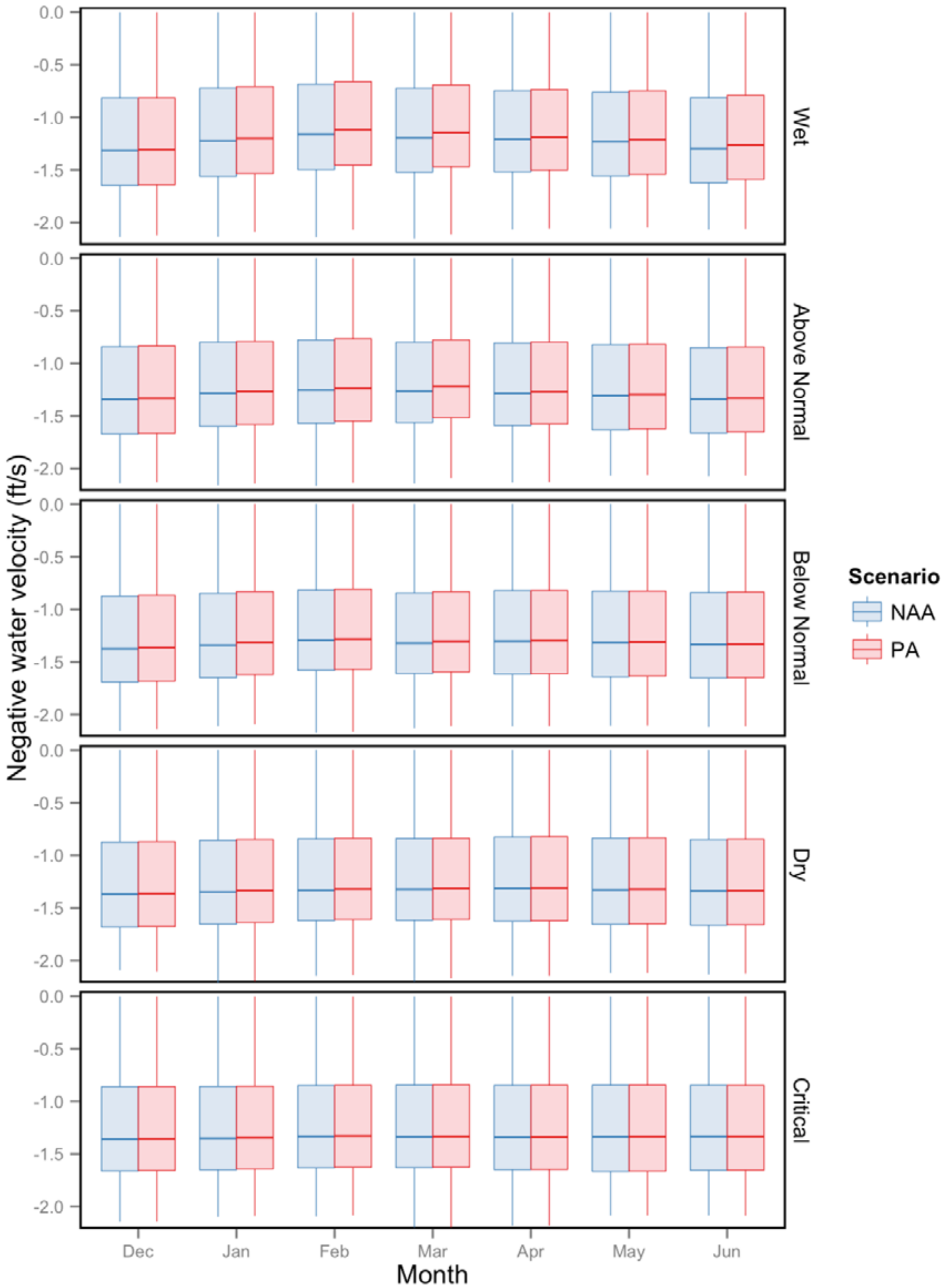


Figure 5.D-12. Velocity of flow entering the interior delta at channel 45, the San Joaquin River near the confluence with the Mokelumne River, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.2.3 Channel 94, Old River downstream of the facilities

Wet Water Years

In the month of January during wet water years, the median negative water velocity was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-13). Median negative water velocity (ft/s) was -0.895 for the NAA and -0.849 for the PA (Figure 5.D-13). The 25th percentile value of negative water velocity (ft/s) for the NAA was -1.096 and -1.052 for the PA while the 75th percentile value was -0.508 and -0.495 for the PA (Figure 5.D-13). The minimum value of negative water velocity (ft/s) for the NAA was -1.515 and -1.409 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-13).

In the month of February during wet water years, the median negative water velocity was predicted to be 10% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-13). Median negative water velocity (ft/s) was -0.859 for the NAA and -0.775 for the PA (Figure 5.D-13). The 25th percentile value of negative water velocity (ft/s) for the NAA was -1.08 and -0.969 for the PA while the 75th percentile value was -0.443 and -0.451 for the PA (Figure 5.D-13). The minimum value of negative water velocity (ft/s) for the NAA was -1.52 and -1.381 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-13).

In the month of March during wet water years, the median negative water velocity was predicted to be 17% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-13). Median negative water velocity (ft/s) was -0.873 for the NAA and -0.724 for the PA (Figure 5.D-13). The 25th percentile value of negative water velocity (ft/s) for the NAA was -1.095 and -0.926 for the PA while the 75th percentile value was -0.464 and -0.421 for the PA (Figure 5.D-13). The minimum value of negative water velocity (ft/s) for the NAA was -1.461 and -1.276 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-13).

In the month of June during wet water years, the median negative water velocity was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-13). Median negative water velocity (ft/s) was -0.917 for the NAA and -0.815 for the PA (Figure 5.D-13). The 25th percentile value of negative water velocity (ft/s) for the NAA was -1.098 and -1.008 for the PA while the 75th percentile value was -0.573 and -0.506 for the PA (Figure 5.D-13). The minimum value of negative water velocity (ft/s) for the NAA was -1.436 and -1.297 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-13).

Above Normal Water Years

In the month of March during above normal water years, the median negative water velocity was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-13). Median negative water velocity (ft/s) was -0.927 for the NAA and -0.812 for the PA (Figure 5.D-13). The 25th percentile value of negative water velocity (ft/s) for the NAA was -1.112 and -0.978 for the PA while the 75th percentile value was -0.528 and -0.519 for the PA (Figure 5.D-13). The minimum value of negative water velocity (ft/s) for the NAA was -1.464 and -1.299 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-13).

Below Normal Water Years

In the month of January during below normal water years, the median negative water velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure

5.D-13). Median negative water velocity (ft/s) was -0.956 for the NAA and -0.888 for the PA (Figure 5.D-13). The 25th percentile value of negative water velocity (ft/s) for the NAA was -1.117 and -1.048 for the PA while the 75th percentile value was -0.605 and -0.595 for the PA (Figure 5.D-13). The minimum value of negative water velocity (ft/s) for the NAA was -1.41 and -1.33 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-13).

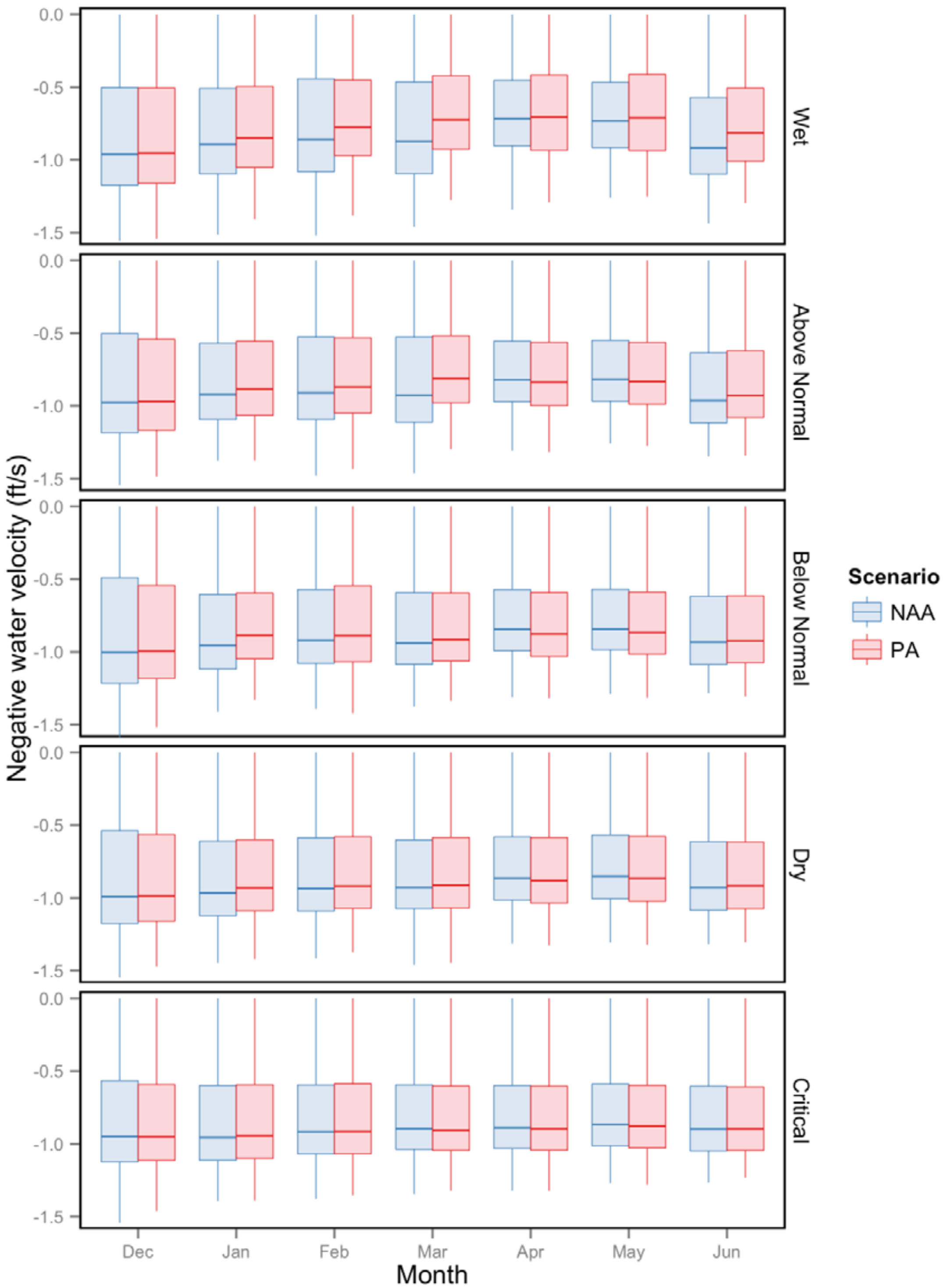


Figure 5.D-13. Velocity of flow entering the interior delta at channel 94, Old River downstream of the facilities, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.2.4 Channel 212, Old River upstream of the facilities

Wet Water Years

In the month of January during wet water years, the median negative water velocity was predicted to be 51% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.461 for the NAA and -0.698 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.761 and -0.939 for the PA while the 75th percentile value was -0.25 and -0.409 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.116 and -1.305 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of February during wet water years, the median negative water velocity was predicted to be 83% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.377 for the NAA and -0.691 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.636 and -0.89 for the PA while the 75th percentile value was -0.188 and -0.387 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.056 and -1.258 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of March during wet water years, the median negative water velocity was predicted to be 93% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.342 for the NAA and -0.661 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.596 and -0.872 for the PA while the 75th percentile value was -0.151 and -0.374 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.055 and -1.239 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of April during wet water years, the median negative water velocity was predicted to be 69% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.418 for the NAA and -0.705 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.594 and -0.875 for the PA while the 75th percentile value was -0.211 and -0.425 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.009 and -1.24 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of May during wet water years, the median negative water velocity was predicted to be 52% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.504 for the NAA and -0.766 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.694 and -0.943 for the PA while the 75th percentile value was -0.255 and -0.471 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.07 and -1.269 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of June during wet water years, the median negative water velocity was predicted to be 22% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.261 for the NAA and -0.319 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.42 and -0.481 for the PA while the 75th percentile value was -0.137 and -0.19 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -0.87 and -1.155 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

Above Normal Water Years

In the month of January during above normal water years, the median negative water velocity was predicted to be 35% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.531 for the NAA and -0.718 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.799 and -0.969 for the PA while the 75th percentile value was -0.303 and -0.431 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.168 and -1.329 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of February during above normal water years, the median negative water velocity was predicted to be 38% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.49 for the NAA and -0.678 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.759 and -0.933 for the PA while the 75th percentile value was -0.235 and -0.415 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.167 and -1.312 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of March during above normal water years, the median negative water velocity was predicted to be 79% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.431 for the NAA and -0.773 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.667 and -0.942 for the PA while the 75th percentile value was -0.229 and -0.479 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.083 and -1.268 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of April during above normal water years, the median negative water velocity was predicted to be 52% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.506 for the NAA and -0.767 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.681 and -0.925 for the PA while the 75th percentile value was -0.279 and -0.488 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.045 and -1.252 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of May during above normal water years, the median negative water velocity was predicted to be 47% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.55 for the NAA and -0.807 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.742 and -0.972 for the PA while the 75th percentile value was -0.301 and -0.517 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.118 and -1.303 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of June during above normal water years, the median negative water velocity was predicted to be 14% higher for the NAA relative to the PA over the 82 water years (Figure

5.D-14). Median negative water velocity (ft/s) was -0.306 for the NAA and -0.348 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.462 and -0.501 for the PA while the 75th percentile value was -0.167 and -0.227 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -0.881 and -1.134 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

Below Normal Water Years

In the month of January during below normal water years, the median negative water velocity was predicted to be 45% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.526 for the NAA and -0.761 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.809 and -0.985 for the PA while the 75th percentile value was -0.3 and -0.479 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.125 and -1.253 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of February during below normal water years, the median negative water velocity was predicted to be 35% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.501 for the NAA and -0.678 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.775 and -0.91 for the PA while the 75th percentile value was -0.261 and -0.403 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.18 and -1.255 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of March during below normal water years, the median negative water velocity was predicted to be 45% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.465 for the NAA and -0.675 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.711 and -0.86 for the PA while the 75th percentile value was -0.254 and -0.42 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.127 and -1.264 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of April during below normal water years, the median negative water velocity was predicted to be 37% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.548 for the NAA and -0.75 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.742 and -0.924 for the PA while the 75th percentile value was -0.315 and -0.464 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.048 and -1.234 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of May during below normal water years, the median negative water velocity was predicted to be 32% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.604 for the NAA and -0.798 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.803 and -0.978 for the PA while the 75th percentile value was -0.341 and -0.497 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.106 and -1.278 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of June during below normal water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.369 for the NAA and -0.396 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.517 and -0.547 for the PA while the 75th percentile value was -0.229 and -0.27 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.003 and -1.13 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

Dry Water Years

In the month of January during dry water years, the median negative water velocity was predicted to be 40% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.5 for the NAA and -0.699 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.811 and -0.95 for the PA while the 75th percentile value was -0.311 and -0.436 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.152 and -1.281 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of February during dry water years, the median negative water velocity was predicted to be 30% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.544 for the NAA and -0.707 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.805 and -0.926 for the PA while the 75th percentile value was -0.328 and -0.433 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.136 and -1.258 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of March during dry water years, the median negative water velocity was predicted to be 25% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.578 for the NAA and -0.723 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.785 and -0.899 for the PA while the 75th percentile value was -0.357 and -0.437 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.147 and -1.253 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of April during dry water years, the median negative water velocity was predicted to be 24% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.62 for the NAA and -0.767 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.816 and -0.945 for the PA while the 75th percentile value was -0.345 and -0.473 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.145 and -1.259 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of May during dry water years, the median negative water velocity was predicted to be 24% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.642 for the NAA and -0.793 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.859 and -0.996 for the PA while the 75th percentile value was -0.358 and -0.485 for the PA (Figure 5.D-14). The

minimum value of negative water velocity (ft/s) for the NAA was -1.17 and -1.282 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of June during dry water years, the median negative water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.4 for the NAA and -0.43 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.556 and -0.579 for the PA while the 75th percentile value was -0.257 and -0.294 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.084 and -1.142 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

Critical Water Years

In the month of January during critical water years, the median negative water velocity was predicted to be 26% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.554 for the NAA and -0.7 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.848 and -0.949 for the PA while the 75th percentile value was -0.346 and -0.44 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.112 and -1.261 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of February during critical water years, the median negative water velocity was predicted to be 20% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.596 for the NAA and -0.716 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.845 and -0.953 for the PA while the 75th percentile value was -0.356 and -0.443 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.087 and -1.221 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of March during critical water years, the median negative water velocity was predicted to be 15% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.691 for the NAA and -0.797 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.862 and -0.972 for the PA while the 75th percentile value was -0.4 and -0.499 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.153 and -1.277 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of April during critical water years, the median negative water velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.735 for the NAA and -0.829 for the PA (Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.899 and -1.001 for the PA while the 75th percentile value was -0.456 and -0.527 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.175 and -1.281 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

In the month of May during critical water years, the median negative water velocity was predicted to be 14% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-14). Median negative water velocity (ft/s) was -0.731 for the NAA and -0.83 for the PA

(Figure 5.D-14). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.908 and -1.012 for the PA while the 75th percentile value was -0.447 and -0.531 for the PA (Figure 5.D-14). The minimum value of negative water velocity (ft/s) for the NAA was -1.216 and -1.281 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-14).

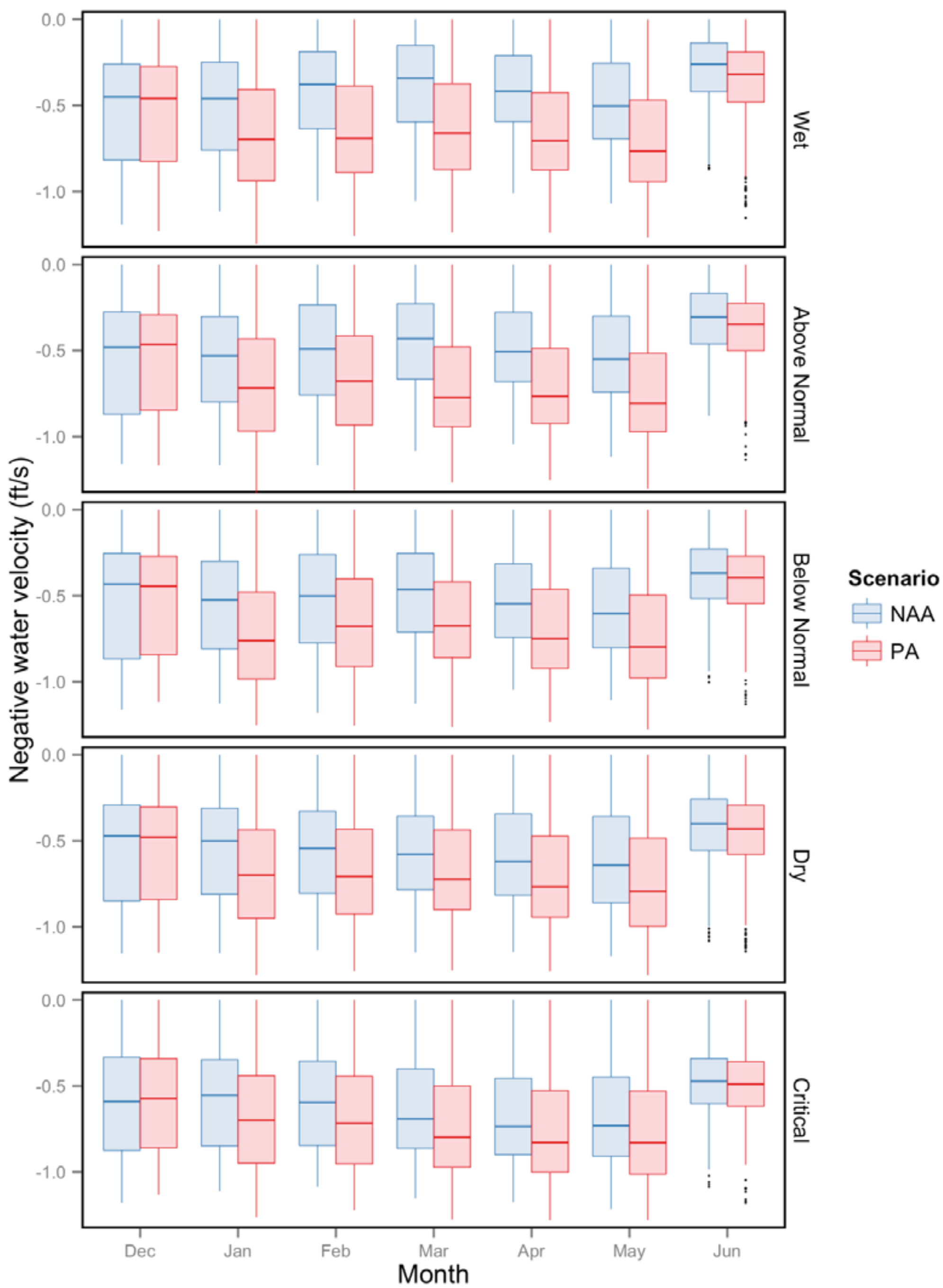


Figure 5.D-14. Velocity of flow entering the interior delta at channel 212, Old River upstream of the facilities, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.2.5 Channel 365, Delta Cross Channel

Wet Water Years

In the month of June during wet water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-15). Median negative water velocity (ft/s) was -0.056 for the NAA and -0.06 for the PA (Figure 5.D-15). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.068 and -0.079 for the PA while the 75th percentile value was -0.035 and -0.038 for the PA (Figure 5.D-15). The minimum value of negative water velocity (ft/s) for the NAA was -0.833 and -0.877 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-15).

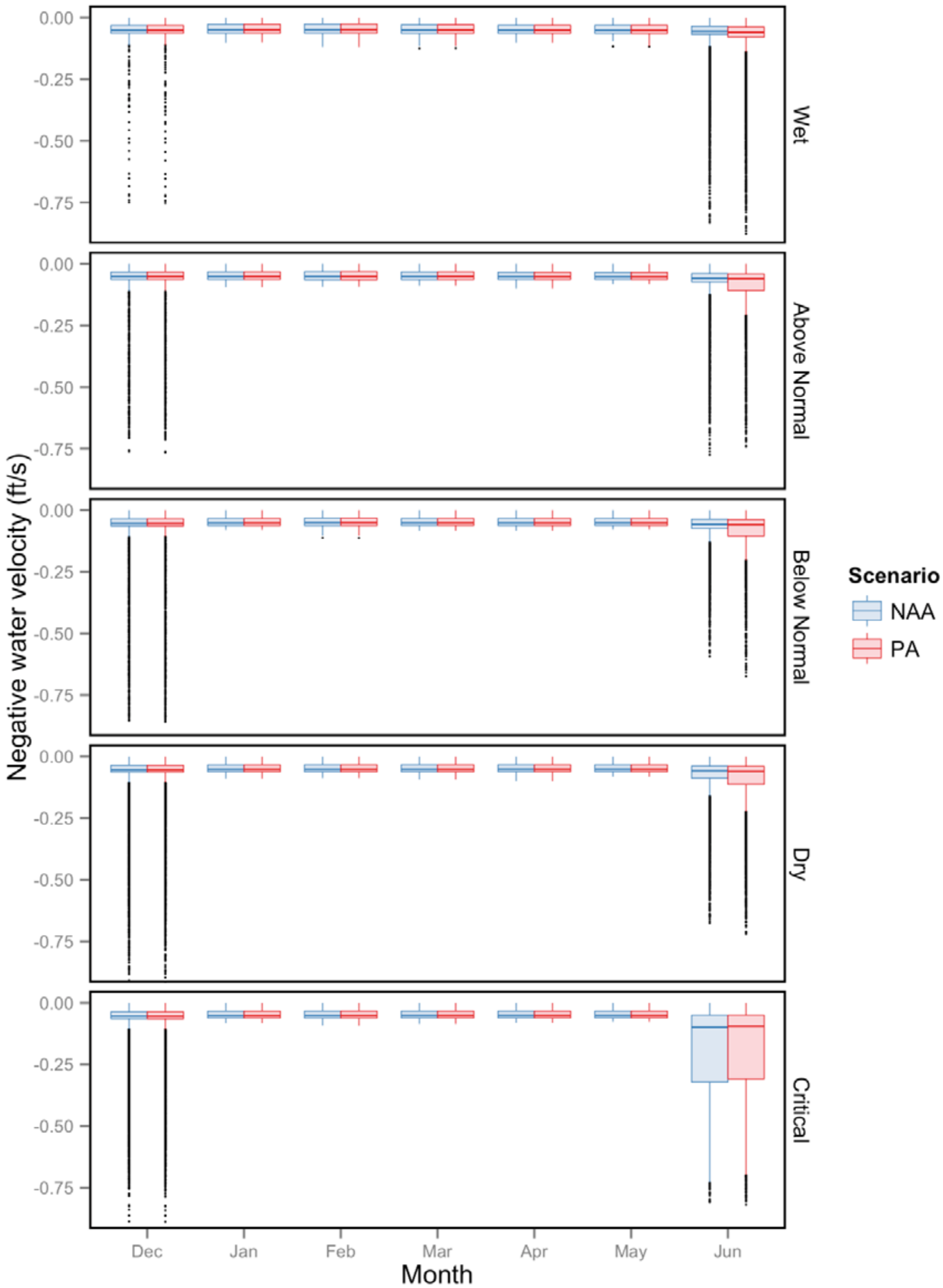


Figure 5.D-15. Velocity of flow entering the interior delta at channel 365, the Delta Cross Channel, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.2.6 Channel 379, Steamboat Slough

Wet Water Years

In the month of December during wet water years, the median negative water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.12 for the NAA and -0.127 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.207 and -0.218 for the PA while the 75th percentile value was -0.053 and -0.051 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.68 and -0.686 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of February during wet water years, the median negative water velocity was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.025 for the NAA and -0.022 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.03 and -0.035 for the PA while the 75th percentile value was -0.016 and -0.01 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.033 and -0.057 for the PA while the maximum value was -0.009 and -0.006 for the PA (Figure 5.D-16).

In the month of April during wet water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.111 for the NAA and -0.119 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.265 and -0.252 for the PA while the 75th percentile value was -0.047 and -0.051 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.514 and -0.523 for the PA while the maximum value was -0.001 and 0 for the PA (Figure 5.D-16).

In the month of June during wet water years, the median negative water velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.147 for the NAA and -0.135 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.239 and -0.241 for the PA while the 75th percentile value was -0.07 and -0.053 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.69 and -0.672 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

Above Normal Water Years

In the month of December during above normal water years, the median negative water velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.224 for the NAA and -0.209 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.369 and -0.358 for the PA while the 75th percentile value was -0.11 and -0.085 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.752 and -0.76 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of January during above normal water years, the median negative water velocity was predicted to be 37% lower for the NAA relative to the PA over the 82 water years (Figure

5.D-16). Median negative water velocity (ft/s) was -0.099 for the NAA and -0.062 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.126 and -0.139 for the PA while the 75th percentile value was -0.04 and -0.033 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.188 and -0.206 for the PA while the maximum value was 0 and -0.001 for the PA (Figure 5.D-16).

In the month of February during above normal water years, the median negative water velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.206 for the NAA and -0.177 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.471 and -0.478 for the PA while the 75th percentile value was -0.082 and -0.073 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.773 and -0.784 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of May during above normal water years, the median negative water velocity was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.14 for the NAA and -0.123 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.238 and -0.225 for the PA while the 75th percentile value was -0.065 and -0.059 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.61 and -0.617 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of June during above normal water years, the median negative water velocity was predicted to be 24% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.135 for the NAA and -0.104 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.248 and -0.209 for the PA while the 75th percentile value was -0.058 and -0.043 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.716 and -0.598 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

Below Normal Water Years

In the month of December during below normal water years, the median negative water velocity was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.218 for the NAA and -0.199 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.363 and -0.351 for the PA while the 75th percentile value was -0.105 and -0.093 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.765 and -0.772 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of January during below normal water years, the median negative water velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.173 for the NAA and -0.162 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.304 and -0.283 for the PA while the 75th percentile value was -0.082 and -0.07 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.715 and -0.663 for the PA while the maximum value was 0 and -0.001 for the PA (Figure 5.D-16).

In the month of February during below normal water years, the median negative water velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.295 for the NAA and -0.271 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.486 and -0.478 for the PA while the 75th percentile value was -0.119 and -0.106 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.697 and -0.702 for the PA while the maximum value was -0.002 and 0 for the PA (Figure 5.D-16).

In the month of April during below normal water years, the median negative water velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.154 for the NAA and -0.142 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.289 and -0.265 for the PA while the 75th percentile value was -0.068 and -0.067 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.699 and -0.705 for the PA while the maximum value was 0 and -0.001 for the PA (Figure 5.D-16).

Dry Water Years

In the month of December during dry water years, the median negative water velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.194 for the NAA and -0.18 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.332 and -0.31 for the PA while the 75th percentile value was -0.09 and -0.083 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.8 and -0.799 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of January during dry water years, the median negative water velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.136 for the NAA and -0.128 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.241 and -0.231 for the PA while the 75th percentile value was -0.065 and -0.058 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.626 and -0.639 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of February during dry water years, the median negative water velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.153 for the NAA and -0.143 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.242 and -0.243 for the PA while the 75th percentile value was -0.07 and -0.064 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.544 and -0.538 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of March during dry water years, the median negative water velocity was predicted to be 10% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.127 for the NAA and -0.115 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.211 and -0.202 for the PA while the 75th percentile value was -0.063 and -0.052 for the PA (Figure 5.D-16). The

minimum value of negative water velocity (ft/s) for the NAA was -0.481 and -0.482 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of May during dry water years, the median negative water velocity was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.149 for the NAA and -0.136 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.256 and -0.232 for the PA while the 75th percentile value was -0.069 and -0.067 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.682 and -0.681 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of June during dry water years, the median negative water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.143 for the NAA and -0.156 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.242 and -0.265 for the PA while the 75th percentile value was -0.068 and -0.071 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.586 and -0.614 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

Critical Water Years

In the month of January during critical water years, the median negative water velocity was predicted to be 37% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.192 for the NAA and -0.121 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.341 and -0.259 for the PA while the 75th percentile value was -0.077 and -0.051 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.738 and -0.559 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of February during critical water years, the median negative water velocity was predicted to be 16% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.149 for the NAA and -0.173 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.257 and -0.291 for the PA while the 75th percentile value was -0.068 and -0.076 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.616 and -0.639 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

In the month of March during critical water years, the median negative water velocity was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-16). Median negative water velocity (ft/s) was -0.166 for the NAA and -0.145 for the PA (Figure 5.D-16). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.285 and -0.242 for the PA while the 75th percentile value was -0.075 and -0.068 for the PA (Figure 5.D-16). The minimum value of negative water velocity (ft/s) for the NAA was -0.658 and -0.597 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-16).

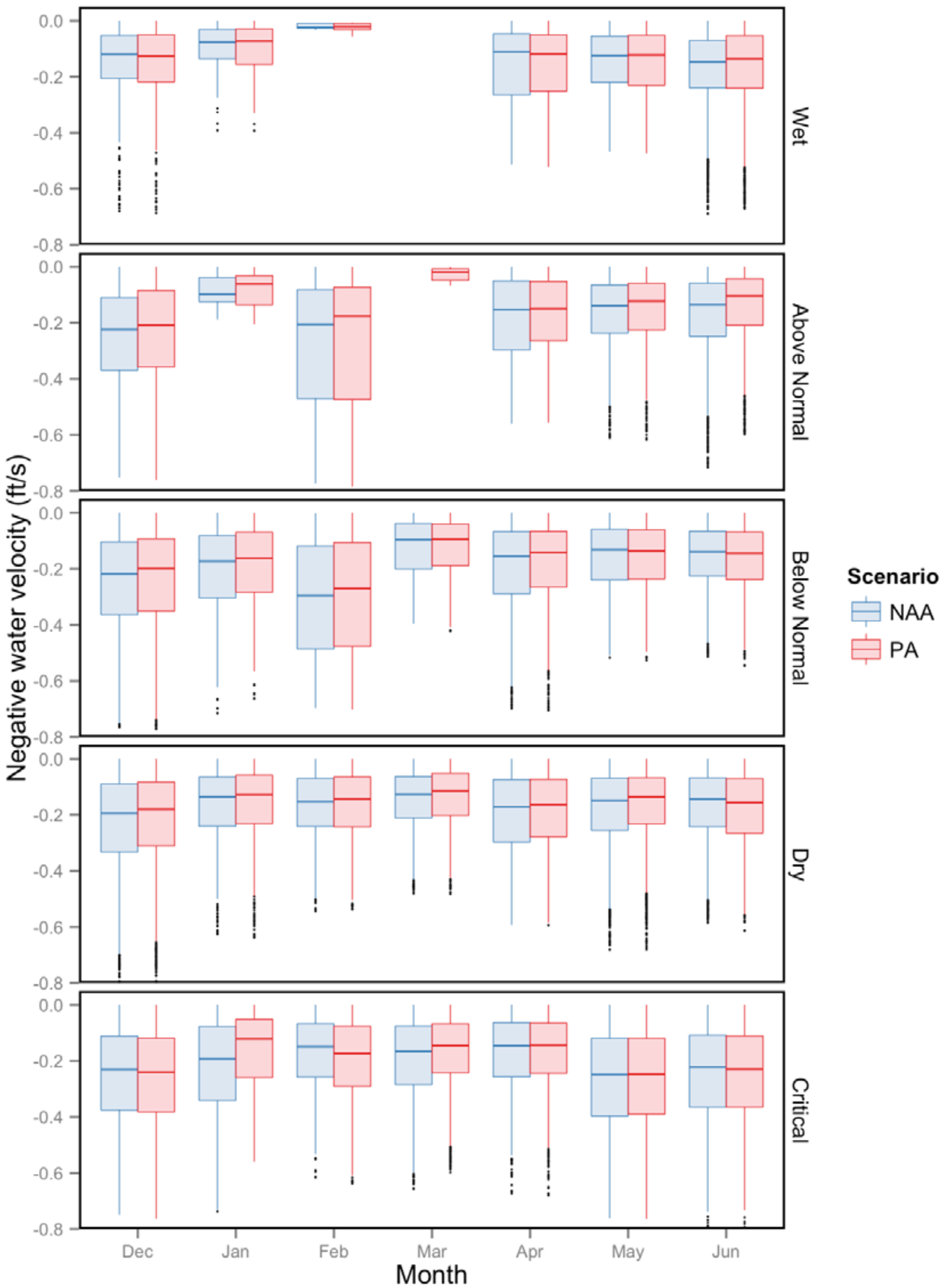


Figure 5.D-16. Velocity of flow entering the interior delta at channel 379, Steamboat Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.2.7 Channel 383, Sutter Slough

Wet Water Years

In the month of February during wet water years, the median negative water velocity was predicted to be 35% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.185 for the NAA and -0.25 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.351 and -0.401 for the PA while the 75th percentile value was -0.101 and -0.133 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -0.803 and -1.03 for the PA while the maximum value was -0.001 and -0.001 for the PA (Figure 5.D-17).

In the month of March during wet water years, the median negative water velocity was predicted to be 117% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.16 for the NAA and -0.347 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.306 and -0.515 for the PA while the 75th percentile value was -0.077 and -0.171 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -0.574 and -0.869 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

In the month of April during wet water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.372 for the NAA and -0.397 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.543 and -0.583 for the PA while the 75th percentile value was -0.198 and -0.212 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.112 and -1.123 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

In the month of May during wet water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.41 for the NAA and -0.438 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.604 and -0.657 for the PA while the 75th percentile value was -0.222 and -0.242 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.091 and -1.217 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

In the month of June during wet water years, the median negative water velocity was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.55 for the NAA and -0.579 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.764 and -0.753 for the PA while the 75th percentile value was -0.311 and -0.358 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.384 and -1.418 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

Above Normal Water Years

In the month of December during above normal water years, the median negative water velocity was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure

5.D-17). Median negative water velocity (ft/s) was -0.492 for the NAA and -0.516 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.705 and -0.719 for the PA while the 75th percentile value was -0.27 and -0.29 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.401 and -1.408 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

In the month of February during above normal water years, the median negative water velocity was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.525 for the NAA and -0.461 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.737 and -0.675 for the PA while the 75th percentile value was -0.293 and -0.237 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.302 and -1.312 for the PA while the maximum value was -0.001 and 0 for the PA (Figure 5.D-17).

In the month of March during above normal water years, the median negative water velocity was predicted to be 32% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.246 for the NAA and -0.324 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.397 and -0.483 for the PA while the 75th percentile value was -0.099 and -0.164 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -0.642 and -0.921 for the PA while the maximum value was -0.001 and -0.001 for the PA (Figure 5.D-17).

In the month of April during above normal water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.367 for the NAA and -0.393 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.555 and -0.601 for the PA while the 75th percentile value was -0.191 and -0.195 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.201 and -1.218 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

In the month of May during above normal water years, the median negative water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.431 for the NAA and -0.456 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.628 and -0.688 for the PA while the 75th percentile value was -0.231 and -0.255 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.245 and -1.288 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

Below Normal Water Years

In the month of December during below normal water years, the median negative water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.484 for the NAA and -0.511 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.709 and -0.723 for the PA while the 75th percentile value was -0.261 and -0.301 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.426 and -1.431 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

In the month of March during below normal water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.392 for the NAA and -0.419 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.565 and -0.611 for the PA while the 75th percentile value was -0.203 and -0.22 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -0.96 and -1.028 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

In the month of April during below normal water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.434 for the NAA and -0.463 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.629 and -0.653 for the PA while the 75th percentile value was -0.243 and -0.263 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.311 and -1.318 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

In the month of June during below normal water years, the median negative water velocity was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.578 for the NAA and -0.547 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.775 and -0.753 for the PA while the 75th percentile value was -0.34 and -0.346 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.221 and -1.272 for the PA while the maximum value was -0.001 and 0 for the PA (Figure 5.D-17).

Dry Water Years

In the month of January during dry water years, the median negative water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.439 for the NAA and -0.474 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.63 and -0.648 for the PA while the 75th percentile value was -0.241 and -0.273 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.214 and -1.229 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

In the month of February during dry water years, the median negative water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.376 for the NAA and -0.421 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.554 and -0.599 for the PA while the 75th percentile value was -0.203 and -0.232 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.073 and -1.067 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

In the month of March during dry water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.384 for the NAA and -0.409 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.552 and -0.605 for the PA while the 75th percentile value was -0.209 and -0.213 for the PA (Figure 5.D-17). The

minimum value of negative water velocity (ft/s) for the NAA was -0.966 and -0.995 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

Critical Water Years

In the month of February during critical water years, the median negative water velocity was predicted to be 16% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.419 for the NAA and -0.485 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.59 and -0.668 for the PA while the 75th percentile value was -0.235 and -0.28 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.12 and -1.19 for the PA while the maximum value was 0 and -0.001 for the PA (Figure 5.D-17).

In the month of March during critical water years, the median negative water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-17). Median negative water velocity (ft/s) was -0.487 for the NAA and -0.516 for the PA (Figure 5.D-17). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.663 and -0.708 for the PA while the 75th percentile value was -0.29 and -0.313 for the PA (Figure 5.D-17). The minimum value of negative water velocity (ft/s) for the NAA was -1.275 and -1.221 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-17).

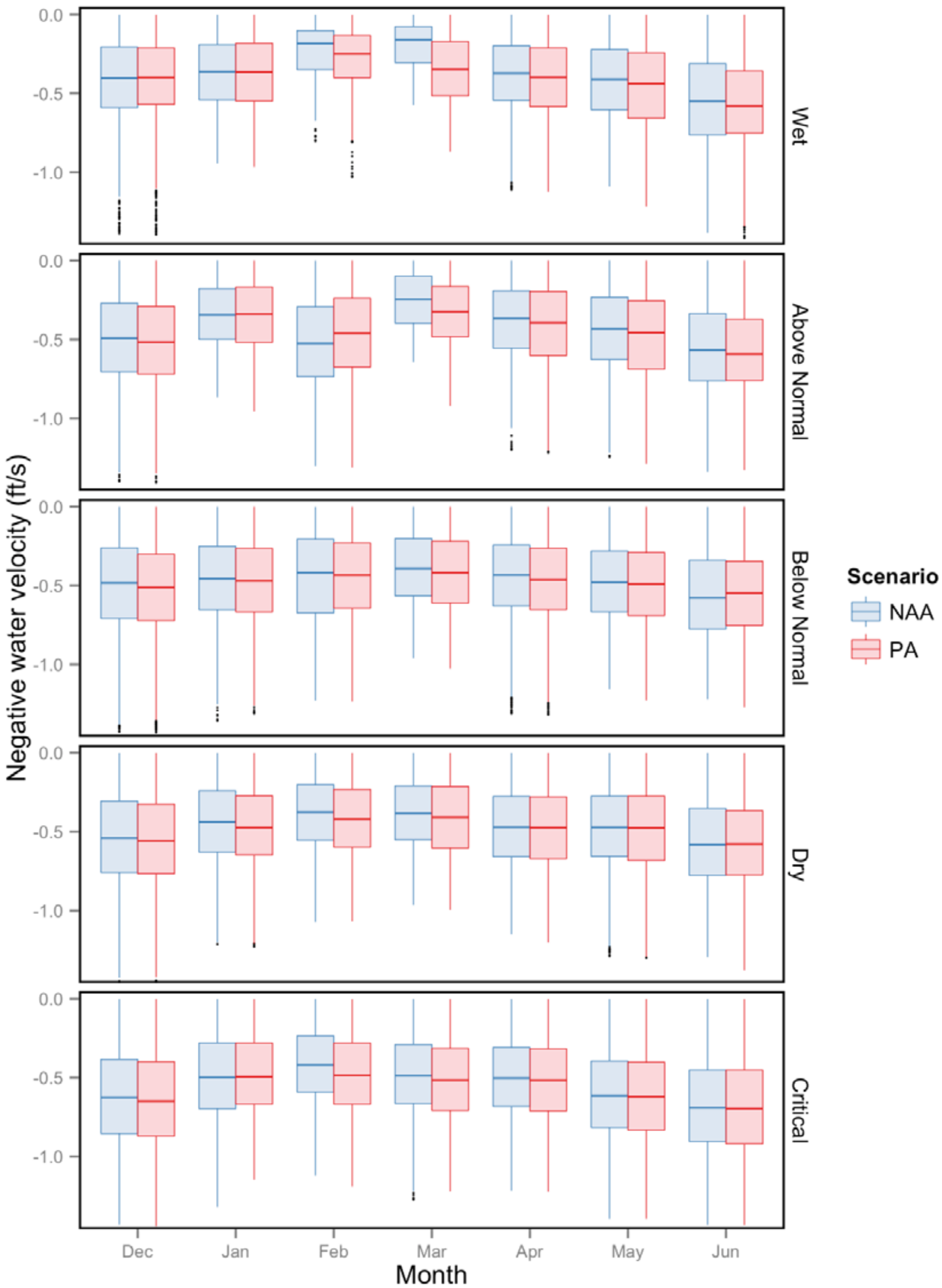


Figure 5.D-17. Velocity of flow entering the interior delta at channel 383, Sutter Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.2.8 Channel 418, Sacramento River downstream of proposed diversions

Wet Water Years

In the month of December during wet water years, the median negative water velocity was predicted to be 14% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.12 for the NAA and -0.136 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.202 and -0.245 for the PA while the 75th percentile value was -0.056 and -0.056 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.801 and -0.793 for the PA while the maximum value was 0 and -0.001 for the PA (Figure 5.D-18).

In the month of May during wet water years, the median negative water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.145 for the NAA and -0.154 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.254 and -0.269 for the PA while the 75th percentile value was -0.063 and -0.068 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.557 and -0.613 for the PA while the maximum value was -0.001 and 0 for the PA (Figure 5.D-18).

In the month of June during wet water years, the median negative water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.156 for the NAA and -0.175 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.308 and -0.317 for the PA while the 75th percentile value was -0.067 and -0.082 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.898 and -0.891 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

Above Normal Water Years

In the month of February during above normal water years, the median negative water velocity was predicted to be 17% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.265 for the NAA and -0.22 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.55 and -0.541 for the PA while the 75th percentile value was -0.095 and -0.071 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.933 and -0.916 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

In the month of April during above normal water years, the median negative water velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.2 for the NAA and -0.183 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.351 and -0.324 for the PA while the 75th percentile value was -0.086 and -0.059 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.669 and -0.667 for the PA while the maximum value was -0.001 and 0 for the PA (Figure 5.D-18).

In the month of May during above normal water years, the median negative water velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.15 for the NAA and -0.14 for the PA

(Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.269 and -0.255 for the PA while the 75th percentile value was -0.067 and -0.064 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.76 and -0.772 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

Below Normal Water Years

In the month of June during above normal water years, the median negative water velocity was predicted to be 23% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.202 for the NAA and -0.156 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.368 and -0.288 for the PA while the 75th percentile value was -0.086 and -0.072 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.879 and -0.756 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

In the month of December during below normal water years, the median negative water velocity was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.254 for the NAA and -0.231 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.535 and -0.464 for the PA while the 75th percentile value was -0.11 and -0.1 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -1.051 and -1.041 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

In the month of March during below normal water years, the median negative water velocity was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.126 for the NAA and -0.114 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.219 and -0.216 for the PA while the 75th percentile value was -0.051 and -0.048 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.454 and -0.487 for the PA while the maximum value was -0.001 and 0 for the PA (Figure 5.D-18).

In the month of May during below normal water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.15 for the NAA and -0.16 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.28 and -0.273 for the PA while the 75th percentile value was -0.067 and -0.074 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.612 and -0.613 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

Dry Water Years

In the month of December during dry water years, the median negative water velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.233 for the NAA and -0.2 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.42 and -0.372 for the PA while the 75th percentile value was -0.106 and -0.089 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -1.099 and -1.083 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

In the month of April during dry water years, the median negative water velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.194 for the NAA and -0.182 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.337 and -0.316 for the PA while the 75th percentile value was -0.089 and -0.084 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.722 and -0.712 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

In the month of May during dry water years, the median negative water velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.168 for the NAA and -0.158 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.294 and -0.266 for the PA while the 75th percentile value was -0.074 and -0.07 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.851 and -0.847 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

Critical Water Years

In the month of January during critical water years, the median negative water velocity was predicted to be 35% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.224 for the NAA and -0.146 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.401 and -0.294 for the PA while the 75th percentile value was -0.095 and -0.053 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.921 and -0.637 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

In the month of February during critical water years, the median negative water velocity was predicted to be 21% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.155 for the NAA and -0.188 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.274 and -0.318 for the PA while the 75th percentile value was -0.077 and -0.088 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.646 and -0.732 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

In the month of March during critical water years, the median negative water velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-18). Median negative water velocity (ft/s) was -0.183 for the NAA and -0.169 for the PA (Figure 5.D-18). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.325 and -0.284 for the PA while the 75th percentile value was -0.085 and -0.076 for the PA (Figure 5.D-18). The minimum value of negative water velocity (ft/s) for the NAA was -0.812 and -0.721 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-18).

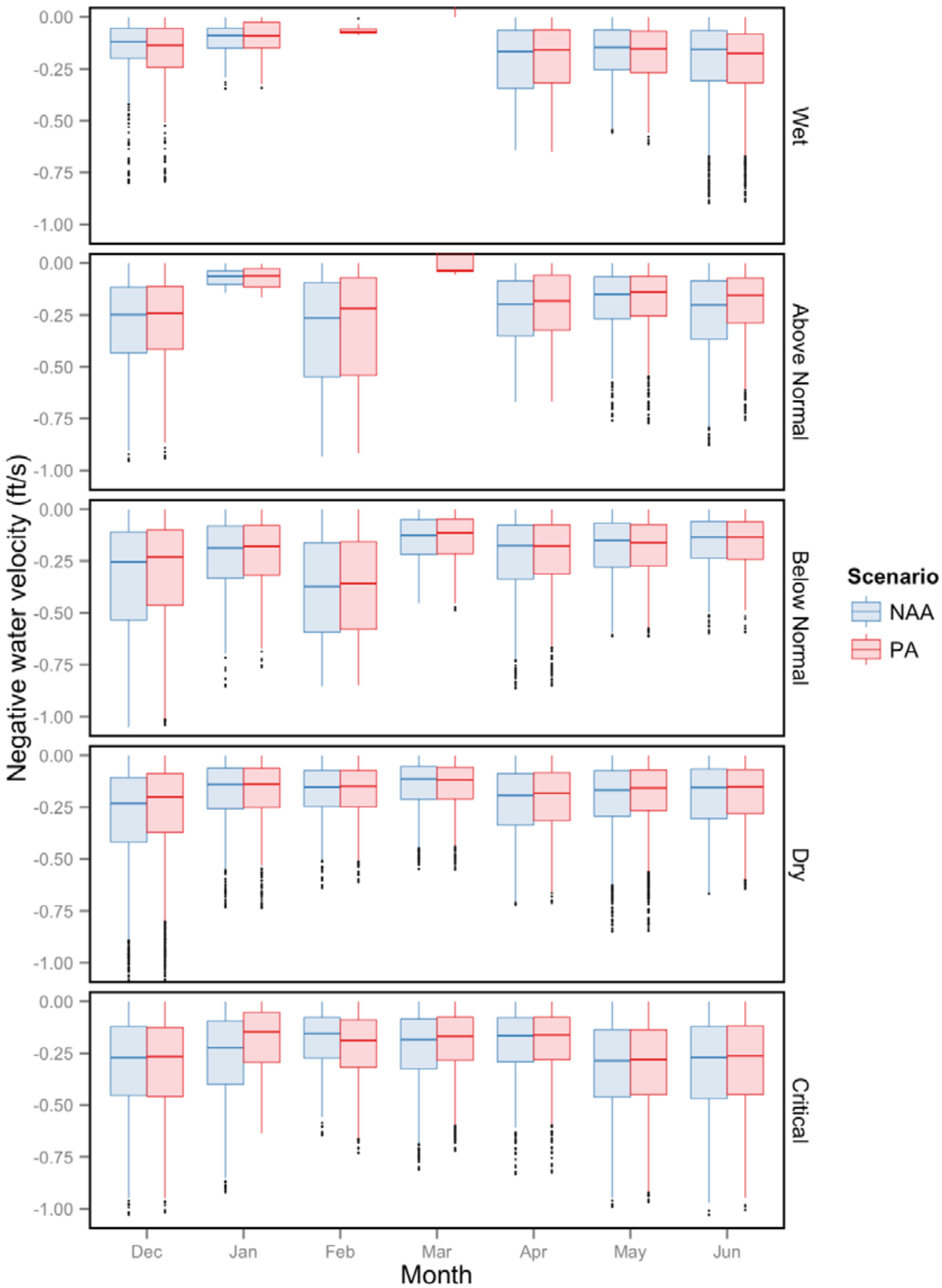


Figure 5.D-18. Velocity of flow entering the interior delta at channel 418, Sacramento River downstream of proposed diversions, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.2.9 Channel 421, Sacramento River upstream of Georgiana Slough

Wet Water Years

In the month of December during wet water years, the median negative water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.074 for the NAA and -0.08 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.128 and -0.161 for the PA while the 75th percentile value was -0.036 and -0.03 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.682 and -0.697 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of January during wet water years, the median negative water velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.061 for the NAA and -0.052 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.089 and -0.104 for the PA while the 75th percentile value was -0.033 and -0.014 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.202 and -0.21 for the PA while the maximum value was -0.001 and 0 for the PA (Figure 5.D-19).

In the month of May during wet water years, the median negative water velocity was predicted to be 33% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.111 for the NAA and -0.147 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.188 and -0.251 for the PA while the 75th percentile value was -0.047 and -0.065 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.442 and -0.567 for the PA while the maximum value was -0.001 and 0 for the PA (Figure 5.D-19).

Above Normal Water Years

In the month of January during above normal water years, the median negative water velocity was predicted to be 78% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.047 for the NAA and -0.084 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.069 and -0.128 for the PA while the 75th percentile value was -0.032 and -0.035 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.088 and -0.251 for the PA while the maximum value was -0.003 and 0 for the PA (Figure 5.D-19).

In the month of February during above normal water years, the median negative water velocity was predicted to be 22% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.179 for the NAA and -0.139 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.4 and -0.366 for the PA while the 75th percentile value was -0.063 and -0.056 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.745 and -0.758 for the PA while the maximum value was -0.002 and 0 for the PA (Figure 5.D-19).

In the month of April during above normal water years, the median negative water velocity was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.156 for the NAA and -0.137 for the PA

(Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.251 and -0.257 for the PA while the 75th percentile value was -0.061 and -0.044 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.517 and -0.544 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of May during above normal water years, the median negative water velocity was predicted to be 29% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.11 for the NAA and -0.142 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.192 and -0.234 for the PA while the 75th percentile value was -0.049 and -0.067 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.622 and -0.701 for the PA while the maximum value was 0 and -0.001 for the PA (Figure 5.D-19).

In the month of June during above normal water years, the median negative water velocity was predicted to be 21% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.186 for the NAA and -0.147 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.311 and -0.274 for the PA while the 75th percentile value was -0.091 and -0.066 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.774 and -0.663 for the PA while the maximum value was 0 and -0.001 for the PA (Figure 5.D-19).

Below Normal Water Years

In the month of December during below normal water years, the median negative water velocity was predicted to be 18% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.218 for the NAA and -0.179 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.48 and -0.414 for the PA while the 75th percentile value was -0.086 and -0.08 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.991 and -1.012 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of February during below normal water years, the median negative water velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.304 for the NAA and -0.278 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.469 and -0.461 for the PA while the 75th percentile value was -0.148 and -0.117 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.73 and -0.751 for the PA while the maximum value was -0.001 and 0 for the PA (Figure 5.D-19).

In the month of March during below normal water years, the median negative water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.088 for the NAA and -0.096 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.15 and -0.17 for the PA while the 75th percentile value was -0.032 and -0.045 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.338 and -0.395 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of April during below normal water years, the median negative water velocity was predicted to be 21% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.133 for the NAA and -0.161 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.255 and -0.283 for the PA while the 75th percentile value was -0.054 and -0.063 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.692 and -0.706 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of May during below normal water years, the median negative water velocity was predicted to be 27% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.115 for the NAA and -0.146 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.207 and -0.247 for the PA while the 75th percentile value was -0.056 and -0.068 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.474 and -0.535 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of June during below normal water years, the median negative water velocity was predicted to be 18% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.113 for the NAA and -0.133 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.195 and -0.219 for the PA while the 75th percentile value was -0.055 and -0.062 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.489 and -0.487 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

Dry Water Years

In the month of December during dry water years, the median negative water velocity was predicted to be 10% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.178 for the NAA and -0.161 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.324 and -0.302 for the PA while the 75th percentile value was -0.08 and -0.073 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -1.006 and -1.029 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of February during dry water years, the median negative water velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.106 for the NAA and -0.118 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.169 and -0.189 for the PA while the 75th percentile value was -0.049 and -0.057 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.497 and -0.49 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of March during dry water years, the median negative water velocity was predicted to be 18% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.077 for the NAA and -0.092 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.148 and -0.165 for the PA while the 75th percentile value was -0.035 and -0.043 for the PA (Figure

5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.427 and -0.46 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of April during dry water years, the median negative water velocity was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.149 for the NAA and -0.157 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.25 and -0.267 for the PA while the 75th percentile value was -0.069 and -0.07 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.603 and -0.612 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of May during dry water years, the median negative water velocity was predicted to be 16% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.125 for the NAA and -0.145 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.218 and -0.245 for the PA while the 75th percentile value was -0.056 and -0.065 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.7 and -0.728 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of June during dry water years, the median negative water velocity was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.162 for the NAA and -0.142 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.277 and -0.273 for the PA while the 75th percentile value was -0.069 and -0.064 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.551 and -0.596 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

Critical Water Years

In the month of January during critical water years, the median negative water velocity was predicted to be 33% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.163 for the NAA and -0.108 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.303 and -0.221 for the PA while the 75th percentile value was -0.075 and -0.037 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.765 and -0.507 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of February during critical water years, the median negative water velocity was predicted to be 35% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.113 for the NAA and -0.152 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.195 and -0.245 for the PA while the 75th percentile value was -0.059 and -0.075 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.508 and -0.591 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of April during critical water years, the median negative water velocity was predicted to be 15% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.122 for the NAA and -0.139 for the PA

(Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.213 and -0.246 for the PA while the 75th percentile value was -0.057 and -0.066 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.696 and -0.712 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

In the month of May during critical water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-19). Median negative water velocity (ft/s) was -0.219 for the NAA and -0.234 for the PA (Figure 5.D-19). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.359 and -0.381 for the PA while the 75th percentile value was -0.106 and -0.117 for the PA (Figure 5.D-19). The minimum value of negative water velocity (ft/s) for the NAA was -0.858 and -0.861 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-19).

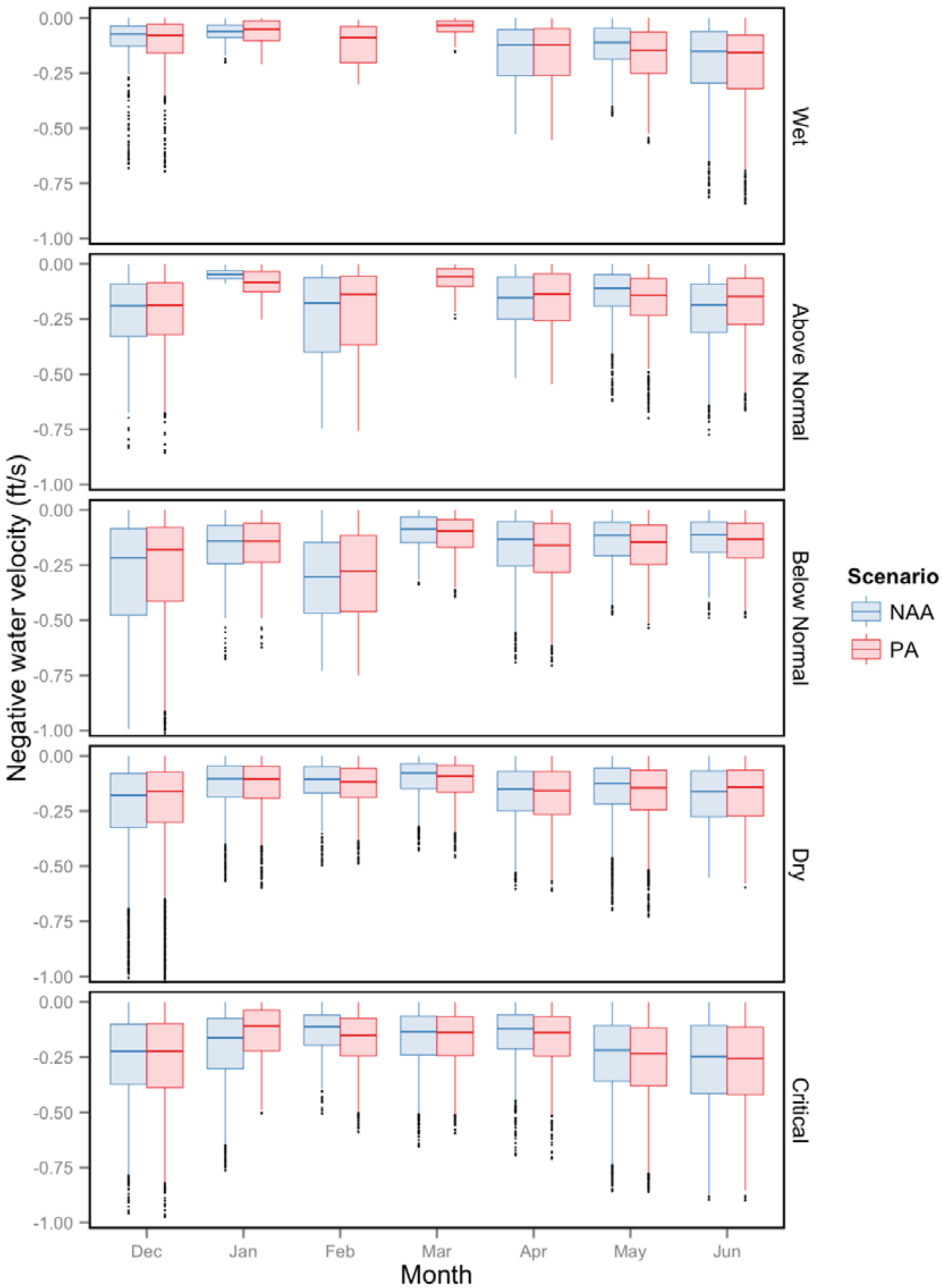


Figure 5.D-19. Velocity of flow entering the interior delta at channel 421, Sacramento River upstream of Georgiana Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.2.10 Channel 423, Sacramento River downstream of Georgiana Slough

Wet Water Years

In the month of March during wet water years, the median negative water velocity was predicted to be 98% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.144 for the NAA and -0.286 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.256 and -0.463 for the PA while the 75th percentile value was -0.071 and -0.135 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -0.575 and -0.918 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of April during wet water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.317 for the NAA and -0.338 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.493 and -0.528 for the PA while the 75th percentile value was -0.151 and -0.167 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.082 and -1.096 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of May during wet water years, the median negative water velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.356 for the NAA and -0.384 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.564 and -0.608 for the PA while the 75th percentile value was -0.182 and -0.197 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.072 and -1.227 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of June during wet water years, the median negative water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.545 for the NAA and -0.58 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.755 and -0.762 for the PA while the 75th percentile value was -0.315 and -0.348 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.313 and -1.344 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

Above Normal Water Years

In the month of February during above normal water years, the median negative water velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.467 for the NAA and -0.402 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.695 and -0.623 for the PA while the 75th percentile value was -0.237 and -0.2 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.218 and -1.227 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of March during above normal water years, the median negative water velocity was predicted to be 25% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.213 for the NAA and -0.268 for the PA

(Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.357 and -0.431 for the PA while the 75th percentile value was -0.105 and -0.131 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -0.64 and -0.988 for the PA while the maximum value was -0.001 and 0 for the PA (Figure 5.D-20).

In the month of April during above normal water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.312 for the NAA and -0.333 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.494 and -0.539 for the PA while the 75th percentile value was -0.153 and -0.164 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.165 and -1.173 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of May during above normal water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.377 for the NAA and -0.403 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.582 and -0.641 for the PA while the 75th percentile value was -0.199 and -0.214 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.202 and -1.305 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of June during above normal water years, the median negative water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.576 for the NAA and -0.61 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.765 and -0.779 for the PA while the 75th percentile value was -0.345 and -0.376 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.269 and -1.321 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

Below Normal Water Years

In the month of December during below normal water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.449 for the NAA and -0.479 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.687 and -0.708 for the PA while the 75th percentile value was -0.231 and -0.273 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.359 and -1.361 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of February during below normal water years, the median negative water velocity was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.354 for the NAA and -0.372 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.598 and -0.583 for the PA while the 75th percentile value was -0.178 and -0.197 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.184 and -1.188 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of March during below normal water years, the median negative water velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.329 for the NAA and -0.363 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.517 and -0.562 for the PA while the 75th percentile value was -0.163 and -0.176 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -0.943 and -1.087 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of April during below normal water years, the median negative water velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.385 for the NAA and -0.412 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.588 and -0.609 for the PA while the 75th percentile value was -0.211 and -0.227 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.257 and -1.262 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

Dry Water Years

In the month of January during dry water years, the median negative water velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.389 for the NAA and -0.426 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.588 and -0.612 for the PA while the 75th percentile value was -0.209 and -0.229 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.164 and -1.175 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of February during dry water years, the median negative water velocity was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.329 for the NAA and -0.369 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.508 and -0.555 for the PA while the 75th percentile value was -0.173 and -0.192 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.027 and -1.025 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

Critical Water Years

In the month of February during critical water years, the median negative water velocity was predicted to be 16% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.373 for the NAA and -0.432 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.546 and -0.625 for the PA while the 75th percentile value was -0.199 and -0.235 for the PA (Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.068 and -1.144 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

In the month of March during critical water years, the median negative water velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-20). Median negative water velocity (ft/s) was -0.435 for the NAA and -0.463 for the PA (Figure 5.D-20). The 25th percentile value of negative water velocity (ft/s) for the NAA was -0.626 and -0.671 for the PA while the 75th percentile value was -0.246 and -0.264 for the PA

(Figure 5.D-20). The minimum value of negative water velocity (ft/s) for the NAA was -1.237 and -1.206 for the PA while the maximum value was 0 and 0 for the PA (Figure 5.D-20).

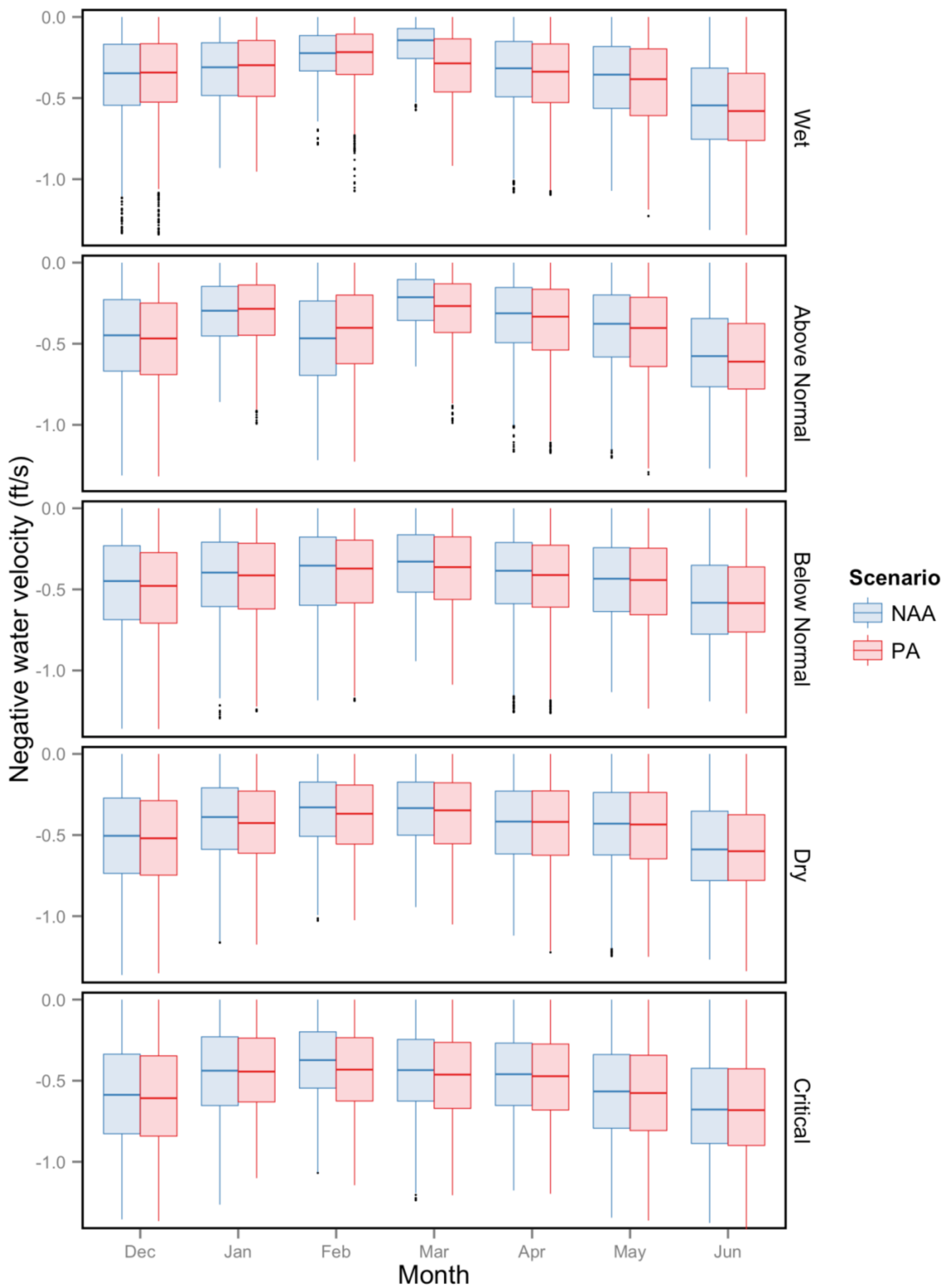


Figure 5.D-20. Velocity of flow entering the interior delta at channel 423, Sacramento River downstream of Georgiana Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.3 Daily Proportion of Negative Velocity

5.D.1.2.1.2.1.3.1 Channel 21, San Joaquin River downstream of the head of Old River

Wet Water Years

In the month of January during wet water years, the median daily proportion negative velocity was predicted to be 31% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.365 for the NAA and 0.25 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.073 and 0.031 for the PA while the 75th percentile value was 0.438 and 0.406 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.49 and 0.479 for the PA (Figure 5.D-21).

In the month of February during wet water years, the median daily proportion negative velocity was predicted to be 62% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.219 for the NAA and 0.083 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.385 and 0.271 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.5 and 0.458 for the PA (Figure 5.D-21).

In the month of March during wet water years, the median daily proportion negative velocity was predicted to be 62% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.167 for the NAA and 0.062 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.365 and 0.198 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.5 and 0.469 for the PA (Figure 5.D-21).

In the month of April during wet water years, the median daily proportion negative velocity was predicted to be 60% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.234 for the NAA and 0.094 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.021 and 0.01 for the PA while the 75th percentile value was 0.375 and 0.229 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.469 and 0.417 for the PA (Figure 5.D-21).

In the month of May during wet water years, the median daily proportion negative velocity was predicted to be 54% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.292 for the NAA and 0.135 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.021 and 0.021 for the PA while the 75th percentile value was 0.406 and 0.312 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.469 and 0.406 for the PA (Figure 5.D-21).

In the month of June during wet water years, the median daily proportion negative velocity was predicted to be 16% higher for the NAA relative to the PA over the 82 water years (Figure

5.D-21). Median daily proportion negative velocity was 0.385 for the NAA and 0.323 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.094 and 0.062 for the PA while the 75th percentile value was 0.438 and 0.427 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.5 and 0.49 for the PA (Figure 5.D-21).

Above Normal Water Years

In the month of January during above normal water years, the median daily proportion negative velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.438 for the NAA and 0.406 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.375 and 0.26 for the PA while the 75th percentile value was 0.458 and 0.438 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.49 and 0.479 for the PA (Figure 5.D-21).

In the month of February during above normal water years, the median daily proportion negative velocity was predicted to be 18% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.406 for the NAA and 0.333 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.292 and 0.125 for the PA while the 75th percentile value was 0.448 and 0.406 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.5 and 0.5 for the PA (Figure 5.D-21).

In the month of March during above normal water years, the median daily proportion negative velocity was predicted to be 34% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.396 for the NAA and 0.26 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.271 and 0.083 for the PA while the 75th percentile value was 0.438 and 0.396 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.49 and 0.448 for the PA (Figure 5.D-21).

In the month of April during above normal water years, the median daily proportion negative velocity was predicted to be 26% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.396 for the NAA and 0.292 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.344 and 0.177 for the PA while the 75th percentile value was 0.417 and 0.365 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.469 and 0.438 for the PA (Figure 5.D-21).

In the month of May during above normal water years, the median daily proportion negative velocity was predicted to be 21% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.406 for the NAA and 0.323 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.375 and 0.219 for the PA while the 75th percentile value was 0.427 and 0.38 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.479 and 0.448 for the PA (Figure 5.D-21).

Below Normal Water Years

In the month of January during below normal water years, the median daily proportion negative velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.458 for the NAA and 0.427 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.438 and 0.396 for the PA while the 75th percentile value was 0.469 and 0.448 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0.073 and 0 for the PA while the maximum value was 0.51 and 0.5 for the PA (Figure 5.D-21).

In the month of February during below normal water years, the median daily proportion negative velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.438 for the NAA and 0.396 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.406 and 0.312 for the PA while the 75th percentile value was 0.458 and 0.438 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.49 and 0.479 for the PA (Figure 5.D-21).

In the month of March during below normal water years, the median daily proportion negative velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.438 for the NAA and 0.396 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.406 and 0.312 for the PA while the 75th percentile value was 0.458 and 0.438 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0.073 and 0 for the PA while the maximum value was 0.5 and 0.479 for the PA (Figure 5.D-21).

In the month of April during below normal water years, the median daily proportion negative velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.427 for the NAA and 0.385 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.396 and 0.271 for the PA while the 75th percentile value was 0.448 and 0.406 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0.135 and 0 for the PA while the maximum value was 0.479 and 0.448 for the PA (Figure 5.D-21).

In the month of May during below normal water years, the median daily proportion negative velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.438 for the NAA and 0.396 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.406 and 0.312 for the PA while the 75th percentile value was 0.458 and 0.417

for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0.271 and 0.135 for the PA while the maximum value was 0.49 and 0.469 for the PA (Figure 5.D-21).

Dry Water Years

In the month of February during dry water years, the median daily proportion negative velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.458 for the NAA and 0.427 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.438 and 0.396 for the PA while the 75th percentile value was 0.469 and 0.448 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.5 and 0.479 for the PA (Figure 5.D-21).

In the month of April during dry water years, the median daily proportion negative velocity was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-21). Median daily proportion negative velocity was 0.448 for the NAA and 0.417 for the PA (Figure 5.D-21). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.417 and 0.354 for the PA while the 75th percentile value was 0.458 and 0.438 for the PA (Figure 5.D-21). The minimum value of the daily proportion negative velocity for the NAA was 0.021 and 0 for the PA while the maximum value was 0.49 and 0.479 for the PA (Figure 5.D-21).

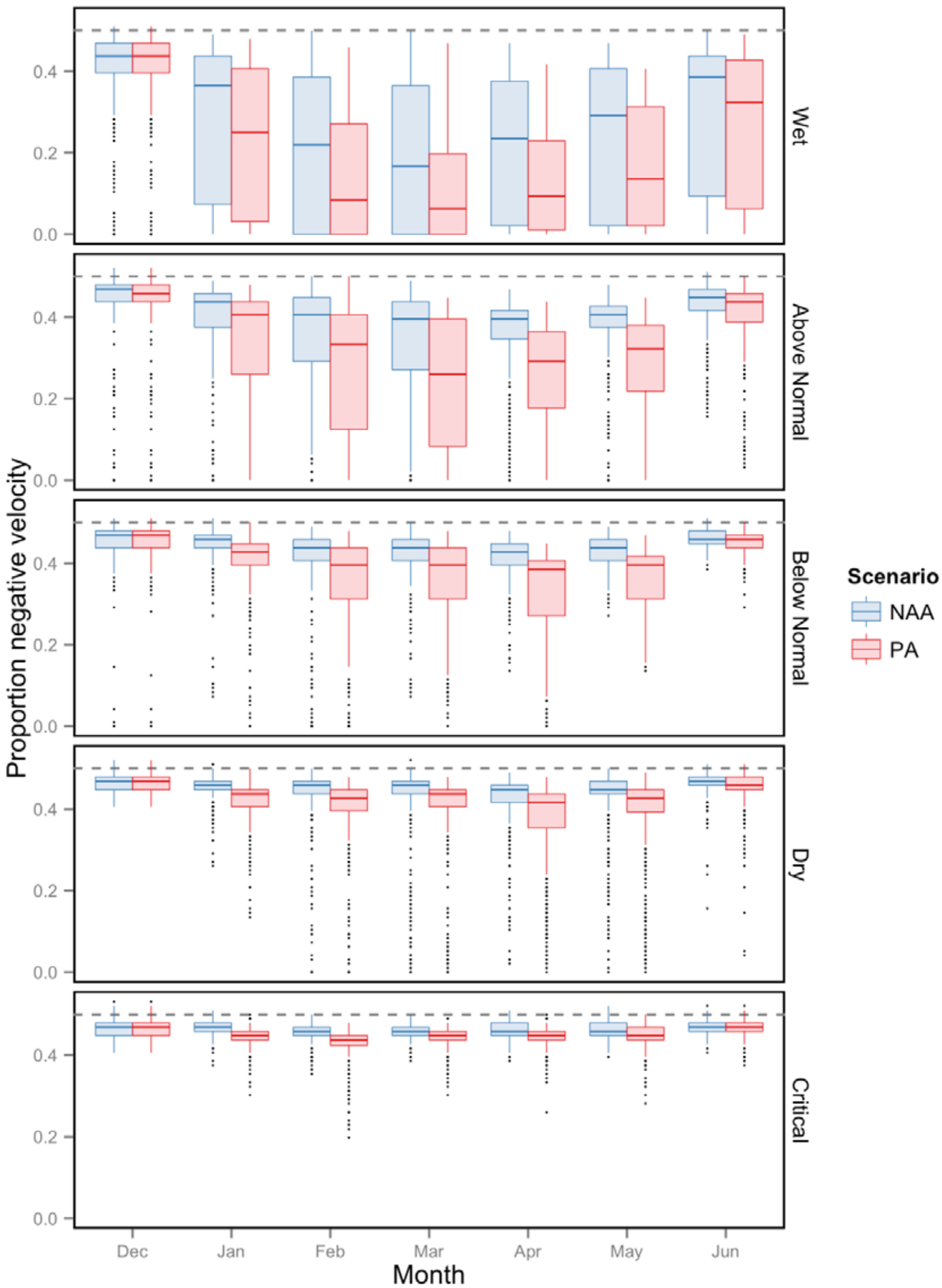


Figure 5.D-21. Daily proportion of negative velocity entering the interior at delta channel 21, the San Joaquin River downstream of the head of Old River, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.3.2 *Channel 45, San Joaquin River near the confluence with the Mokelumne River*

All Water Years

In all months of all years, the median daily proportion of negative velocity was predicted to be less than 5% different between the NAA and the PA over the 82 water years (Figure 5.D-22).

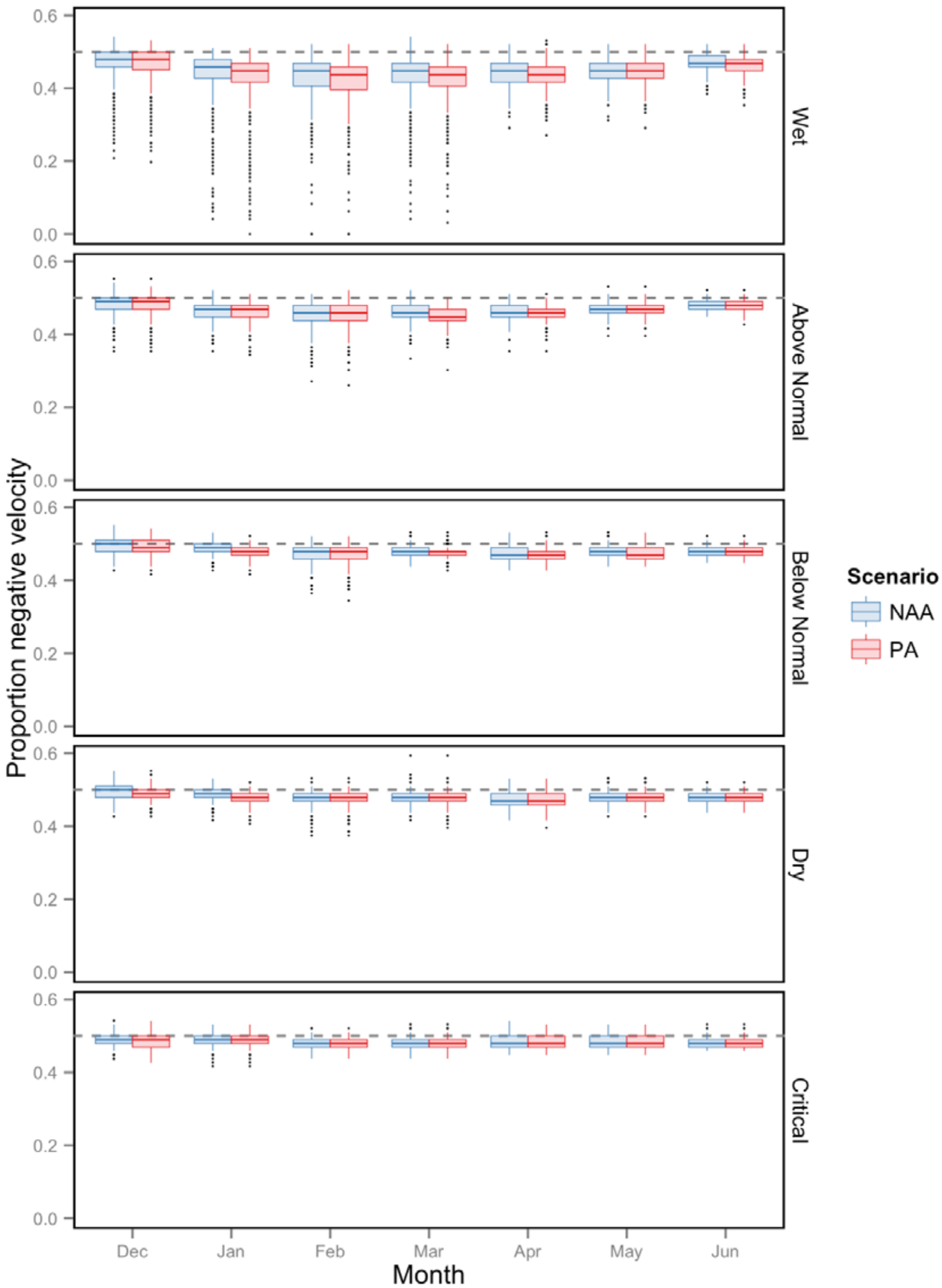


Figure 5.D-22. Daily proportion of negative velocity entering the interior at delta channel 45, the San Joaquin River near the confluence with the Mokelumne River, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.3.3 Channel 94, Old River downstream of the facilities

Wet Water Years

In the month of January during wet water years, the median daily proportion negative velocity was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-23). Median daily proportion negative velocity was 0.531 for the NAA and 0.49 for the PA (Figure 5.D-23). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.49 and 0.438 for the PA while the 75th percentile value was 0.552 and 0.521 for the PA (Figure 5.D-23). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.823 and 0.708 for the PA (Figure 5.D-23).

In the month of February during wet water years, the median daily proportion negative velocity was predicted to be 16% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-23). Median daily proportion negative velocity was 0.531 for the NAA and 0.448 for the PA (Figure 5.D-23). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.469 and 0.365 for the PA while the 75th percentile value was 0.562 and 0.479 for the PA (Figure 5.D-23). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.792 and 0.542 for the PA (Figure 5.D-23).

In the month of March during wet water years, the median daily proportion negative velocity was predicted to be 18% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-23). Median daily proportion negative velocity was 0.531 for the NAA and 0.438 for the PA (Figure 5.D-23). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.448 and 0.333 for the PA while the 75th percentile value was 0.562 and 0.479 for the PA (Figure 5.D-23). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.771 and 0.531 for the PA (Figure 5.D-23).

In the month of June during wet water years, the median daily proportion negative velocity was predicted to be 10% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-23). Median daily proportion negative velocity was 0.531 for the NAA and 0.479 for the PA (Figure 5.D-23). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.51 and 0.438 for the PA while the 75th percentile value was 0.552 and 0.51 for the PA (Figure 5.D-23). The minimum value of the daily proportion negative velocity for the NAA was 0.292 and 0.073 for the PA while the maximum value was 0.646 and 0.583 for the PA (Figure 5.D-23).

Above Normal Water Years

In the month of February during above normal water years, the median daily proportion negative velocity was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-23). Median daily proportion negative velocity was 0.531 for the NAA and 0.5 for the PA (Figure 5.D-23). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.5 and 0.469 for the PA while the 75th percentile value was 0.562 and 0.521 for the PA (Figure 5.D-23). The minimum value of the daily proportion negative velocity for the NAA was 0.052 and 0 for the PA while the maximum value was 0.677 and 0.646 for the PA (Figure 5.D-23).

In the month of March during above normal water years, the median daily proportion negative velocity was predicted to be 13% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-23). Median daily proportion negative velocity was 0.542 for the NAA and 0.469 for the PA (Figure 5.D-23). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.531 and 0.438 for the PA while the 75th percentile value was 0.562 and 0.479 for the PA (Figure 5.D-23). The minimum value of the daily proportion negative velocity for the NAA was 0.198 and 0.052 for the PA while the maximum value was 0.719 and 0.521 for the PA (Figure 5.D-23).

Below Normal Water Years

In the month of December during below normal water years, the median daily proportion negative velocity was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-23). Median daily proportion negative velocity was 0.667 for the NAA and 0.604 for the PA (Figure 5.D-23). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.583 and 0.562 for the PA while the 75th percentile value was 0.719 and 0.656 for the PA (Figure 5.D-23). The minimum value of the daily proportion negative velocity for the NAA was 0.5 and 0.469 for the PA while the maximum value was 0.792 and 0.75 for the PA (Figure 5.D-23).

In the month of January during below normal water years, the median daily proportion negative velocity was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-23). Median daily proportion negative velocity was 0.552 for the NAA and 0.49 for the PA (Figure 5.D-23). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.531 and 0.469 for the PA while the 75th percentile value was 0.573 and 0.531 for the PA (Figure 5.D-23). The minimum value of the daily proportion negative velocity for the NAA was 0.469 and 0.417 for the PA while the maximum value was 0.677 and 0.604 for the PA (Figure 5.D-23).

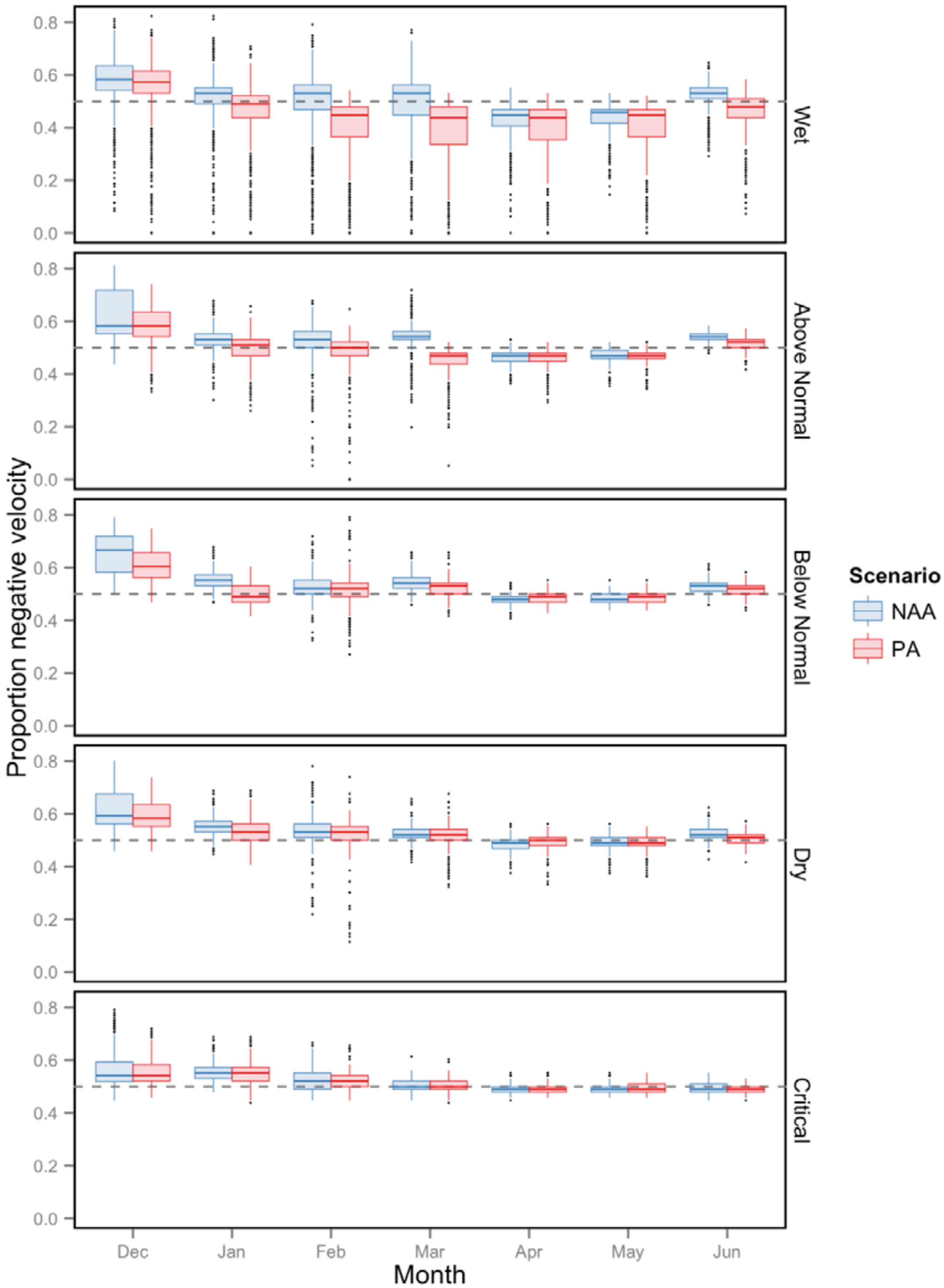


Figure 5.D-23. Daily proportion of negative velocity entering the interior at delta channel 94, Old River downstream of the facilities, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.3.4 Channel 212, Old River upstream of the facilities

Wet Water Years

In the month of January during wet water years, the median daily proportion negative velocity was predicted to be 36% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.292 for the NAA and 0.396 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.104 and 0.146 for the PA while the 75th percentile value was 0.365 and 0.438 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.438 and 0.5 for the PA (Figure 5.D-24).

In the month of February during wet water years, the median daily proportion negative velocity was predicted to be 183% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.125 for the NAA and 0.354 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.281 and 0.417 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.427 and 0.49 for the PA (Figure 5.D-24).

In the month of March during wet water years, the median daily proportion negative velocity was predicted to be 217% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.094 for the NAA and 0.297 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.198 and 0.406 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.427 and 0.5 for the PA (Figure 5.D-24).

In the month of April during wet water years, the median daily proportion negative velocity was predicted to be 106% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.177 for the NAA and 0.365 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.323 and 0.417 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.427 and 0.469 for the PA (Figure 5.D-24).

In the month of May during wet water years, the median daily proportion negative velocity was predicted to be 73% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.229 for the NAA and 0.396 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.354 and 0.438 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.427 and 0.49 for the PA (Figure 5.D-24).

In the month of June during wet water years, the median daily proportion negative velocity was predicted to be 106% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.188 for the NAA and 0.385 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.031 and 0.031 for the PA while the 75th percentile value was 0.417 and 0.458 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.51 and 0.552 for the PA (Figure 5.D-24).

Above Normal Water Years

In the month of December during above normal water years, the median daily proportion negative velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.344 for the NAA and 0.365 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.312 and 0.333 for the PA while the 75th percentile value was 0.396 and 0.396 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.458 and 0.458 for the PA (Figure 5.D-24).

In the month of January during above normal water years, the median daily proportion negative velocity was predicted to be 17% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.365 for the NAA and 0.427 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.276 and 0.375 for the PA while the 75th percentile value was 0.406 and 0.458 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.448 and 0.49 for the PA (Figure 5.D-24).

In the month of February during above normal water years, the median daily proportion negative velocity was predicted to be 30% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.312 for the NAA and 0.406 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.198 and 0.354 for the PA while the 75th percentile value was 0.375 and 0.438 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.51 and 0.51 for the PA (Figure 5.D-24).

In the month of March during above normal water years, the median daily proportion negative velocity was predicted to be 54% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.271 for the NAA and 0.417 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.125 and 0.375 for the PA while the 75th percentile value was 0.365 and 0.448 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.438 and 0.49 for the PA (Figure 5.D-24).

In the month of April during above normal water years, the median daily proportion negative velocity was predicted to be 24% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.344 for the NAA and 0.427 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.281 and 0.406 for the PA while the 75th percentile value was 0.375 and 0.448 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the

NAA was 0 and 0 for the PA while the maximum value was 0.448 and 0.469 for the PA (Figure 5.D-24).

In the month of May during above normal water years, the median daily proportion negative velocity was predicted to be 20% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.365 for the NAA and 0.438 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.312 and 0.417 for the PA while the 75th percentile value was 0.385 and 0.448 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.438 and 0.49 for the PA (Figure 5.D-24).

In the month of June during above normal water years, the median daily proportion negative velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.438 for the NAA and 0.464 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.333 and 0.427 for the PA while the 75th percentile value was 0.458 and 0.5 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.51 and 0.552 for the PA (Figure 5.D-24).

Below Normal Water Years

In the month of December during below normal water years, the median daily proportion negative velocity was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.333 for the NAA and 0.365 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.302 and 0.323 for the PA while the 75th percentile value was 0.365 and 0.396 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0.094 and 0.125 for the PA while the maximum value was 0.427 and 0.427 for the PA (Figure 5.D-24).

In the month of January during below normal water years, the median daily proportion negative velocity was predicted to be 16% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.385 for the NAA and 0.448 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.344 and 0.417 for the PA while the 75th percentile value was 0.406 and 0.458 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0.052 and 0.094 for the PA while the maximum value was 0.458 and 0.51 for the PA (Figure 5.D-24).

In the month of February during below normal water years, the median daily proportion negative velocity was predicted to be 17% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.365 for the NAA and 0.427 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.281 and 0.385 for the PA while the 75th percentile value was 0.396 and 0.458 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the

NAA was 0 and 0 for the PA while the maximum value was 0.458 and 0.479 for the PA (Figure 5.D-24).

In the month of March during below normal water years, the median daily proportion negative velocity was predicted to be 24% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.354 for the NAA and 0.438 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.292 and 0.406 for the PA while the 75th percentile value was 0.396 and 0.458 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.479 and 0.5 for the PA (Figure 5.D-24).

In the month of April during below normal water years, the median daily proportion negative velocity was predicted to be 17% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.375 for the NAA and 0.438 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.333 and 0.427 for the PA while the 75th percentile value was 0.396 and 0.458 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0.073 and 0.344 for the PA while the maximum value was 0.438 and 0.49 for the PA (Figure 5.D-24).

In the month of May during below normal water years, the median daily proportion negative velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.396 for the NAA and 0.448 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.365 and 0.438 for the PA while the 75th percentile value was 0.417 and 0.469 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0.24 and 0.385 for the PA while the maximum value was 0.448 and 0.5 for the PA (Figure 5.D-24).

Dry Water Years

In the month of January during dry water years, the median daily proportion negative velocity was predicted to be 16% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.385 for the NAA and 0.448 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.365 and 0.417 for the PA while the 75th percentile value was 0.406 and 0.458 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0.125 and 0.323 for the PA while the maximum value was 0.458 and 0.5 for the PA (Figure 5.D-24).

In the month of February during dry water years, the median daily proportion negative velocity was predicted to be 16% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.385 for the NAA and 0.448 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.354 and 0.406 for the PA while the 75th percentile value was 0.417 and 0.458 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.479 and 0.5 for the PA (Figure 5.D-24).

In the month of March during dry water years, the median daily proportion negative velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.396 for the NAA and 0.448 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.365 and 0.417 for the PA while the 75th percentile value was 0.427 and 0.469 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.469 and 0.542 for the PA (Figure 5.D-24).

In the month of April during dry water years, the median daily proportion negative velocity was predicted to be 10% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.406 for the NAA and 0.448 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.354 and 0.427 for the PA while the 75th percentile value was 0.427 and 0.469 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.469 and 0.5 for the PA (Figure 5.D-24).

In the month of May during dry water years, the median daily proportion negative velocity was predicted to be 10% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.417 for the NAA and 0.458 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.385 and 0.448 for the PA while the 75th percentile value was 0.438 and 0.479 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.479 and 0.51 for the PA (Figure 5.D-24).

Critical Water Years

In the month of January during critical water years, the median daily proportion negative velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.406 for the NAA and 0.458 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.375 and 0.427 for the PA while the 75th percentile value was 0.427 and 0.469 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0.25 and 0.323 for the PA while the maximum value was 0.469 and 0.5 for the PA (Figure 5.D-24).

In the month of February during critical water years, the median daily proportion negative velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.396 for the NAA and 0.448 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.375 and 0.417 for the PA while the 75th percentile value was 0.427 and 0.469 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0.156 and 0.312 for the PA while the maximum value was 0.469 and 0.5 for the PA (Figure 5.D-24).

In the month of March during critical water years, the median daily proportion negative velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.438 for the NAA and 0.469 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.396 and 0.448 for the PA while the 75th percentile value was 0.448 and 0.479 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0.312 and 0.365 for the PA while the maximum value was 0.479 and 0.5 for the PA (Figure 5.D-24).

In the month of April during critical water years, the median daily proportion negative velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.438 for the NAA and 0.469 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.427 and 0.448 for the PA while the 75th percentile value was 0.458 and 0.479 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0.344 and 0.417 for the PA while the maximum value was 0.49 and 0.5 for the PA (Figure 5.D-24).

In the month of May during critical water years, the median daily proportion negative velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-24). Median daily proportion negative velocity was 0.438 for the NAA and 0.469 for the PA (Figure 5.D-24). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.427 and 0.458 for the PA while the 75th percentile value was 0.458 and 0.484 for the PA (Figure 5.D-24). The minimum value of the daily proportion negative velocity for the NAA was 0.344 and 0.427 for the PA while the maximum value was 0.51 and 0.521 for the PA (Figure 5.D-24).

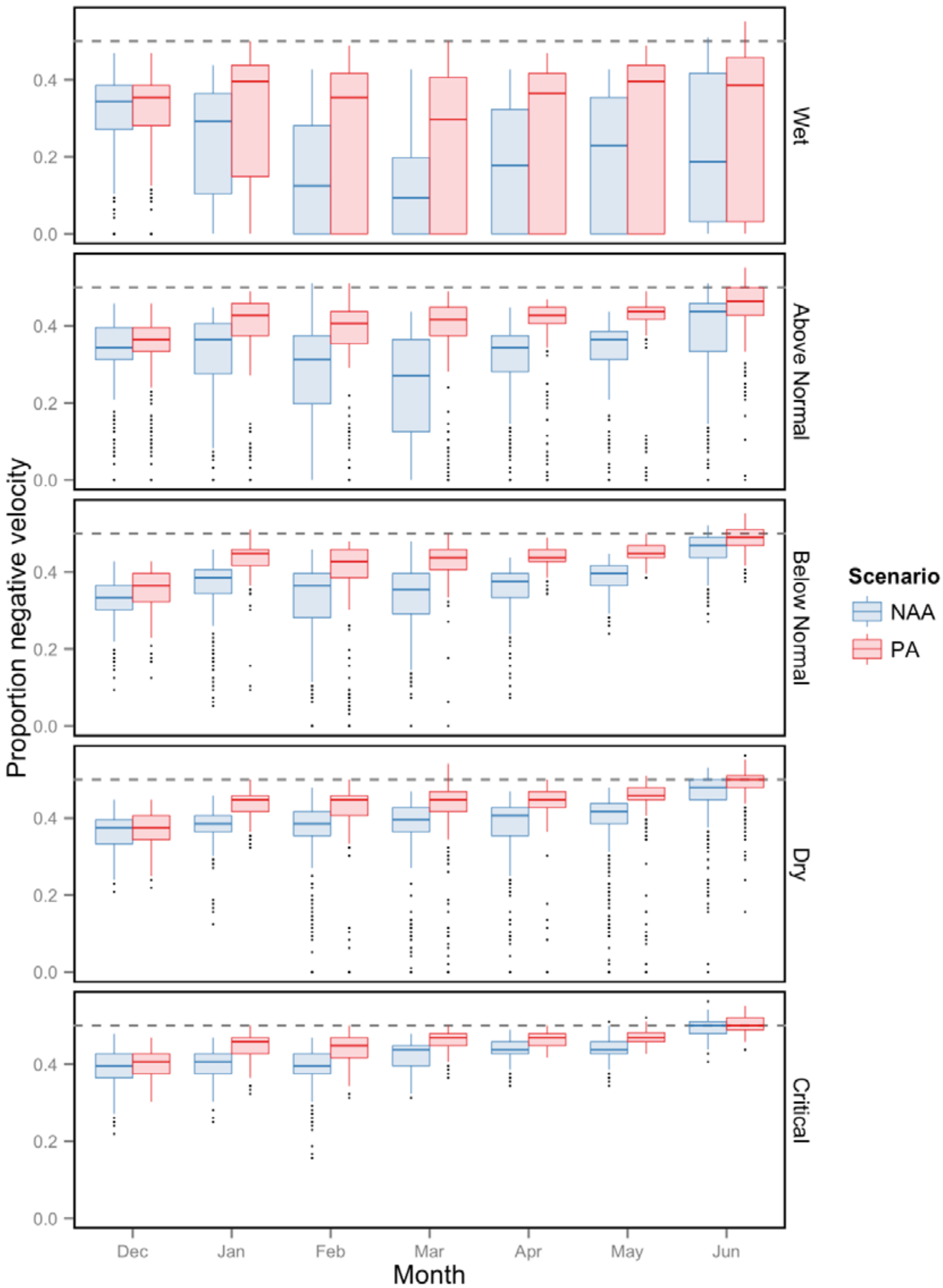


Figure 5.D-24. Daily proportion of negative velocity entering the interior at delta channel 212, Old River upstream of the facilities, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.3.5 Channel 365, Delta Cross Channel

Wet Water Years

In the month of June during wet water years, the median daily proportion negative velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-25). Median daily proportion negative velocity was 0.073 for the NAA and 0.083 for the PA (Figure 5.D-25). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.021 for the PA while the 75th percentile value was 0.427 and 0.24 for the PA (Figure 5.D-25). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.5 and 0.49 for the PA (Figure 5.D-25).

Above Normal Water Years

In the month of June during above normal water years, the median daily proportion negative velocity was predicted to be 100% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-25). Median daily proportion negative velocity was 0.031 for the NAA and 0.062 for the PA (Figure 5.D-25). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.094 and 0.115 for the PA (Figure 5.D-25). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.5 and 0.5 for the PA (Figure 5.D-25).

Below Normal Water Years

In the month of June during below normal water years, the median daily proportion negative velocity was predicted to be 50% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-25). Median daily proportion negative velocity was 0.042 for the NAA and 0.062 for the PA (Figure 5.D-25). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.031 for the PA while the 75th percentile value was 0.083 and 0.115 for the PA (Figure 5.D-25). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.51 and 0.5 for the PA (Figure 5.D-25).

Dry Water Years

In the month of June during dry water years, the median daily proportion negative velocity was predicted to be 75% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-25). Median daily proportion negative velocity was 0.042 for the NAA and 0.073 for the PA (Figure 5.D-25). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.042 for the PA while the 75th percentile value was 0.083 and 0.104 for the PA (Figure 5.D-25). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.51 and 0.51 for the PA (Figure 5.D-25).

Critical Water Years

In the month of June during critical water years, the median daily proportion negative velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-25). Median daily proportion negative velocity was 0.146 for the NAA and 0.156 for the PA (Figure 5.D-25). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.073 and 0.094 for the PA while the 75th percentile value was 0.208 and 0.208 for the PA (Figure 5.D-25). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.51 and 0.51 for the PA (Figure 5.D-25).

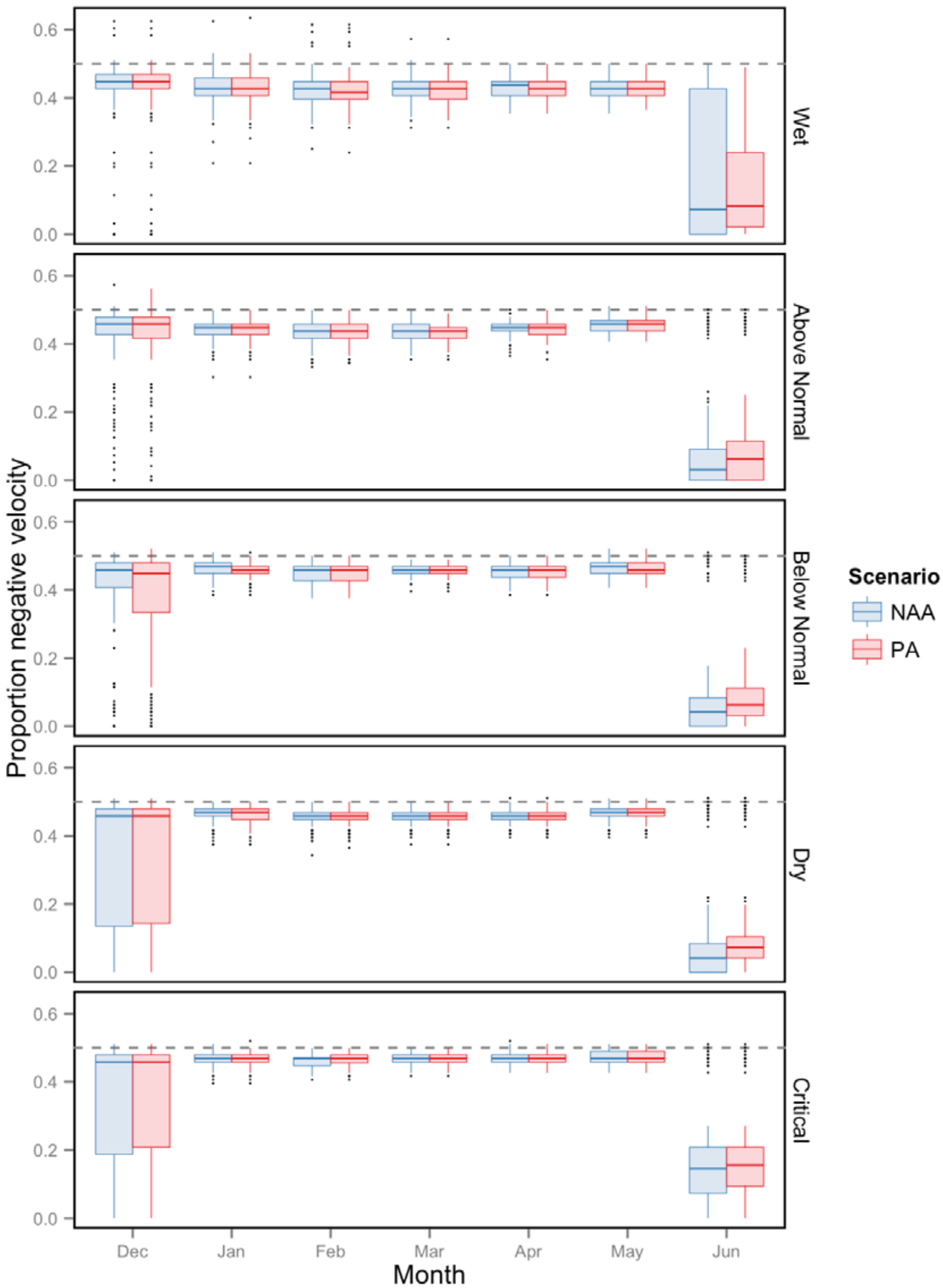


Figure 5.D-25. Daily proportion of negative velocity entering the interior at delta Channel 365, the Delta Cross Channel, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.3.6 Channel 379, Steamboat Slough

Above Normal Water Years

In the month of June during above normal water years, the median daily proportion negative velocity was predicted to be 25% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-26). Median daily proportion negative velocity was 0.083 for the NAA and 0.062 for the PA (Figure PNV6). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.135 and 0.125 for the PA (Figure 5.D-26). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.396 and 0.365 for the PA (Figure 5.D-26).

Below Normal Water Years

In the month of May during below normal water years, the median daily proportion negative velocity was predicted to be 20% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-26). Median daily proportion negative velocity was 0.052 for the NAA and 0.062 for the PA (Figure 5.D-26). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.115 and 0.125 for the PA (Figure 5.D-26). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.281 and 0.292 for the PA (Figure 5.D-26).

In the month of June during below normal water years, the median daily proportion negative velocity was predicted to be 20% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-26). Median daily proportion negative velocity was 0.104 for the NAA and 0.083 for the PA (Figure 5.D-26). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.052 and 0 for the PA while the 75th percentile value was 0.146 and 0.125 for the PA (Figure 5.D-26). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.323 and 0.333 for the PA (Figure 5.D-26).

Dry Water Years

In the month of December during dry water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-26). Median daily proportion negative velocity was 0 for the NAA and 0.062 for the PA (Figure 5.D-26). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.156 and 0.167 for the PA (Figure 5.D-26). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.448 and 0.448 for the PA (Figure 5.D-26).

Critical Water Years

In the month of December during critical water years, the median daily proportion negative velocity was predicted to be 22% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-26). Median daily proportion negative velocity was 0.167 for the NAA and 0.203 for the PA (Figure 5.D-26). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.271 and 0.292 for the PA (Figure 5.D-26). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.417 and 0.438 for the PA (Figure 5.D-26).

In the month of March during critical water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-26). Median daily proportion negative velocity was 0 for the NAA and 0.021 for the PA (Figure 5.D-26). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.125 and 0.135 for the PA (Figure 5.D-26). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.344 and 0.365 for the PA (Figure 5.D-26).

In the month of April during critical water years, the median daily proportion negative velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-26). Median daily proportion negative velocity was 0.083 for the NAA and 0.094 for the PA (Figure 5.D-26). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.146 and 0.167 for the PA (Figure 5.D-26). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.344 and 0.354 for the PA (Figure 5.D-26).

In the month of May during critical water years, the median daily proportion negative velocity was predicted to be 13% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-26). Median daily proportion negative velocity was 0.167 for the NAA and 0.188 for the PA (Figure 5.D-26). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.115 and 0.125 for the PA while the 75th percentile value was 0.292 and 0.302 for the PA (Figure 5.D-26). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.385 and 0.396 for the PA (Figure 5.D-26).

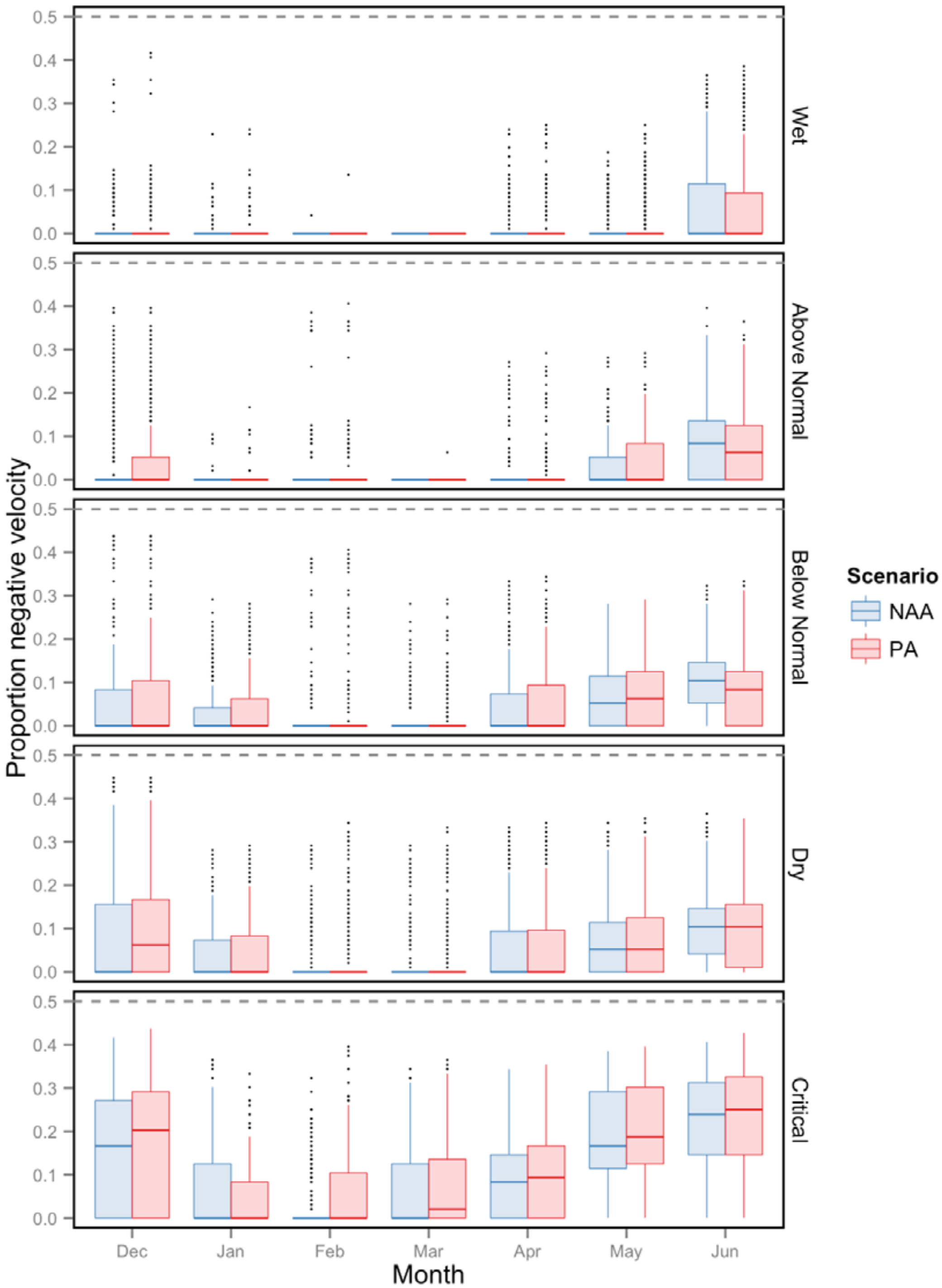


Figure 5.D-26. Daily proportion of negative velocity entering the interior at delta Channel 379, Steamboat Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.3.7 Channel 383, Sutter Slough

Wet Water Years

In the month of June during wet water years, the median daily proportion negative velocity was predicted to be 53% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.198 for the NAA and 0.302 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.172 for the PA while the 75th percentile value was 0.323 and 0.344 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.427 and 0.438 for the PA (Figure 5.D-27).

Above Normal Water Years

In the month of December during above normal water years, the median daily proportion negative velocity was predicted to be 33% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.125 for the NAA and 0.167 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.25 and 0.292 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.448 and 0.458 for the PA (Figure 5.D-27).

In the month of April during above normal water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0 for the NAA and 0.031 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.115 and 0.146 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.375 and 0.396 for the PA (Figure 5.D-27).

In the month of May during above normal water years, the median daily proportion negative velocity was predicted to be 22% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.188 for the NAA and 0.229 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.083 for the PA while the 75th percentile value was 0.281 and 0.292 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.385 and 0.385 for the PA (Figure 5.D-27).

In the month of June during above normal water years, the median daily proportion negative velocity was predicted to be 10% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.302 for the NAA and 0.333 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.25 and 0.302 for the PA while the 75th percentile value was 0.344 and 0.354 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.427 and 0.417 for the PA (Figure 5.D-27).

Below Normal Water Years

In the month of December during below normal water years, the median daily proportion negative velocity was predicted to be 38% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.167 for the NAA and 0.229 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.062 and 0.125 for the PA while the 75th percentile value was 0.292 and 0.312 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.479 and 0.479 for the PA (Figure 5.D-27).

In the month of January during below normal water years, the median daily proportion negative velocity was predicted to be 27% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.115 for the NAA and 0.146 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.26 and 0.292 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.375 and 0.406 for the PA (Figure 5.D-27).

In the month of February during below normal water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0 for the NAA and 0.094 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.156 and 0.198 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.448 and 0.448 for the PA (Figure 5.D-27).

In the month of March during below normal water years, the median daily proportion negative velocity was predicted to be 250% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.042 for the NAA and 0.146 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.073 for the PA while the 75th percentile value was 0.229 and 0.26 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.365 and 0.385 for the PA (Figure 5.D-27).

In the month of April during below normal water years, the median daily proportion negative velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.219 for the NAA and 0.25 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.073 and 0.115 for the PA while the 75th percentile value was 0.302 and 0.312 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.427 and 0.427 for the PA (Figure 5.D-27).

Dry Water Years

In the month of December during dry water years, the median daily proportion negative velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure

5.D-27). Median daily proportion negative velocity was 0.26 for the NAA and 0.281 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.135 and 0.177 for the PA while the 75th percentile value was 0.333 and 0.344 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.479 and 0.479 for the PA (Figure 5.D-27).

In the month of January during dry water years, the median daily proportion negative velocity was predicted to be 23% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.182 for the NAA and 0.224 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.083 for the PA while the 75th percentile value was 0.271 and 0.292 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.385 and 0.406 for the PA (Figure 5.D-27).

In the month of February during dry water years, the median daily proportion negative velocity was predicted to be 500% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.021 for the NAA and 0.125 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.188 and 0.24 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.396 and 0.406 for the PA (Figure 5.D-27).

In the month of March during dry water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0 for the NAA and 0.125 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.208 and 0.245 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.406 and 0.396 for the PA (Figure 5.D-27).

Critical Water Years

In the month of January during critical water years, the median daily proportion negative velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.219 for the NAA and 0.25 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.094 and 0.135 for the PA while the 75th percentile value was 0.302 and 0.302 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.438 and 0.417 for the PA (Figure 5.D-27).

In the month of February during critical water years, the median daily proportion negative velocity was predicted to be 46% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-27). Median daily proportion negative velocity was 0.146 for the NAA and 0.214 for the PA (Figure 5.D-27). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.042 and 0.115 for the PA while the 75th percentile value was 0.26 and 0.302 for the PA (Figure 5.D-27). The minimum value of the daily proportion negative velocity for the

NAA was 0 and 0 for the PA while the maximum value was 0.406 and 0.417 for the PA (Figure 5.D-27).

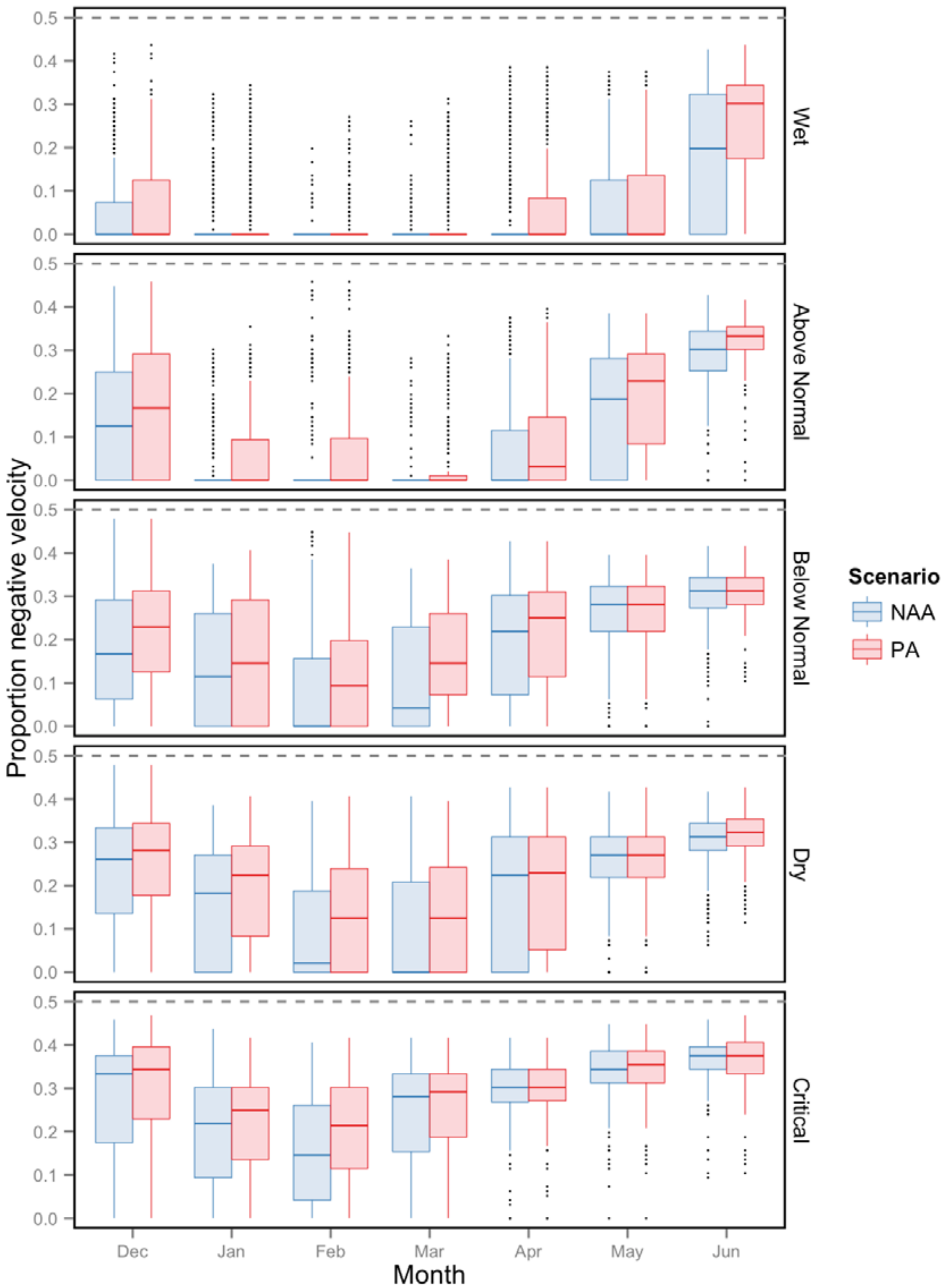


Figure 5.D-27. Daily proportion of negative velocity entering the interior at delta Channel 383, Sutter Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed

for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.3.8 Channel 418, Sacramento River downstream of proposed diversions

Below Normal Water Years

In the month of May during below normal water years, the median daily proportion negative velocity was predicted to be 67% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-28). Median daily proportion negative velocity was 0.031 for the NAA and 0.052 for the PA (Figure 5.D-28). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.104 and 0.115 for the PA (Figure 5.D-28). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.26 and 0.271 for the PA (Figure 5.D-28).

Dry Water Years

In the month of May during dry water years, the median daily proportion negative velocity was predicted to be 100% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-28). Median daily proportion negative velocity was 0.021 for the NAA and 0.042 for the PA (Figure 5.D-28). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.104 and 0.115 for the PA (Figure 5.D-28). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.344 and 0.354 for the PA (Figure 5.D-28).

Critical Water Years

In the month of December during critical water years, the median daily proportion negative velocity was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-28). Median daily proportion negative velocity was 0.141 for the NAA and 0.156 for the PA (Figure 5.D-28). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.198 and 0.24 for the PA (Figure 5.D-28). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.365 and 0.385 for the PA (Figure 5.D-28).

In the month of March during critical water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-28). Median daily proportion negative velocity was 0 for the NAA and 0.005 for the PA (Figure 5.D-28). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.115 and 0.135 for the PA (Figure 5.D-28). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.354 and 0.344 for the PA (Figure 5.D-28).

In the month of April during critical water years, the median daily proportion negative velocity was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-28). Median daily proportion negative velocity was 0.073 for the NAA and 0.083 for the PA (Figure 5.D-28). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.135 and 0.146 for the PA (Figure 5.D-28). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.344 and 0.344 for the PA (Figure 5.D-28).

In the month of May during critical water years, the median daily proportion negative velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-28). Median daily proportion negative velocity was 0.156 for the NAA and 0.167 for the PA (Figure 5.D-28). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.104 and 0.115 for the PA while the 75th percentile value was 0.281 and 0.292 for the PA (Figure 5.D-28). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.396 and 0.396 for the PA (Figure 5.D-28).

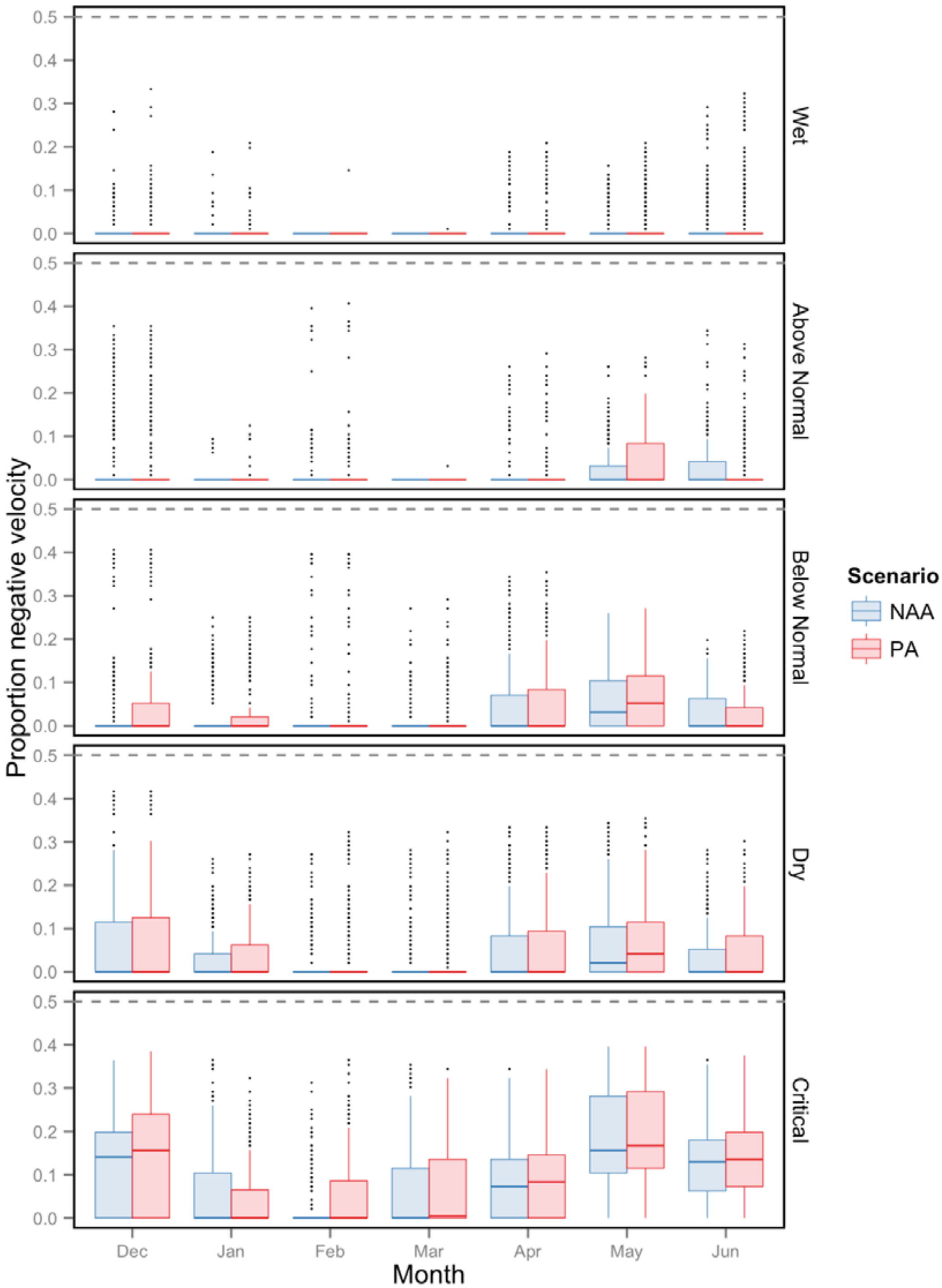


Figure 5.D-28. Daily proportion of negative velocity entering the interior at delta Channel 418, Sacramento River downstream of proposed diversions, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.3.9 Channel 421, Sacramento River upstream of Georgiana Slough

Above Normal Water Year

In the month of May during above normal water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-29). Median daily proportion negative velocity was 0 for the NAA and 0.031 for the PA (Figure 5.D-29). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.052 and 0.115 for the PA (Figure 5.D-29). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.281 and 0.292 for the PA (Figure 5.D-29).

Below Normal Water Years

In the month of May during below normal water years, the median daily proportion negative velocity was predicted to be 75% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-29). Median daily proportion negative velocity was 0.042 for the NAA and 0.073 for the PA (Figure 5.D-29). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.125 and 0.135 for the PA (Figure 5.D-29). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.281 and 0.302 for the PA (Figure 5.D-29).

Dry Water Years

In the month of May during dry water years, the median daily proportion negative velocity was predicted to be 250% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-29). Median daily proportion negative velocity was 0.021 for the NAA and 0.073 for the PA (Figure 5.D-29). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.125 and 0.125 for the PA (Figure 5.D-29). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.354 and 0.354 for the PA (Figure 5.D-29).

Critical Water Years

In the month of December during critical water years, the median daily proportion negative velocity was predicted to be 15% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-29). Median daily proportion negative velocity was 0.135 for the NAA and 0.156 for the PA (Figure 5.D-29). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.188 and 0.229 for the PA (Figure 5.D-29). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.365 and 0.385 for the PA (Figure 5.D-29).

In the month of March during critical water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-29). Median daily proportion negative velocity was 0 for the NAA and 0.052 for the PA (Figure 5.D-29). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.135 and 0.151 for the PA (Figure 5.D-29). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.375 and 0.365 for the PA (Figure 5.D-29).

In the month of April during critical water years, the median daily proportion negative velocity was predicted to be 25% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-29). Median daily proportion negative velocity was 0.083 for the NAA and 0.104 for the PA (Figure 5.D-29). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.021 for the PA while the 75th percentile value was 0.146 and 0.156 for the PA (Figure 5.D-29). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.354 and 0.365 for the PA (Figure 5.D-29).

In the month of June during critical water years, the median daily proportion negative velocity was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-29). Median daily proportion negative velocity was 0.125 for the NAA and 0.135 for the PA (Figure 5.D-29). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.042 for the PA while the 75th percentile value was 0.167 and 0.177 for the PA (Figure 5.D-29). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.385 and 0.385 for the PA (Figure 5.D-29).

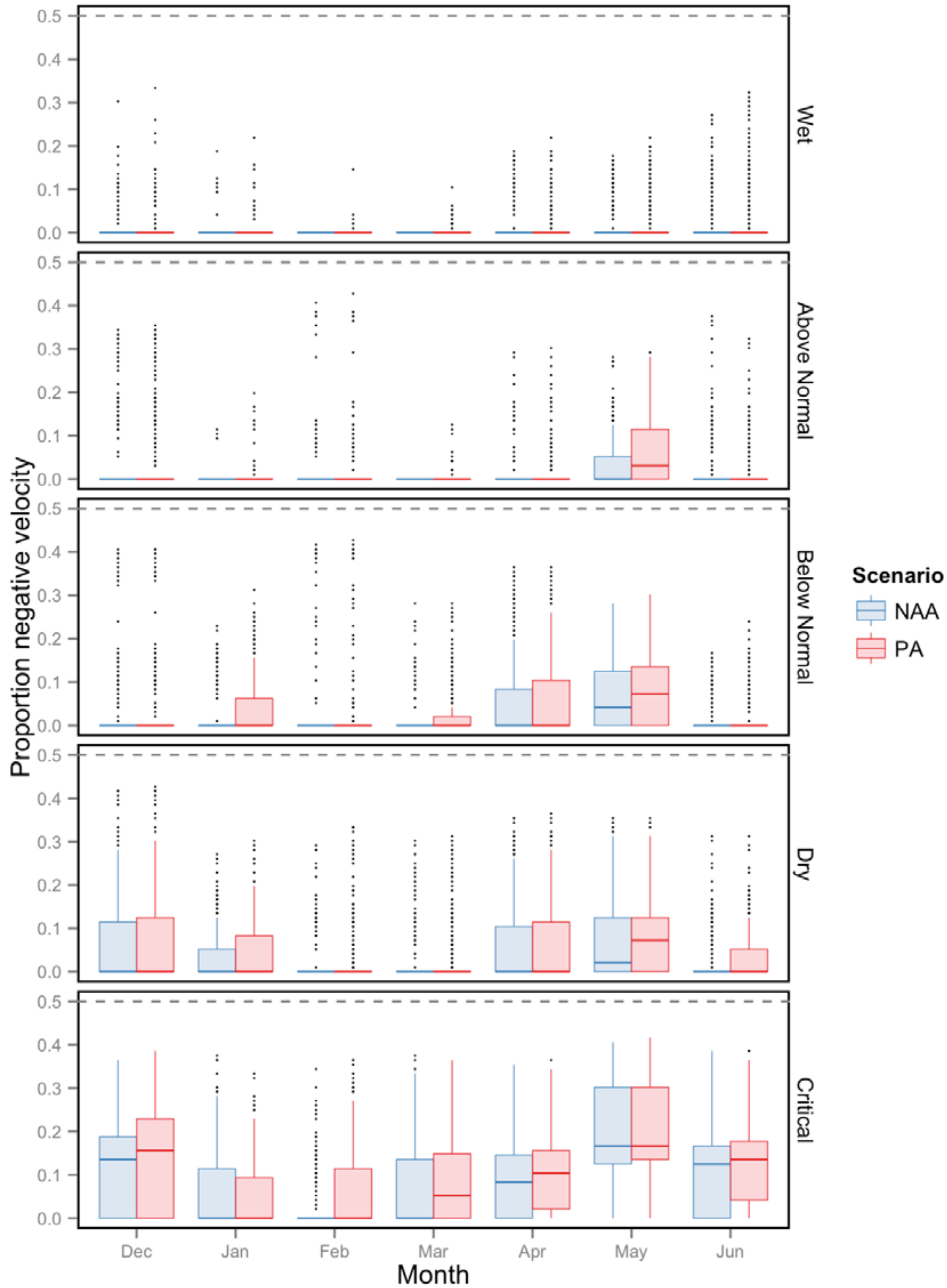


Figure 5.D-29. Daily proportion of negative velocity entering the interior at delta Channel 421, Sacramento River upstream of Georgiana Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.1.3.10 Channel 423, Sacramento River downstream of Georgiana Slough

Wet Water Years

In the month of June during wet water years, the median daily proportion negative velocity was predicted to be 19% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.281 for the NAA and 0.333 for the PA (Figure PNV10). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.26 for the PA while the 75th percentile value was 0.354 and 0.365 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.448 and 0.438 for the PA (Figure 5.D-30).

Above Normal Water Years

In the month of December during above normal water years, the median daily proportion negative velocity was predicted to be 29% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.146 for the NAA and 0.188 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.292 and 0.312 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.479 and 0.469 for the PA (Figure 5.D-30).

In the month of April during above normal water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0 for the NAA and 0.062 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.146 and 0.177 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.375 and 0.385 for the PA (Figure 5.D-30).

In the month of May during above normal water years, the median daily proportion negative velocity was predicted to be 20% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.208 for the NAA and 0.25 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.052 and 0.104 for the PA while the 75th percentile value was 0.292 and 0.302 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.385 and 0.385 for the PA (Figure 5.D-30).

In the month of June during above normal water years, the median daily proportion negative velocity was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.344 for the NAA and 0.365 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.312 and 0.333 for the PA while the 75th percentile value was 0.365 and 0.375 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0.052 for the PA while the maximum value was 0.438 and 0.427 for the PA (Figure 5.D-30).

Below Normal Water Years

In the month of December during below normal water years, the median daily proportion negative velocity was predicted to be 33% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.188 for the NAA and 0.25 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.104 and 0.146 for the PA while the 75th percentile value was 0.312 and 0.333 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.49 and 0.49 for the PA (Figure 5.D-30).

In the month of January during below normal water years, the median daily proportion negative velocity was predicted to be 23% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.135 for the NAA and 0.167 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.073 for the PA while the 75th percentile value was 0.271 and 0.292 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.396 and 0.396 for the PA (Figure 5.D-30).

In the month of February during below normal water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0 for the NAA and 0.115 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.188 and 0.224 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.448 and 0.448 for the PA (Figure 5.D-30).

In the month of March during below normal water years, the median daily proportion negative velocity was predicted to be 113% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.083 for the NAA and 0.177 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.104 for the PA while the 75th percentile value was 0.25 and 0.271 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.365 and 0.385 for the PA (Figure 5.D-30).

Dry Water Years

In the month of December during dry water years, the median daily proportion negative velocity was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.281 for the NAA and 0.302 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.156 and 0.198 for the PA while the 75th percentile value was 0.354 and 0.365 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.5 and 0.5 for the PA (Figure 5.D-30).

In the month of January during dry water years, the median daily proportion negative velocity was predicted to be 21% lower for the NAA relative to the PA over the 82 water years (Figure

5.D-30). Median daily proportion negative velocity was 0.198 for the NAA and 0.24 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.062 and 0.104 for the PA while the 75th percentile value was 0.281 and 0.302 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.396 and 0.406 for the PA (Figure 5.D-30).

In the month of February during dry water years, the median daily proportion negative velocity was predicted to be 75% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.083 for the NAA and 0.146 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the 75th percentile value was 0.219 and 0.25 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.406 and 0.417 for the PA (Figure 5.D-30).

In the month of March during dry water years, the median daily proportion negative velocity was predicted to be Inf% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0 for the NAA and 0.146 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0 and 0.036 for the PA while the 75th percentile value was 0.229 and 0.26 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.406 and 0.417 for the PA (Figure 5.D-30).

Critical Water Years

In the month of January during critical water years, the median daily proportion negative velocity was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.24 for the NAA and 0.26 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.115 and 0.156 for the PA while the 75th percentile value was 0.312 and 0.312 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.438 and 0.406 for the PA (Figure 5.D-30).

In the month of February during critical water years, the median daily proportion negative velocity was predicted to be 29% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-30). Median daily proportion negative velocity was 0.177 for the NAA and 0.229 for the PA (Figure 5.D-30). The 25th percentile value of the daily proportion negative velocity for the NAA was 0.078 and 0.135 for the PA while the 75th percentile value was 0.271 and 0.312 for the PA (Figure 5.D-30). The minimum value of the daily proportion negative velocity for the NAA was 0 and 0 for the PA while the maximum value was 0.417 and 0.427 for the PA (Figure 5.D-30).

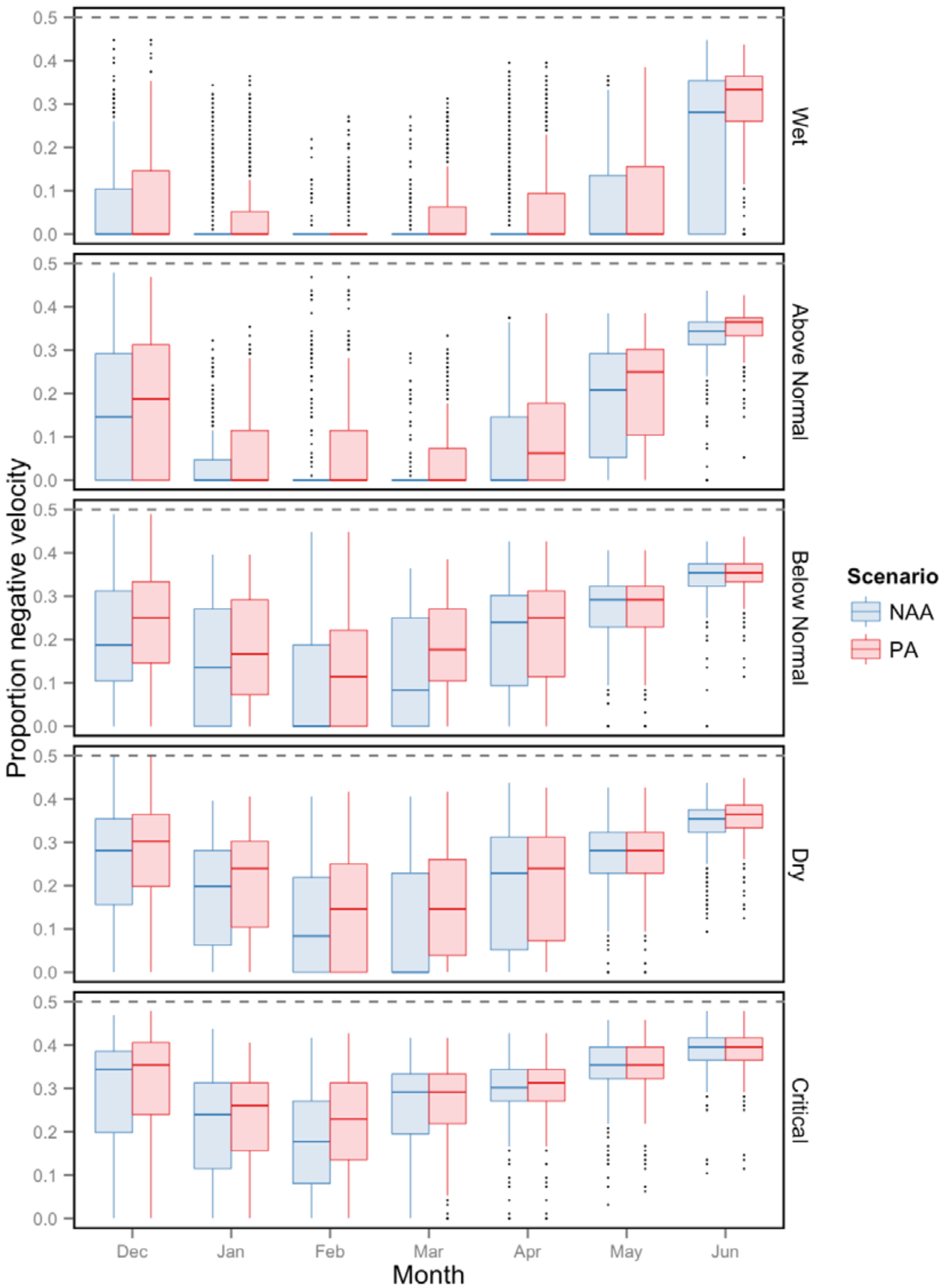


Figure 5.D-30. Daily proportion of negative velocity entering the interior at delta Channel 423, Sacramento River downstream of Georgiana Slough, during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.2 Flow Routing at Junctions

5.D.1.2.1.2.2.1 Sutter Slough and Steamboat Slough

In all years, the median proportion of flow into Sutter Slough and Steamboat Slough was predicted to be very similar for the NAA relative to the PA over the 82 water years (Figure 5.D-31 and Figure 5.D-32). Median proportion of flow into the Sutter Slough and Steamboat Slough did not differ by more than 5% for the NAA and when compared to the PA (Figure 5.D-31 and Figure 5.D-32).

5.D.1.2.1.2.2.1.1 Wet Water Years

In the month of June during wet water years, the median proportion of flow into Sutter Slough was predicted to be 12% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-31). Median proportion of flow into Sutter Slough was 0.219 for the NAA and 0.193 for the PA (Figure 5.D-31). The 25th percentile value of flow proportion for the NAA was 0.174 and 0.171 for the PA while the 75th percentile value was 0.262 and 0.232 for the PA (Figure 5.D-31). The minimum value of flow proportion for the NAA was 0.1343 and 0.1371 for the PA while the maximum value was 0.271 and 0.274 for the PA (Figure 5.D-31).

In the month of December during wet water years, the median proportion of flow into Steamboat Slough was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-32). Median proportion of flow into Steamboat Slough was 0.254 for the NAA and 0.242 for the PA (Figure 5.D-32). The 25th percentile value of flow proportion for the NAA was 0.22 and 0.213 for the PA while the 75th percentile value was 0.279 and 0.278 for the PA (Figure 5.D-32). The minimum value of flow proportion for the NAA was 0.1581 and 0.1526 for the PA while the maximum value was 0.31 and 0.305 for the PA (Figure 5.D-32).

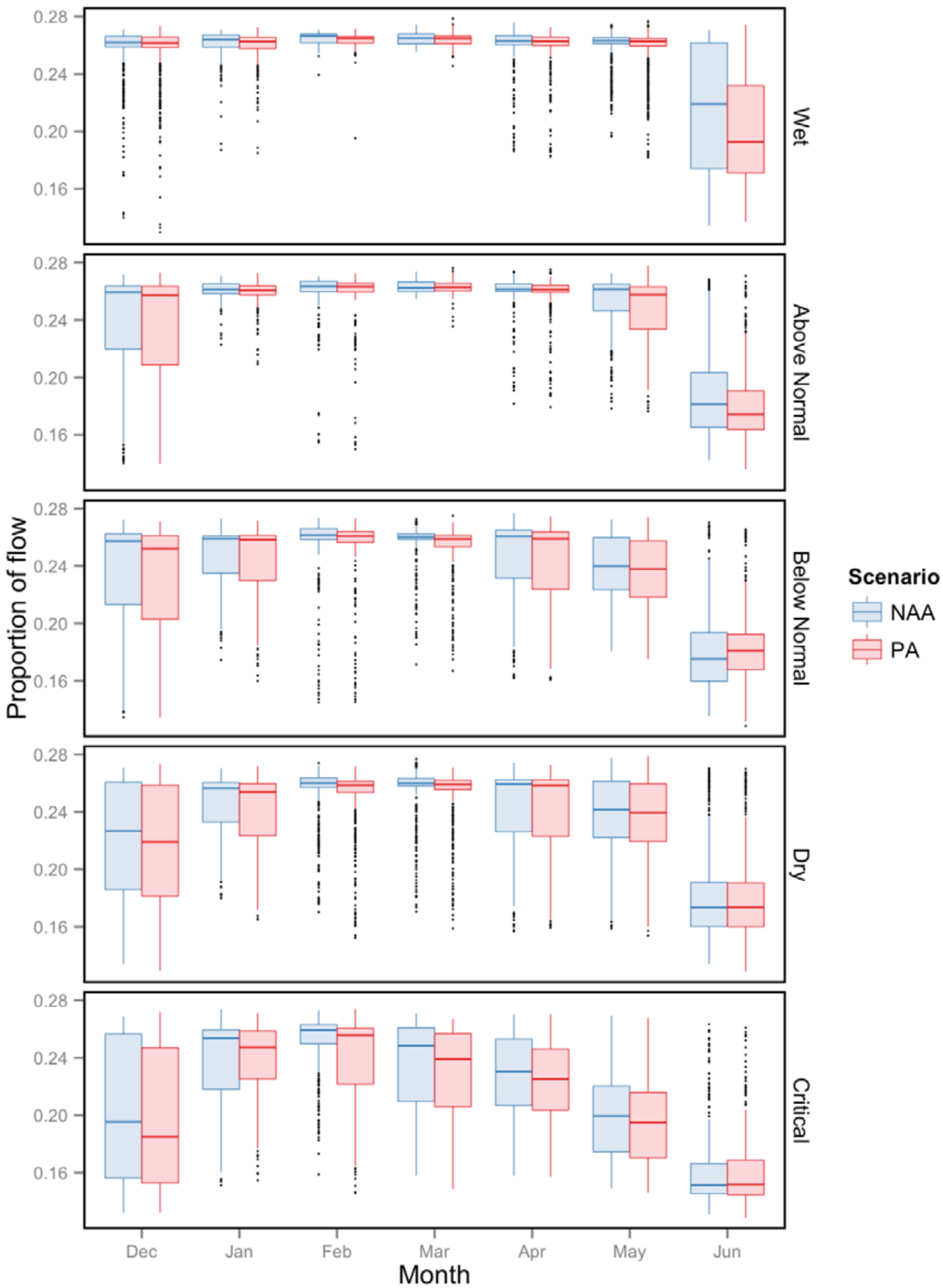


Figure 5.D-31. Proportion of flow entering the interior delta at Sutter Slough during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

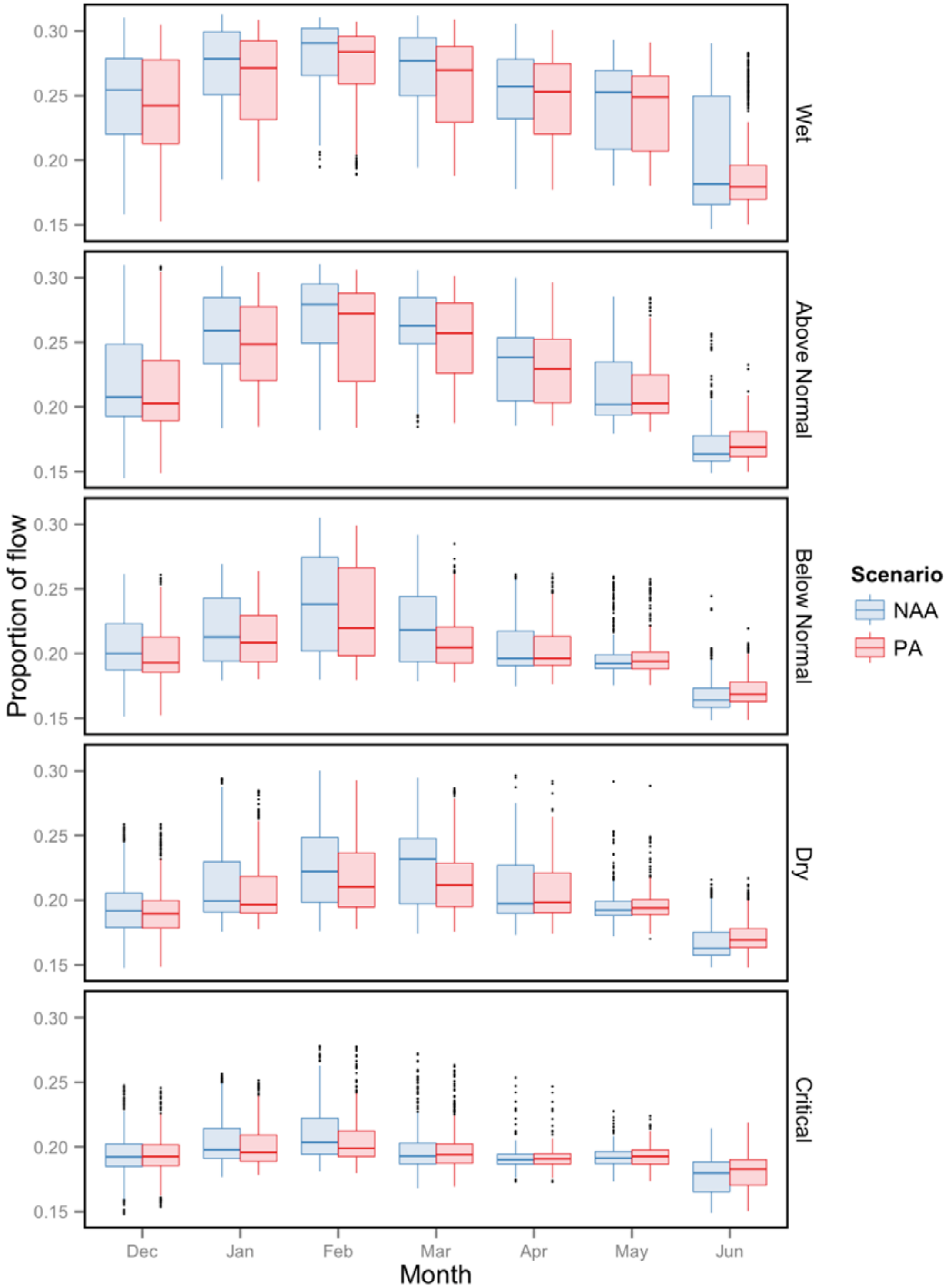


Figure 5.D-32. Proportion of flow entering the interior delta at Steamboat Slough during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.2.1.2 Below Normal Water Years

In the month of February during below normal water years, the median proportion of flow into Steamboat Slough was predicted to be 8% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-32). Median proportion of flow into Steamboat Slough was 0.238 for the NAA and 0.22 for the PA (Figure 5.D-32). The 25th percentile value of flow proportion for the NAA was 0.202 and 0.198 for the PA while the 75th percentile value was 0.275 and 0.266 for the PA (Figure 5.D-32). The minimum value of flow proportion for the NAA was 0.1799 and 0.1796 for the PA while the maximum value was 0.305 and 0.299 for the PA (Figure 5.D-32).

In the month of March during below normal water years, the median proportion of flow into Steamboat Slough was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-32). Median proportion of flow into Steamboat Slough was 0.218 for the NAA and 0.205 for the PA (Figure 5.D-32). The 25th percentile value of flow proportion for the NAA was 0.194 and 0.193 for the PA while the 75th percentile value was 0.244 and 0.22 for the PA (Figure 5.D-32). The minimum value of flow proportion for the NAA was 0.1788 and 0.1779 for the PA while the maximum value was 0.292 and 0.285 for the PA (Figure 5.D-32).

5.D.1.2.1.2.2.1.3 Dry Water Years

In the month of February during dry water years, the median proportion of flow into Steamboat Slough was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-32). Median proportion of flow into Steamboat Slough was 0.222 for the NAA and 0.21 for the PA (Figure 5.D-32). The 25th percentile value of flow proportion for the NAA was 0.198 and 0.195 for the PA while the 75th percentile value was 0.249 and 0.237 for the PA (Figure 5.D-32). The minimum value of flow proportion for the NAA was 0.176 and 0.1778 for the PA while the maximum value was 0.3 and 0.293 for the PA (Figure 5.D-32).

In the month of March during dry water years, the median proportion of flow into Steamboat Slough was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-32). Median proportion of flow into Steamboat Slough was 0.232 for the NAA and 0.212 for the PA (Figure 5.D-32). The 25th percentile value of flow proportion for the NAA was 0.197 and 0.195 for the PA while the 75th percentile value was 0.248 and 0.229 for the PA (Figure 5.D-32). The minimum value of flow proportion for the NAA was 0.1742 and 0.1755 for the PA while the maximum value was 0.295 and 0.287 for the PA (Figure 5.D-32).

5.D.1.2.1.2.2.1.4 Critical Water Years

In the month of December during critical water years, the median proportion of flow into Sutter Slough was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-31). Median proportion of flow into Sutter Slough was 0.195 for the NAA and 0.185 for the PA (Figure 5.D-31). The 25th percentile value of flow proportion for the NAA was 0.156 and 0.153 for the PA while the 75th percentile value was 0.256 and 0.247 for the PA (Figure 5.D-31). The minimum value of flow proportion for the NAA was 0.1319 and 0.1321 for the PA while the maximum value was 0.269 and 0.272 for the PA (Figure 5.D-31).

5.D.1.2.1.2.2.2 Delta Cross Channel

5.D.1.2.1.2.2.2.1 Wet Water Years

In the month of December during wet water years, the median proportion of flow into the Delta Cross Channel was predicted to be 17% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.006 for the NAA and 0.007 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.004 and 0.004 for the PA while the 75th percentile value was 0.008 and 0.009 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0004 and 0.0005 for the PA while the maximum value was 0.465 and 0.468 for the PA (Figure 5.D-33).

In the month of April during wet water years, the median proportion of flow into the Delta Cross Channel was predicted to be 20% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.005 for the NAA and 0.006 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.003 and 0.004 for the PA while the 75th percentile value was 0.008 and 0.008 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0013 and 0.0014 for the PA while the maximum value was 0.013 and 0.015 for the PA (Figure 5.D-33).

5.D.1.2.1.2.2.2.2 Above Normal Water Years

In the month of December during above normal water years, the median proportion of flow into the Delta Cross Channel was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.009 for the NAA and 0.01 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.006 and 0.007 for the PA while the 75th percentile value was 0.011 and 0.012 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.001 and 0.0011 for the PA while the maximum value was 0.467 and 0.467 for the PA (Figure 5.D-33).

In the month of January during above normal water years, the median proportion of flow into the Delta Cross Channel was predicted to be 20% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.005 for the NAA and 0.006 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.003 and 0.004 for the PA while the 75th percentile value was 0.008 and 0.008 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0011 and 0.0012 for the PA while the maximum value was 0.011 and 0.014 for the PA (Figure 5.D-33).

In the month of March during above normal water years, the median proportion of flow into the Delta Cross Channel was predicted to be 20% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.005 for the NAA and 0.006 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.003 and 0.004 for the PA while the 75th percentile value was 0.006 and 0.008 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0014 and 0.0015 for the PA while the maximum value was 0.011 and 0.012 for the PA (Figure 5.D-33).

In the month of April during above normal water years, the median proportion of flow into the Delta Cross Channel was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.007 for the NAA and 0.008 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.006 and 0.006 for the PA while the 75th percentile value was 0.009 and 0.009 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0024 and 0.0025 for the PA while the maximum value was 0.024 and 0.025 for the PA (Figure 5.D-33).

In the month of May during above normal water years, the median proportion of flow into the Delta Cross Channel was predicted to be 10% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.01 for the NAA and 0.011 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.008 and 0.008 for the PA while the 75th percentile value was 0.011 and 0.012 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0027 and 0.0027 for the PA while the maximum value was 0.025 and 0.025 for the PA (Figure 5.D-33).

5.D.1.2.1.2.2.2.3 Below Normal Water Years

In the month of December during below normal water years, the median proportion of flow into the Delta Cross Channel was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.009 for the NAA and 0.01 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.008 and 0.009 for the PA while the 75th percentile value was 0.012 and 0.242 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0041 and 0.005 for the PA while the maximum value was 0.468 and 0.471 for the PA (Figure 5.D-33).

In the month of February during below normal water years, the median proportion of flow into the Delta Cross Channel was predicted to be 14% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.007 for the NAA and 0.008 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.004 and 0.004 for the PA while the 75th percentile value was 0.009 and 0.01 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0019 and 0.0021 for the PA while the maximum value was 0.04 and 0.04 for the PA (Figure 5.D-33).

In the month of March during below normal water years, the median proportion of flow into the Delta Cross Channel was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.008 for the NAA and 0.009 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.007 and 0.008 for the PA while the 75th percentile value was 0.01 and 0.01 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0031 and 0.0037 for the PA while the maximum value was 0.013 and 0.014 for the PA (Figure 5.D-33).

5.D.1.2.1.2.2.2.4 Dry Water Years

In the month of February during dry water years, the median proportion of flow into the Delta Cross Channel was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.008 for the NAA and 0.009 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.006 and 0.007 for the PA while the 75th percentile value was 0.01 and 0.01 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0015 and 0.0017 for the PA while the maximum value was 0.017 and 0.024 for the PA (Figure 5.D-33).

In the month of March during dry water years, the median proportion of flow into the Delta Cross Channel was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.008 for the NAA and 0.009 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.006 and 0.008 for the PA while the 75th percentile value was 0.01 and 0.01 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0023 and 0.0025 for the PA while the maximum value was 0.024 and 0.024 for the PA (Figure 5.D-33).

5.D.1.2.1.2.2.2.5 Critical Water Years

In the month of February during critical water years, the median proportion of flow into the Delta Cross Channel was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-33). Median proportion of flow into the Delta Cross Channel was 0.009 for the NAA and 0.01 for the PA (Figure 5.D-33). The 25th percentile value of flow proportion for the NAA was 0.008 and 0.009 for the PA while the 75th percentile value was 0.01 and 0.011 for the PA (Figure 5.D-33). The minimum value of flow proportion for the NAA was 0.0038 and 0.0046 for the PA while the maximum value was 0.025 and 0.026 for the PA (Figure 5.D-33).

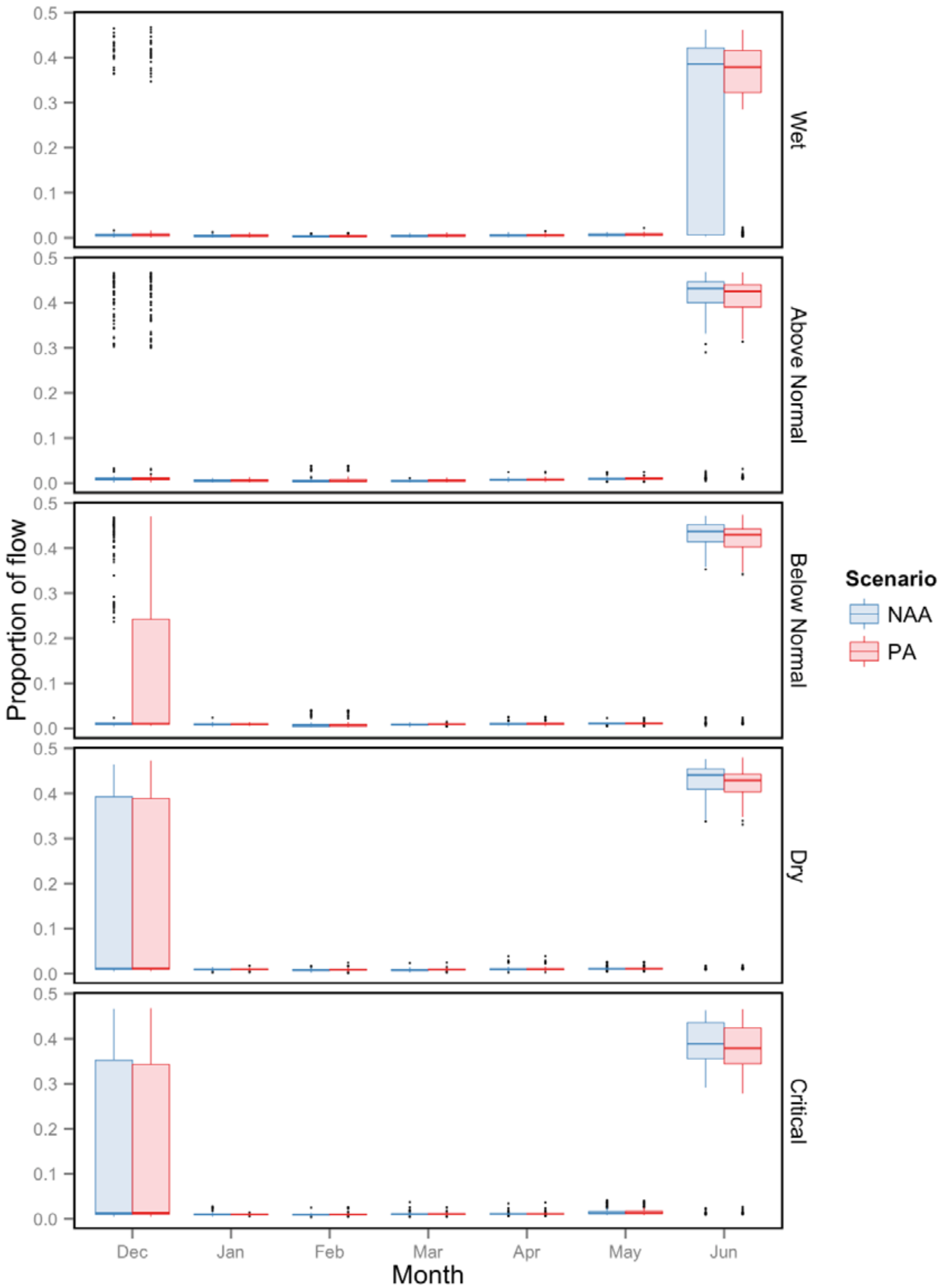


Figure 5.D-33. Proportion of flow entering the interior delta at the Delta Cross Channel during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.2.3 Georgiana Slough

5.D.1.2.1.2.2.3.1 Wet Years

In the month of December during wet water years, the median proportion of flow into Georgiana Slough was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-34). Median proportion of flow into Georgiana Slough was 0.314 for the NAA and 0.342 for the PA (Figure 5.D-34). The 25th percentile value of flow proportion for the NAA was 0.293 and 0.293 for the PA while the 75th percentile value was 0.387 and 0.41 for the PA (Figure 5.D-34). The minimum value of flow proportion for the NAA was 0.2801 and 0.264 for the PA while the maximum value was 0.479 and 0.475 for the PA (Figure 5.D-34).

5.D.1.2.1.2.2.3.2 Above Normal Water Years

In the month of January during above normal water years, the median proportion of flow into Georgiana Slough was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-34). Median proportion of flow into Georgiana Slough was 0.304 for the NAA and 0.327 for the PA (Figure 5.D-34). The 25th percentile value of flow proportion for the NAA was 0.291 and 0.293 for the PA while the 75th percentile value was 0.364 and 0.385 for the PA (Figure 5.D-34). The minimum value of flow proportion for the NAA was 0.2851 and 0.2847 for the PA while the maximum value was 0.468 and 0.461 for the PA (Figure 5.D-34).

In the month of April during above normal water years, the median proportion of flow into Georgiana Slough was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-34). Median proportion of flow into Georgiana Slough was 0.336 for the NAA and 0.36 for the PA (Figure 5.D-34). The 25th percentile value of flow proportion for the NAA was 0.305 and 0.307 for the PA while the 75th percentile value was 0.408 and 0.409 for the PA (Figure 5.D-34). The minimum value of flow proportion for the NAA was 0.2856 and 0.2853 for the PA while the maximum value was 0.46 and 0.461 for the PA (Figure 5.D-34).

5.D.1.2.1.2.2.3.3 Below Normal Water Years

In the month of February during below normal water years, the median proportion of flow into Georgiana Slough was predicted to be 12% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-34). Median proportion of flow into Georgiana Slough was 0.339 for the NAA and 0.379 for the PA (Figure 5.D-34). The 25th percentile value of flow proportion for the NAA was 0.29 and 0.292 for the PA while the 75th percentile value was 0.416 and 0.428 for the PA (Figure 5.D-34). The minimum value of flow proportion for the NAA was 0.2187 and 0.2132 for the PA while the maximum value was 0.471 and 0.473 for the PA (Figure 5.D-34).

In the month of March during below normal water years, the median proportion of flow into Georgiana Slough was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-34). Median proportion of flow into Georgiana Slough was 0.391 for the NAA and 0.417 for the PA (Figure 5.D-34). The 25th percentile value of flow proportion for the NAA was 0.325 and 0.378 for the PA while the 75th percentile value was 0.441 and 0.437 for the PA (Figure 5.D-34). The minimum value of flow proportion for the NAA was 0.2903 and 0.2903 for the PA while the maximum value was 0.47 and 0.466 for the PA (Figure 5.D-34).

5.D.1.2.1.2.2.3.4 Dry Water Years

In the month of February during dry water years, the median proportion of flow into Georgiana Slough was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-34). Median proportion of flow into Georgiana Slough was 0.382 for the NAA and 0.4 for the PA (Figure 5.D-34). The 25th percentile value of flow proportion for the NAA was 0.316 and 0.35 for the PA while the 75th percentile value was 0.431 and 0.437 for the PA (Figure 5.D-34). The minimum value of flow proportion for the NAA was 0.2855 and 0.2841 for the PA while the maximum value was 0.48 and 0.482 for the PA (Figure 5.D-34).

In the month of March during dry water years, the median proportion of flow into Georgiana Slough was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-34). Median proportion of flow into Georgiana Slough was 0.366 for the NAA and 0.406 for the PA (Figure 5.D-34). The 25th percentile value of flow proportion for the NAA was 0.316 and 0.366 for the PA while the 75th percentile value was 0.434 and 0.435 for the PA (Figure 5.D-34). The minimum value of flow proportion for the NAA was 0.2885 and 0.2899 for the PA while the maximum value was 0.472 and 0.469 for the PA (Figure 5.D-34).

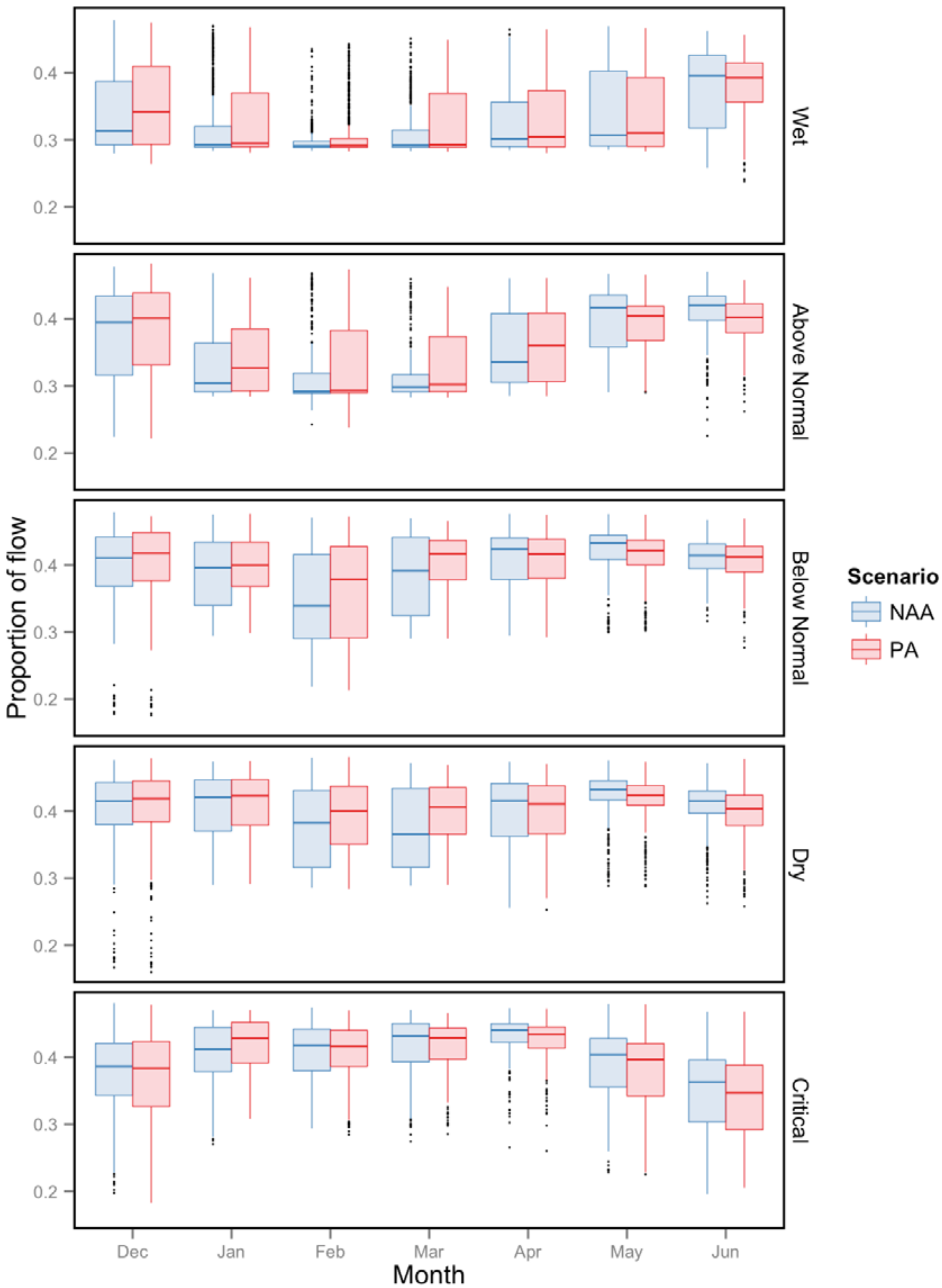


Figure 5.D-34. Proportion of flow entering the interior delta at Georgiana Slough during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.2.4 Head of Old River

5.D.1.2.1.2.2.4.1 Wet Water Years

In the month of January during wet water years, the median proportion of flow into the head of Old River was predicted to be 44% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.58 for the NAA and 0.322 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.533 and 0.26 for the PA while the 75th percentile value was 0.635 and 0.494 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4971 and 0.2469 for the PA while the maximum value was 0.682 and 0.532 for the PA (Figure 5.D-35).

In the month of February during wet water years, the median proportion of flow into the head of Old River was predicted to be 47% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.537 for the NAA and 0.282 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.53 and 0.256 for the PA while the 75th percentile value was 0.571 and 0.502 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4961 and 0.2447 for the PA while the maximum value was 0.686 and 0.534 for the PA (Figure 5.D-35).

In the month of March during wet water years, the median proportion of flow into the head of Old River was predicted to be 40% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.534 for the NAA and 0.323 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.528 and 0.256 for the PA while the 75th percentile value was 0.55 and 0.52 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4945 and 0.2436 for the PA while the maximum value was 0.682 and 0.531 for the PA (Figure 5.D-35).

In the month of April during wet water years, the median proportion of flow into the head of Old River was predicted to be 51% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.525 for the NAA and 0.259 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.521 and 0.253 for the PA while the 75th percentile value was 0.529 and 0.522 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4957 and 0.2451 for the PA while the maximum value was 0.624 and 0.53 for the PA (Figure 5.D-35).

In the month of May during wet water years, the median proportion of flow into the head of Old River was predicted to be 51% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.527 for the NAA and 0.259 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.522 and 0.251 for the PA while the 75th percentile value was 0.533 and 0.519 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.496 and 0.2469 for the PA while the maximum value was 0.603 and 0.529 for the PA (Figure 5.D-35).

5.D.1.2.1.2.2.4.2 Above Normal Water Years

In the month of January during above normal water years, the median proportion of flow into the head of Old River was predicted to be 43% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.616 for the NAA and 0.349 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.555 and 0.27 for the PA while the 75th percentile value was 0.64 and 0.389 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5035 and 0.2539 for the PA while the maximum value was 0.68 and 0.532 for the PA (Figure 5.D-35).

In the month of February during above normal water years, the median proportion of flow into the head of Old River was predicted to be 51% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.577 for the NAA and 0.28 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.535 and 0.258 for the PA while the 75th percentile value was 0.628 and 0.356 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.3425 and 0.2507 for the PA while the maximum value was 0.682 and 0.532 for the PA (Figure 5.D-35).

In the month of March during above normal water years, the median proportion of flow into the head of Old River was predicted to be 53% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.56 for the NAA and 0.264 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.536 and 0.252 for the PA while the 75th percentile value was 0.641 and 0.328 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4967 and 0.2419 for the PA while the maximum value was 0.675 and 0.53 for the PA (Figure 5.D-35).

In the month of April during above normal water years, the median proportion of flow into the head of Old River was predicted to be 52% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.529 for the NAA and 0.253 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.524 and 0.25 for the PA while the 75th percentile value was 0.55 and 0.26 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5169 and 0.2453 for the PA while the maximum value was 0.636 and 0.529 for the PA (Figure 5.D-35).

In the month of May during above normal water years, the median proportion of flow into the head of Old River was predicted to be 53% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.537 for the NAA and 0.252 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.524 and 0.25 for the PA while the 75th percentile value was 0.567 and 0.263 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5169 and 0.2463 for the PA while the maximum value was 0.614 and 0.53 for the PA (Figure 5.D-35).

In the month of June during above normal water years, the median proportion of flow into the head of Old River was predicted to be 11% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.53 for the NAA and 0.474 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.506 and 0.27 for the PA while the 75th percentile value was 0.546 and 0.513 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4828 and 0.238 for the PA while the maximum value was 0.585 and 0.576 for the PA (Figure 5.D-35).

5.D.1.2.1.2.2.4.3 Below Normal Water Years

In the month of January during below normal water years, the median proportion of flow into the head of Old River was predicted to be 46% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.635 for the NAA and 0.342 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.616 and 0.296 for the PA while the 75th percentile value was 0.654 and 0.383 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5316 and 0.2501 for the PA while the maximum value was 0.682 and 0.527 for the PA (Figure 5.D-35).

In the month of February during below normal water years, the median proportion of flow into the head of Old River was predicted to be 41% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.602 for the NAA and 0.353 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.556 and 0.271 for the PA while the 75th percentile value was 0.635 and 0.398 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4661 and 0.2496 for the PA while the maximum value was 0.701 and 0.531 for the PA (Figure 5.D-35).

In the month of March during below normal water years, the median proportion of flow into the head of Old River was predicted to be 53% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.611 for the NAA and 0.289 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.555 and 0.259 for the PA while the 75th percentile value was 0.638 and 0.335 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5291 and 0.245 for the PA while the maximum value was 0.674 and 0.53 for the PA (Figure 5.D-35).

In the month of April during below normal water years, the median proportion of flow into the head of Old River was predicted to be 53% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.559 for the NAA and 0.264 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.527 and 0.254 for the PA while the 75th percentile value was 0.59 and 0.273 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5171 and 0.2472 for the PA while the maximum value was 0.638 and 0.358 for the PA (Figure 5.D-35).

In the month of May during below normal water years, the median proportion of flow into the head of Old River was predicted to be 52% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.582 for the NAA and 0.279 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.534 and 0.252 for the PA while the 75th percentile value was 0.601 and 0.293 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5156 and 0.2485 for the PA while the maximum value was 0.639 and 0.384 for the PA (Figure 5.D-35).

In the month of June during below normal water years, the median proportion of flow into the head of Old River was predicted to be 18% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.504 for the NAA and 0.412 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.48 and 0.344 for the PA while the 75th percentile value was 0.53 and 0.491 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4185 and 0.2347 for the PA while the maximum value was 0.583 and 0.554 for the PA (Figure 5.D-35).

5.D.1.2.1.2.2.4.4 Dry Water Years

In the month of January during dry water years, the median proportion of flow into the head of Old River was predicted to be 44% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.647 for the NAA and 0.362 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.631 and 0.327 for the PA while the 75th percentile value was 0.659 and 0.408 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5323 and 0.2561 for the PA while the maximum value was 0.692 and 0.489 for the PA (Figure 5.D-35).

In the month of February during dry water years, the median proportion of flow into the head of Old River was predicted to be 41% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.634 for the NAA and 0.371 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.605 and 0.315 for the PA while the 75th percentile value was 0.652 and 0.399 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.3196 and 0.2212 for the PA while the maximum value was 0.715 and 0.537 for the PA (Figure 5.D-35).

In the month of March during dry water years, the median proportion of flow into the head of Old River was predicted to be 39% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.629 for the NAA and 0.385 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.59 and 0.316 for the PA while the 75th percentile value was 0.641 and 0.417 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5272 and 0.2528 for the PA while the maximum value was 0.679 and 0.53 for the PA (Figure 5.D-35).

In the month of April during dry water years, the median proportion of flow into the head of Old River was predicted to be 46% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.597 for the NAA and 0.322 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.552 and 0.263 for the PA while the 75th percentile value was 0.609 and 0.366 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5161 and 0.247 for the PA while the maximum value was 0.638 and 0.526 for the PA (Figure 5.D-35).

In the month of May during dry water years, the median proportion of flow into the head of Old River was predicted to be 44% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.602 for the NAA and 0.335 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.575 and 0.28 for the PA while the 75th percentile value was 0.616 and 0.373 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.514 and 0.2455 for the PA while the maximum value was 0.638 and 0.529 for the PA (Figure 5.D-35).

In the month of June during dry water years, the median proportion of flow into the head of Old River was predicted to be 19% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.467 for the NAA and 0.377 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.429 and 0.323 for the PA while the 75th percentile value was 0.518 and 0.43 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.3444 and 0.2394 for the PA while the maximum value was 0.575 and 0.55 for the PA (Figure 5.D-35).

5.D.1.2.1.2.2.4.5 Critical Water Years

In the month of January during critical water years, the median proportion of flow into the head of Old River was predicted to be 37% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.638 for the NAA and 0.405 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.614 and 0.39 for the PA while the 75th percentile value was 0.657 and 0.423 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.5373 and 0.2665 for the PA while the maximum value was 0.686 and 0.483 for the PA (Figure 5.D-35).

In the month of February during critical water years, the median proportion of flow into the head of Old River was predicted to be 38% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.622 for the NAA and 0.383 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.576 and 0.363 for the PA while the 75th percentile value was 0.65 and 0.401 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4607 and 0.253 for the PA while the maximum value was 0.68 and 0.444 for the PA (Figure 5.D-35).

In the month of March during critical water years, the median proportion of flow into the head of Old River was predicted to be 33% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.594 for the NAA and 0.398 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.571 and 0.378 for the PA while the 75th percentile value was 0.618 and 0.417 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4915 and 0.2513 for the PA while the maximum value was 0.647 and 0.457 for the PA (Figure 5.D-35).

In the month of April during critical water years, the median proportion of flow into the head of Old River was predicted to be 31% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.567 for the NAA and 0.393 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.537 and 0.371 for the PA while the 75th percentile value was 0.592 and 0.41 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.4807 and 0.2496 for the PA while the maximum value was 0.633 and 0.449 for the PA (Figure 5.D-35).

In the month of May during critical water years, the median proportion of flow into the head of Old River was predicted to be 34% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.58 for the NAA and 0.383 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.557 and 0.364 for the PA while the 75th percentile value was 0.597 and 0.396 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.3785 and 0.2506 for the PA while the maximum value was 0.631 and 0.421 for the PA (Figure 5.D-35).

In the month of June during critical water years, the median proportion of flow into the head of Old River was predicted to be 16% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-35). Median proportion of flow into the head of Old River was 0.367 for the NAA and 0.307 for the PA (Figure 5.D-35). The 25th percentile value of flow proportion for the NAA was 0.327 and 0.265 for the PA while the 75th percentile value was 0.412 and 0.355 for the PA (Figure 5.D-35). The minimum value of flow proportion for the NAA was 0.203 and 0.125 for the PA while the maximum value was 0.54 and 0.538 for the PA (Figure 5.D-35).

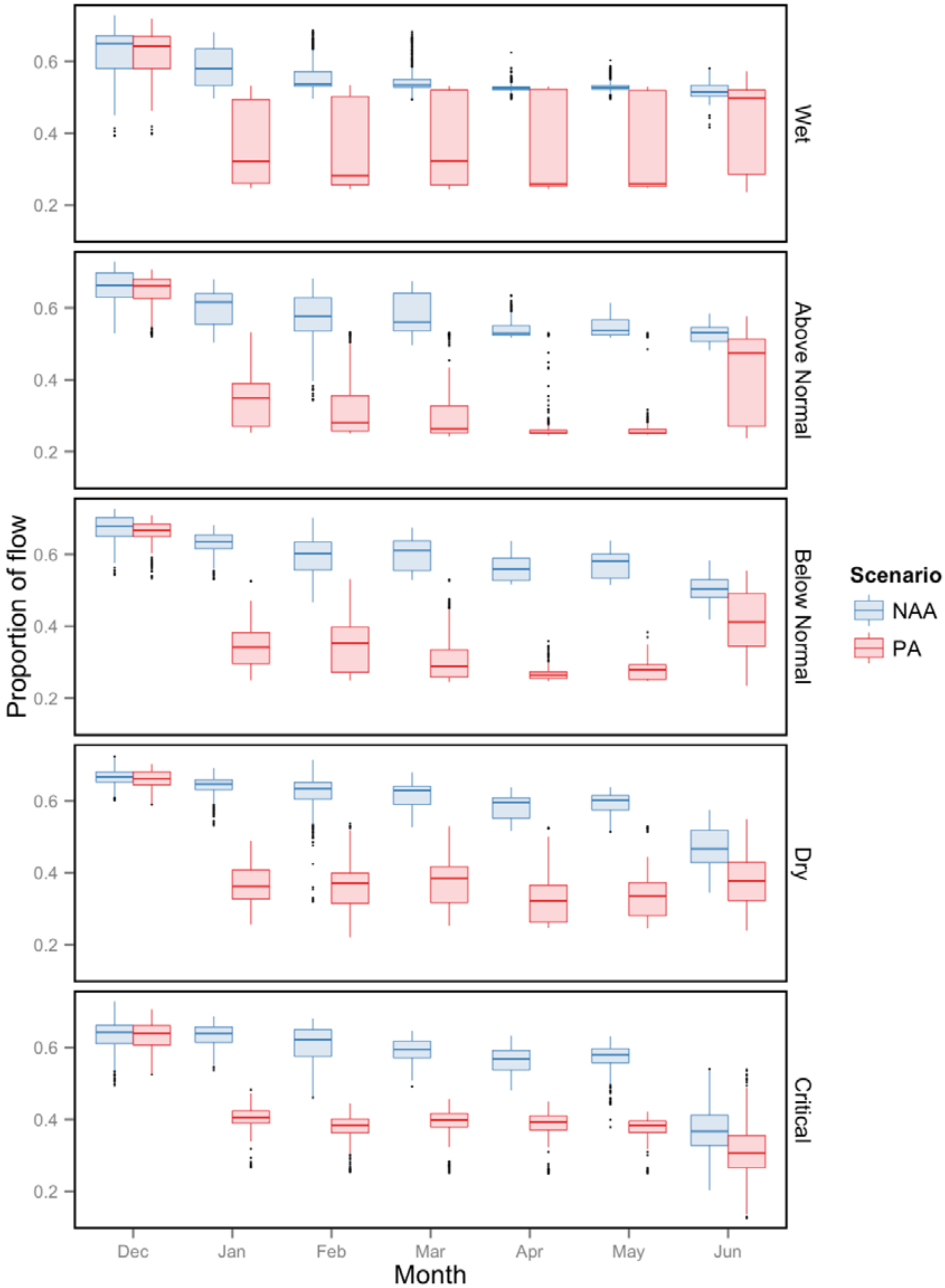


Figure 5.D-35. Proportion of flow entering the interior delta at the head of Old River during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.2.5 Middle River

5.D.1.2.1.2.2.5.1 Wet Water Years

In the month of February during wet water years, the median proportion of flow into Middle River was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-36). Median proportion of flow into Middle River was 0.185 for the NAA and 0.174 for the PA (Figure 5.D-36). The 25th percentile value of flow proportion for the NAA was 0.176 and 0.161 for the PA while the 75th percentile value was 0.191 and 0.182 for the PA (Figure 5.D-36). The minimum value of flow proportion for the NAA was 0.0874 and 0.0346 for the PA while the maximum value was 0.222 and 0.21 for the PA (Figure 5.D-36).

In the month of March during wet water years, the median proportion of flow into Middle River was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-36). Median proportion of flow into Middle River was 0.184 for the NAA and 0.168 for the PA (Figure 5.D-36). The 25th percentile value of flow proportion for the NAA was 0.175 and 0.155 for the PA while the 75th percentile value was 0.19 and 0.178 for the PA (Figure 5.D-36). The minimum value of flow proportion for the NAA was 0.0162 and 0.0082 for the PA while the maximum value was 0.221 and 0.2 for the PA (Figure 5.D-36).

In the month of June during wet water years, the median proportion of flow into Middle River was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-36). Median proportion of flow into Middle River was 0.186 for the NAA and 0.176 for the PA (Figure 5.D-36). The 25th percentile value of flow proportion for the NAA was 0.178 and 0.168 for the PA while the 75th percentile value was 0.192 and 0.182 for the PA (Figure 5.D-36). The minimum value of flow proportion for the NAA was 0.1464 and 0.1232 for the PA while the maximum value was 0.212 and 0.207 for the PA (Figure 5.D-36).

5.D.1.2.1.2.2.5.2 Above Normal Water Years

In the month of March during above normal water years, the median proportion of flow into Middle River was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-36). Median proportion of flow into Middle River was 0.183 for the NAA and 0.173 for the PA (Figure 5.D-36). The 25th percentile value of flow proportion for the NAA was 0.178 and 0.167 for the PA while the 75th percentile value was 0.19 and 0.179 for the PA (Figure 5.D-36). The minimum value of flow proportion for the NAA was 0.1371 and 0.1255 for the PA while the maximum value was 0.209 and 0.196 for the PA (Figure 5.D-36).

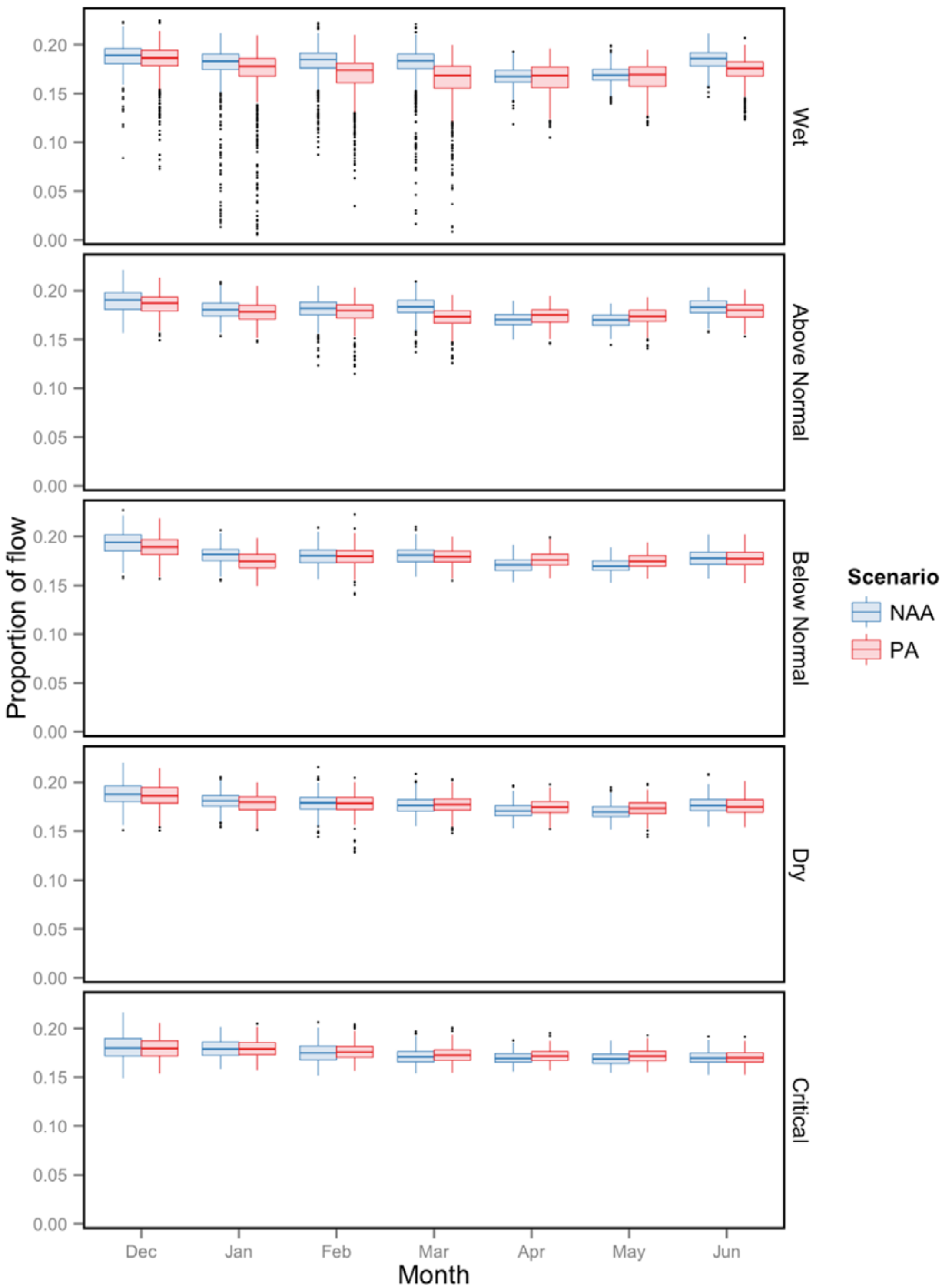


Figure 5.D-36. Proportion of flow entering the interior delta at Middle River during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.2.6 Columbia Cut

5.D.1.2.1.2.2.6.1 Wet Water Years

In the month of February during wet water years, the median proportion of flow into Columbia Cut was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-37). Median proportion of flow into Columbia Cut was 0.171 for the NAA and 0.161 for the PA (Figure 5.D-37). The 25th percentile value of flow proportion for the NAA was 0.158 and 0.148 for the PA while the 75th percentile value was 0.182 and 0.173 for the PA (Figure 5.D-37). The minimum value of flow proportion for the NAA was 0.0394 and 0.0158 for the PA while the maximum value was 0.276 and 0.22 for the PA (Figure 5.D-37).

In the month of March during wet water years, the median proportion of flow into Columbia Cut was predicted to be 9% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-37). Median proportion of flow into Columbia Cut was 0.173 for the NAA and 0.157 for the PA (Figure 5.D-37). The 25th percentile value of flow proportion for the NAA was 0.16 and 0.145 for the PA while the 75th percentile value was 0.182 and 0.169 for the PA (Figure 5.D-37). The minimum value of flow proportion for the NAA was 0 and 0 for the PA while the maximum value was 0.282 and 0.212 for the PA (Figure 5.D-37).

In the month of June during wet water years, the median proportion of flow into Columbia Cut was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-37). Median proportion of flow into Columbia Cut was 0.169 for the NAA and 0.161 for the PA (Figure 5.D-37). The 25th percentile value of flow proportion for the NAA was 0.162 and 0.153 for the PA while the 75th percentile value was 0.179 and 0.169 for the PA (Figure 5.D-37). The minimum value of flow proportion for the NAA was 0.1308 and 0.0779 for the PA while the maximum value was 0.209 and 0.192 for the PA (Figure 5.D-37).

5.D.1.2.1.2.2.6.2 Above Normal Water Years

In the month of March during above normal water years, the median proportion of flow into Columbia Cut was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-37). Median proportion of flow into Columbia Cut was 0.166 for the NAA and 0.158 for the PA (Figure 5.D-37). The 25th percentile value of flow proportion for the NAA was 0.157 and 0.15 for the PA while the 75th percentile value was 0.176 and 0.166 for the PA (Figure 5.D-37). The minimum value of flow proportion for the NAA was 0.1222 and 0.1029 for the PA while the maximum value was 0.225 and 0.194 for the PA (Figure 5.D-37).

In the month of April during above normal water years, the median proportion of flow into Columbia Cut was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-37). Median proportion of flow into Columbia Cut was 0.153 for the NAA and 0.16 for the PA (Figure 5.D-37). The 25th percentile value of flow proportion for the NAA was 0.148 and 0.153 for the PA while the 75th percentile value was 0.157 and 0.166 for the PA (Figure 5.D-37). The minimum value of flow proportion for the NAA was 0.1198 and 0.124 for the PA while the maximum value was 0.178 and 0.187 for the PA (Figure 5.D-37).

In the month of May during above normal water years, the median proportion of flow into Columbia Cut was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-37). Median proportion of flow into Columbia Cut was 0.151 for the NAA and

0.159 for the PA (Figure 5.D-37). The 25th percentile value of flow proportion for the NAA was 0.146 and 0.153 for the PA while the 75th percentile value was 0.156 and 0.164 for the PA (Figure 5.D-37). The minimum value of flow proportion for the NAA was 0.1209 and 0.1293 for the PA while the maximum value was 0.168 and 0.178 for the PA (Figure 5.D-37).

5.D.1.2.1.2.2.6.3 Below Normal Water Years

In the month of April during below normal water years, the median proportion of flow into Columbia Cut was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-37). Median proportion of flow into Columbia Cut was 0.151 for the NAA and 0.16 for the PA (Figure 5.D-37). The 25th percentile value of flow proportion for the NAA was 0.147 and 0.155 for the PA while the 75th percentile value was 0.156 and 0.166 for the PA (Figure 5.D-37). The minimum value of flow proportion for the NAA was 0.1214 and 0.1317 for the PA while the maximum value was 0.176 and 0.188 for the PA (Figure 5.D-37).

In the month of May during below normal water years, the median proportion of flow into Columbia Cut was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-37). Median proportion of flow into Columbia Cut was 0.149 for the NAA and 0.158 for the PA (Figure 5.D-37). The 25th percentile value of flow proportion for the NAA was 0.144 and 0.152 for the PA while the 75th percentile value was 0.154 and 0.163 for the PA (Figure 5.D-37). The minimum value of flow proportion for the NAA was 0.1177 and 0.1251 for the PA while the maximum value was 0.17 and 0.178 for the PA (Figure 5.D-37).

5.D.1.2.1.2.2.6.4 Dry Water Years

In the month of April during dry water years, the median proportion of flow into Columbia Cut was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-37). Median proportion of flow into Columbia Cut was 0.149 for the NAA and 0.156 for the PA (Figure 5.D-37). The 25th percentile value of flow proportion for the NAA was 0.144 and 0.15 for the PA while the 75th percentile value was 0.155 and 0.164 for the PA (Figure 5.D-37). The minimum value of flow proportion for the NAA was 0.1117 and 0.1166 for the PA while the maximum value was 0.179 and 0.19 for the PA (Figure 5.D-37).

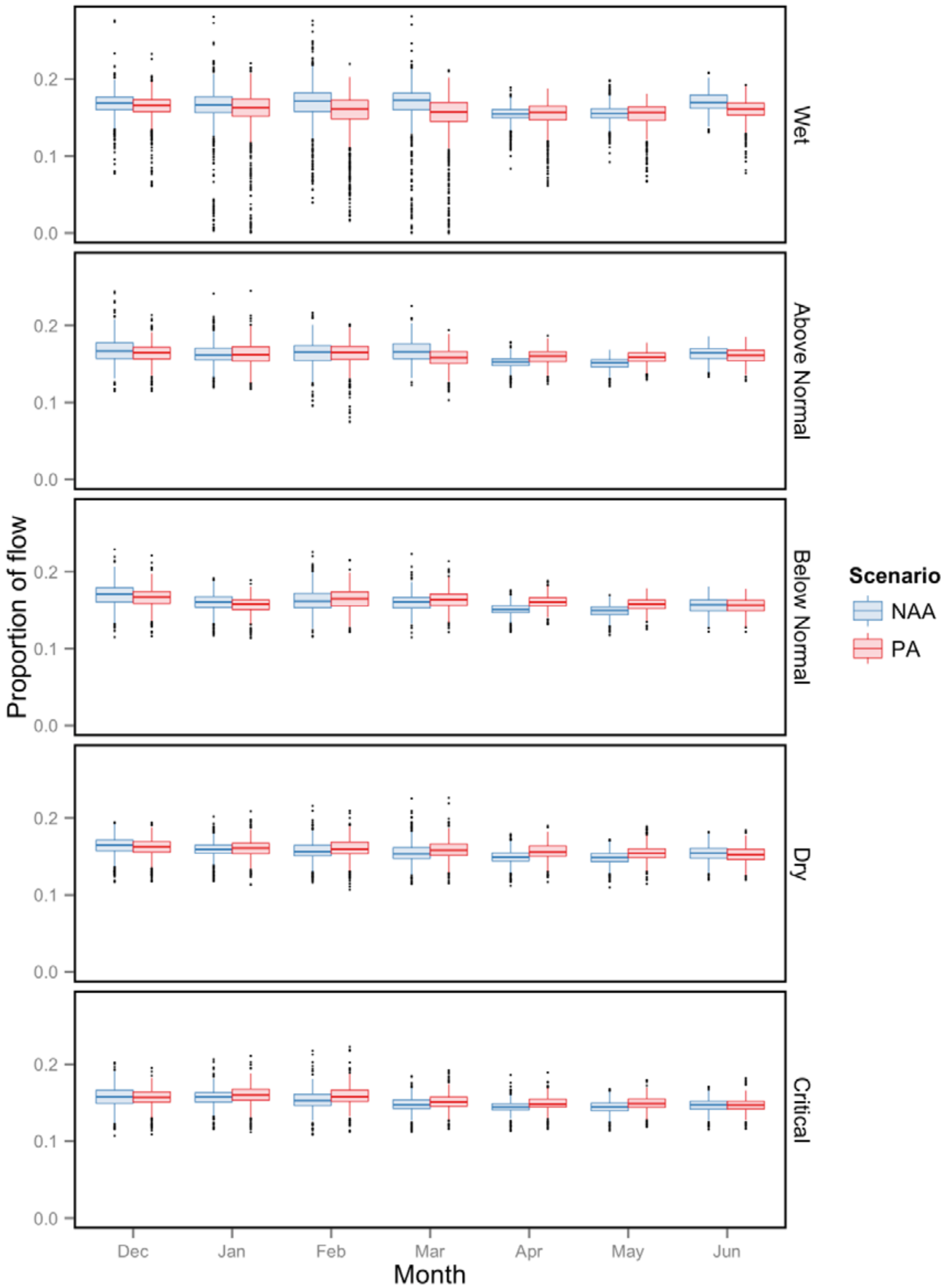


Figure 5.D-37. Proportion of flow entering the interior delta at Columbia Cut during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.2.7 Turner Cut

5.D.1.2.1.2.2.7.1 Wet Water Years

In the month of April during wet water years, the median proportion of flow into Turner Cut was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.18 for the NAA and 0.189 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.169 and 0.18 for the PA while the 75th percentile value was 0.194 and 0.199 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.0733 and 0.0588 for the PA while the maximum value was 0.227 and 0.235 for the PA (Figure 5.D-38).

In the month of May during wet water years, the median proportion of flow into Turner Cut was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.177 for the NAA and 0.187 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.167 and 0.177 for the PA while the 75th percentile value was 0.195 and 0.197 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1084 and 0.0854 for the PA while the maximum value was 0.246 and 0.233 for the PA (Figure 5.D-38).

5.D.1.2.1.2.2.7.2 Above Normal Water Years

In the month of February during above normal water years, the median proportion of flow into Turner Cut was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.175 for the NAA and 0.185 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.162 and 0.168 for the PA while the 75th percentile value was 0.187 and 0.196 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.0712 and 0.058 for the PA while the maximum value was 0.227 and 0.234 for the PA (Figure 5.D-38).

In the month of April during above normal water years, the median proportion of flow into Turner Cut was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.17 for the NAA and 0.188 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.163 and 0.178 for the PA while the 75th percentile value was 0.179 and 0.197 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1348 and 0.1522 for the PA while the maximum value was 0.215 and 0.226 for the PA (Figure 5.D-38).

In the month of May during above normal water years, the median proportion of flow into Turner Cut was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.167 for the NAA and 0.186 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.161 and 0.177 for the PA while the 75th percentile value was 0.177 and 0.196 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1369 and 0.1516 for the PA while the maximum value was 0.209 and 0.228 for the PA (Figure 5.D-38).

5.D.1.2.1.2.2.7.3 Below Normal Water Years

In the month of February during below normal water years, the median proportion of flow into Turner Cut was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.169 for the NAA and 0.182 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.158 and 0.169 for the PA while the 75th percentile value was 0.184 and 0.196 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1291 and 0.133 for the PA while the maximum value was 0.247 and 0.234 for the PA (Figure 5.D-38).

In the month of March during below normal water years, the median proportion of flow into Turner Cut was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.169 for the NAA and 0.182 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.16 and 0.168 for the PA while the 75th percentile value was 0.18 and 0.195 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1319 and 0.1365 for the PA while the maximum value was 0.221 and 0.228 for the PA (Figure 5.D-38).

In the month of April during below normal water years, the median proportion of flow into Turner Cut was predicted to be 11% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.164 for the NAA and 0.182 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.157 and 0.173 for the PA while the 75th percentile value was 0.173 and 0.193 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1362 and 0.1543 for the PA while the maximum value was 0.199 and 0.228 for the PA (Figure 5.D-38).

In the month of May during below normal water years, the median proportion of flow into Turner Cut was predicted to be 9% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.161 for the NAA and 0.176 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.155 and 0.169 for the PA while the 75th percentile value was 0.169 and 0.188 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1307 and 0.1421 for the PA while the maximum value was 0.191 and 0.217 for the PA (Figure 5.D-38).

5.D.1.2.1.2.2.7.4 Dry Water Years

In the month of February during dry water years, the median proportion of flow into Turner Cut was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.161 for the NAA and 0.17 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.156 and 0.162 for the PA while the 75th percentile value was 0.17 and 0.18 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1248 and 0.1034 for the PA while the maximum value was 0.224 and 0.233 for the PA (Figure 5.D-38).

In the month of March during dry water years, the median proportion of flow into Turner Cut was predicted to be 6% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.159 for the NAA and 0.168 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.153 and 0.16 for the PA while the 75th percentile value was 0.167 and 0.18 for the PA (Figure 5.D-38).

The minimum value of flow proportion for the NAA was 0.1235 and 0.1282 for the PA while the maximum value was 0.237 and 0.246 for the PA (Figure 5.D-38).

In the month of April during dry water years, the median proportion of flow into Turner Cut was predicted to be 8% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.157 for the NAA and 0.17 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.15 and 0.162 for the PA while the 75th percentile value was 0.168 and 0.184 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1271 and 0.1346 for the PA while the maximum value was 0.216 and 0.231 for the PA (Figure 5.D-38).

In the month of May during dry water years, the median proportion of flow into Turner Cut was predicted to be 7% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.157 for the NAA and 0.168 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.15 and 0.161 for the PA while the 75th percentile value was 0.165 and 0.179 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1206 and 0.129 for the PA while the maximum value was 0.213 and 0.242 for the PA (Figure 5.D-38).

5.D.1.2.1.2.2.7.5 Critical Water Years

In the month of February during critical water years, the median proportion of flow into Turner Cut was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.158 for the NAA and 0.166 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.153 and 0.16 for the PA while the 75th percentile value was 0.165 and 0.174 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1196 and 0.1263 for the PA while the maximum value was 0.207 and 0.229 for the PA (Figure 5.D-38).

In the month of March during critical water years, the median proportion of flow into Turner Cut was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.152 for the NAA and 0.159 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.147 and 0.153 for the PA while the 75th percentile value was 0.158 and 0.166 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1241 and 0.1276 for the PA while the maximum value was 0.184 and 0.205 for the PA (Figure 5.D-38).

In the month of April during critical water years, the median proportion of flow into Turner Cut was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.15 for the NAA and 0.157 for the PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.146 and 0.151 for the PA while the 75th percentile value was 0.156 and 0.164 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1221 and 0.126 for the PA while the maximum value was 0.18 and 0.202 for the PA (Figure 5.D-38).

In the month of May during critical water years, the median proportion of flow into Turner Cut was predicted to be 5% lower for the NAA relative to the PA over the 82 water years (Figure 5.D-38). Median proportion of flow into Turner Cut was 0.151 for the NAA and 0.158 for the

PA (Figure 5.D-38). The 25th percentile value of flow proportion for the NAA was 0.146 and 0.153 for the PA while the 75th percentile value was 0.157 and 0.165 for the PA (Figure 5.D-38). The minimum value of flow proportion for the NAA was 0.1255 and 0.1324 for the PA while the maximum value was 0.18 and 0.2 for the PA (Figure 5.D-38).

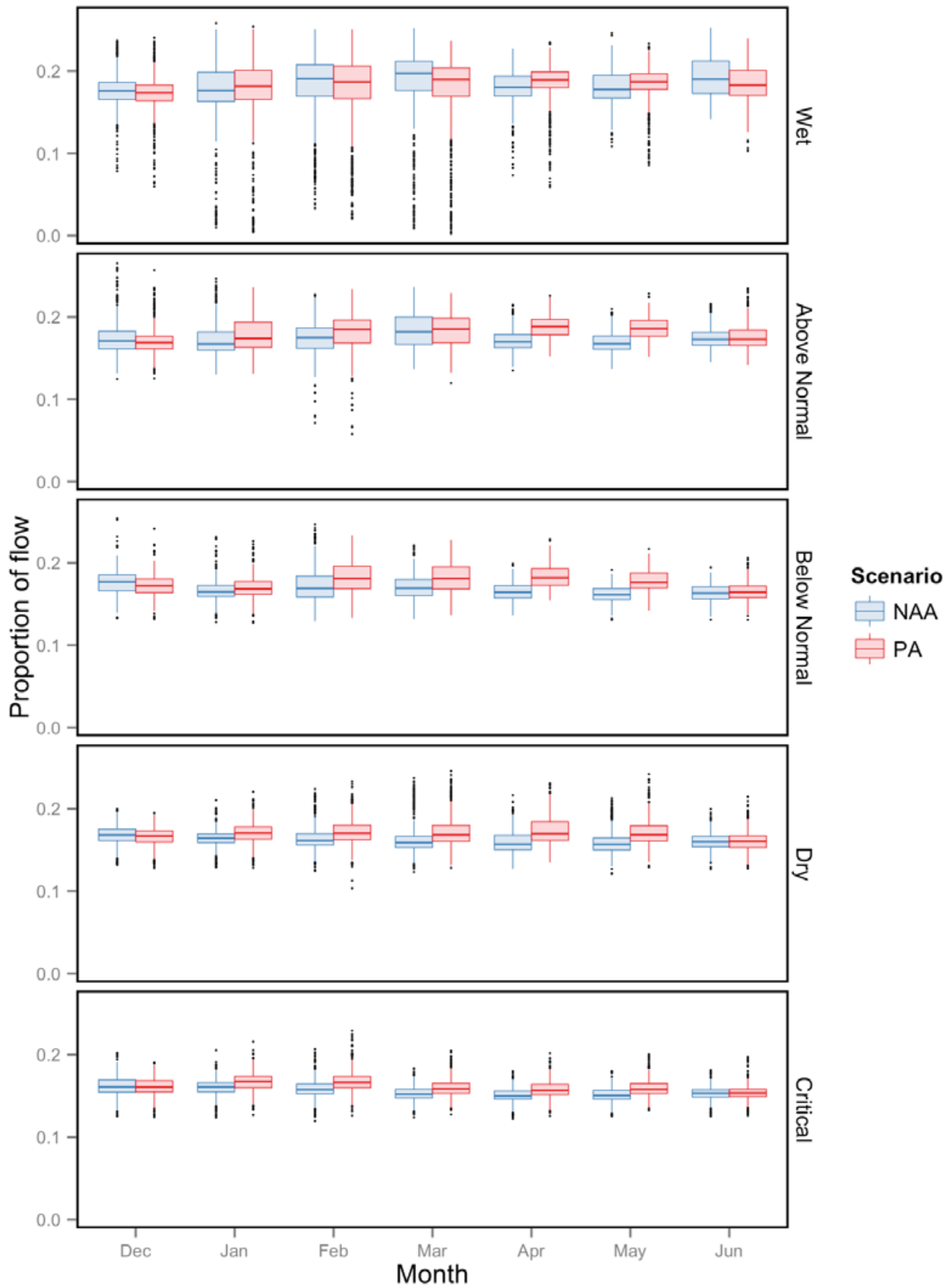


Figure 5.D-38. Proportion of flow entering the interior delta at Turner Cut during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.1.2.2.8 Mouth of Old River

5.D.1.2.1.2.2.8.1 Wet Water Years

In the month of February during wet water years, the median proportion of flow into the mouth of Old River was predicted to be 6% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-39). Median proportion of flow into the mouth of Old River was 0.182 for the NAA and 0.17 for the PA (Figure 5.D-39). The 25th percentile value of flow proportion for the NAA was 0.172 and 0.161 for the PA while the 75th percentile value was 0.196 and 0.18 for the PA (Figure 5.D-39). The minimum value of flow proportion for the NAA was 0.1251 and 0.0932 for the PA while the maximum value was 0.597 and 0.537 for the PA (Figure 5.D-39).

In the month of March during wet water years, the median proportion of flow into the mouth of Old River was predicted to be 7% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-39). Median proportion of flow into the mouth of Old River was 0.177 for the NAA and 0.164 for the PA (Figure 5.D-39). The 25th percentile value of flow proportion for the NAA was 0.168 and 0.157 for the PA while the 75th percentile value was 0.187 and 0.172 for the PA (Figure 5.D-39). The minimum value of flow proportion for the NAA was 0.1219 and 0.0455 for the PA while the maximum value was 0.359 and 0.315 for the PA (Figure 5.D-39).

5.D.1.2.1.2.2.8.2 Above Normal Water Years

In the month of March during above normal water years, the median proportion of flow into the mouth of Old River was predicted to be 5% higher for the NAA relative to the PA over the 82 water years (Figure 5.D-39). Median proportion of flow into the mouth of Old River was 0.173 for the NAA and 0.164 for the PA (Figure 5.D-39). The 25th percentile value of flow proportion for the NAA was 0.164 and 0.158 for the PA while the 75th percentile value was 0.182 and 0.171 for the PA (Figure 5.D-39). The minimum value of flow proportion for the NAA was 0.1414 and 0.1313 for the PA while the maximum value was 0.305 and 0.248 for the PA (Figure 5.D-39).

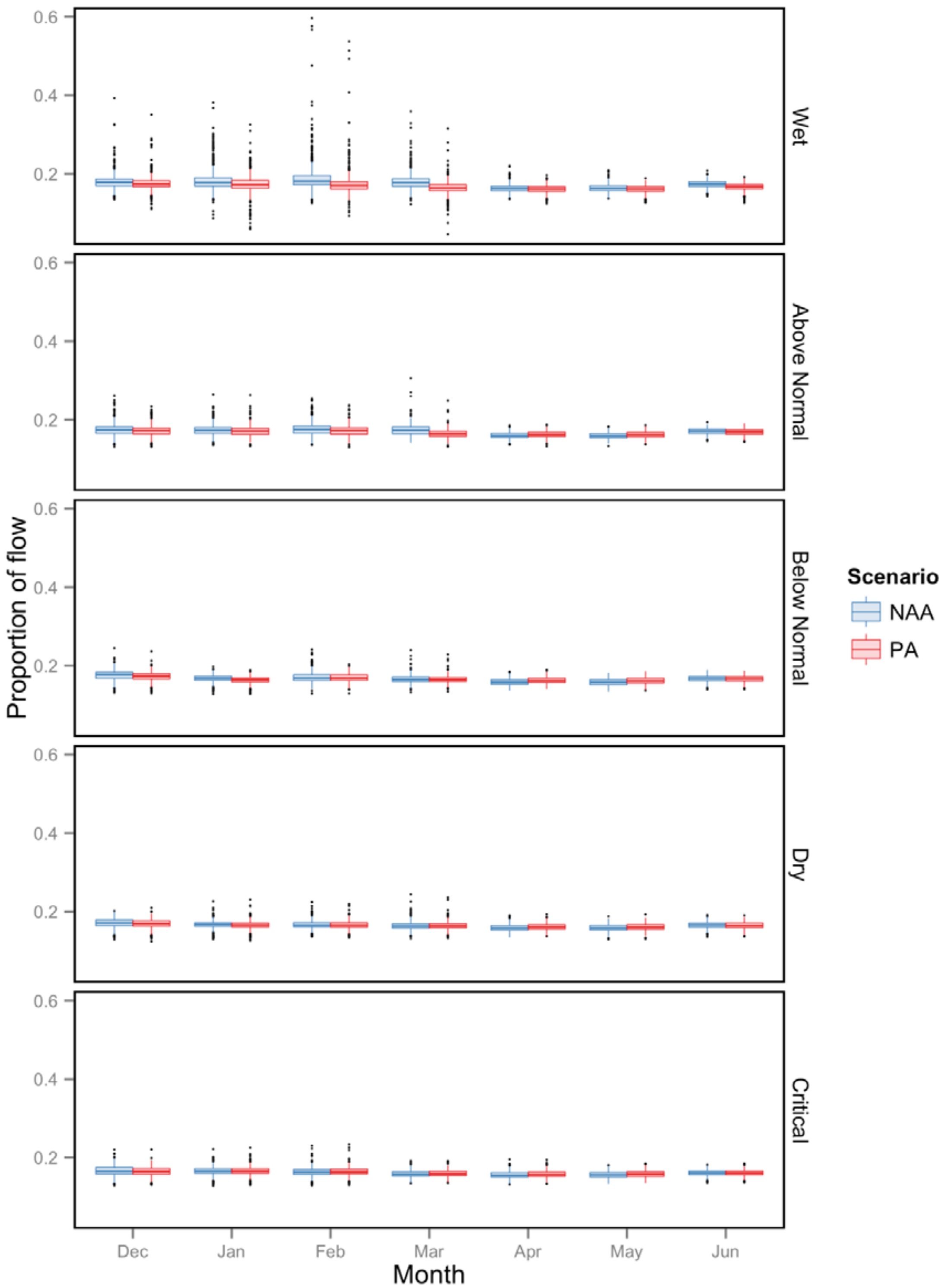


Figure 5.D-39. Proportion of flow entering the interior delta at the mouth of Old River during the 82-year CALSIM period. Comparisons between the NAA (NAA) and the PA (PA) were performed for the months of October through June. Plus symbol indicates median, box represents the interquartile range, and the whiskers represent the minimum and maximum values.

5.D.1.2.2 Delta Passage Model

This section discusses the details of the Delta Passage Model (DPM) and the methods for implementation in the effects analysis of the PA. Results are presented in Chapter 5, Section 5.4.1.3, *Assess Species Response to the Proposed Action*.

5.D.1.2.2.1 Introduction

The DPM simulates migration of Chinook salmon smolts entering the Delta from the Sacramento River, Mokelumne River, and San Joaquin River and estimates survival to Chipps Island. The DPM uses available time-series data and values taken from empirical studies or other sources to parameterize model relationships and inform uncertainty, thereby using the greatest amount of data available to dynamically simulate responses of smolt survival to changes in water management. Although the DPM is based primarily on studies of winter-run Chinook salmon smolt surrogates (late fall–run Chinook salmon), it is applied here for winter-run, spring-run, fall-run, and late fall–run Chinook salmon by adjusting emigration timing and assuming that all migrating Chinook salmon smolts will respond similarly to Delta conditions. The DPM results presented here reflect the current version of the model, which continues to be reviewed and refined, and for which a sensitivity analysis has been completed to examine various aspects of uncertainty related to the model's inputs and parameters (see description of methods and results in Section 5.D.1.2.2.5, *Sensitivity Analysis*).

Although studies have shown considerable variation in emigrant size, with Central Valley Chinook salmon migrating as fry, parr, or smolts (Brandes and McLain 2001; Williams 2001), the DPM relies predominantly on data from acoustic-tagging studies of large (>140 mm) smolts, and therefore should be applied very cautiously to pre-smolt migrants. Salmon juveniles less than 80 mm are more likely to exhibit rearing behavior in the Delta (Moyle 2002) and thus likely will be represented poorly by the DPM. It has been assumed that the downstream emigration of fry, when spawning grounds are well upstream, is probably a dispersal mechanism that helps distribute fry among suitable rearing habitats. However, even when rearing habitat does not appear to be a limiting factor, downstream movement of fry still may be observed, suggesting that fry emigration is a viable alternative life-history strategy (Healy 1980; Healey and Jordan 1982; Miller et al. 2010). Unfortunately, survival data are lacking for small (fry-sized) juvenile emigrants because of the difficulty of tagging such small individuals. Therefore, the DPM should be viewed as a smolt survival model only, with its survival relationships generally having been derived from larger smolts (>140 mm), with the fate of pre-smolt emigrants not incorporated into model results.

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

Survival and abundance estimates generated by the DPM are not intended to predict future outcomes. Instead, the DPM provides a simulation tool that compares the effects of different water management options on smolt migration survival, with accompanying estimates of uncertainty. The DPM was used to evaluate overall through-Delta survival and migration pathway use/survival for the NAA and PA scenarios. Note that the DPM is a tool to compare different scenarios and is not intended to predict actual through-Delta survival under current or future conditions. In keeping with other methods found in the effects analysis, it is possible that underlying relationships (e.g., flow-survival) that are used to inform the DPM will change in the future; there is an assumption of stationarity of these basic relationships to allow scenarios to be compared for the current analysis, recognizing that it may be necessary to re-examine the relationships as new information becomes available.

5.D.1.2.2.2 Model Overview

The DPM is based on a detailed accounting of migratory pathways and reach-specific mortality as Chinook salmon smolts travel through a simplified network of reaches and junctions (Figure 5.D-40). The biological functionality of the DPM is based on the foundation provided by Perry et al. (2010) as well as other acoustic tagging–based studies (San Joaquin River Group Authority 2008, 2010; Holbrook et al. 2009) and coded wire tag (CWT)–based studies (Newman and Brandes 2010; Newman 2008). Uncertainty is explicitly modeled in the DPM by incorporating environmental stochasticity and estimation error whenever available.

The major model functions in the DPM are as follows.

1. Delta Entry Timing, which models the temporal distribution of smolts entering the Delta for each race of Chinook salmon.
2. Fish Behavior at Junctions, which models fish movement as they approach river junctions.
3. Migration Speed, which models reach-specific smolt migration speed and travel time.
4. Route-Specific Survival, which models route-specific survival response to non-flow factors.
5. Flow-Dependent Survival, which models reach-specific survival response to flow.
6. Export-Dependent Survival, which models survival response to water export levels in the Interior Delta reach (see Table 5.D-35 for reach description).

Functional relationships are described in detail in Section 5.D.1.2.2.2.5, *Model Functions.*

5.D.1.2.2.2.1 Model Time Step

The DPM operates on a daily time step using simulated daily average flows and Delta exports as model inputs. The DPM does not attempt to represent sub-daily flows or diel salmon smolt behavior in response to the interaction of tides, flows, and specific channel features. The DPM is intended to represent the net outcome of migration and mortality occurring over days, not three-dimensional movements occurring over minutes or hours (e.g., Blake and Horn 2003). It is acknowledged that finer scale modeling with a shorter time step may match the biological processes governing fish movement better than a daily time step (e.g., because of diel activity patterns; Plumb et al. 2015) and that sub-daily differences in flow proportions into junctions make daily estimates somewhat coarse (Cavallo et al. 2015).

5.D.1.2.2.2.2 Spatial Framework

The DPM is composed of nine reaches and four junctions (Figure 5.D-40; Table 5.D-35) selected to represent primary salmonid migration corridors where high-quality data were available for fish and hydrodynamics. For simplification, Sutter Slough and Steamboat Slough are combined as the reach SS; and Georgiana Slough, the Delta Cross Channel (DCC), and the forks of the Mokelumne River to which the DCC leads are combined as Geo/DCC. The Geo/DCC reach can be entered by Mokelumne River fall-run Chinook salmon at the head of the South and North Forks of the Mokelumne River or by Sacramento runs through the combined junction of Georgiana Slough and DCC (Junction C). The Interior Delta reach can be entered from three different pathways: Geo/DCC, San Joaquin River via Old River Junction (Junction D), and Old River via Junction D. The entire Interior Delta region is treated as a single model reach[3]. The four distributary junctions (channel splits) depicted in the DPM are (A) Sacramento River at Fremont Weir (head of Yolo Bypass), (B) Sacramento River at head of Sutter and Steamboat Sloughs, (C) Sacramento River at the combined junction with Georgiana Slough and DCC, and (D) San Joaquin River at the head of Old River (Figure 5.D-40, Table 5.D-35).

[3] It is acknowledged that reach-specific survival data for the various channels within the Interior Delta are becoming increasingly available (Buchanan et al. 2013; Delaney et al. 2014), which could allow model refinement in the future to account for reach-specific differences. At present, such effects are implicitly represented by the flow-survival relationships described in Section 5.D.1.2.2.2.5.5.

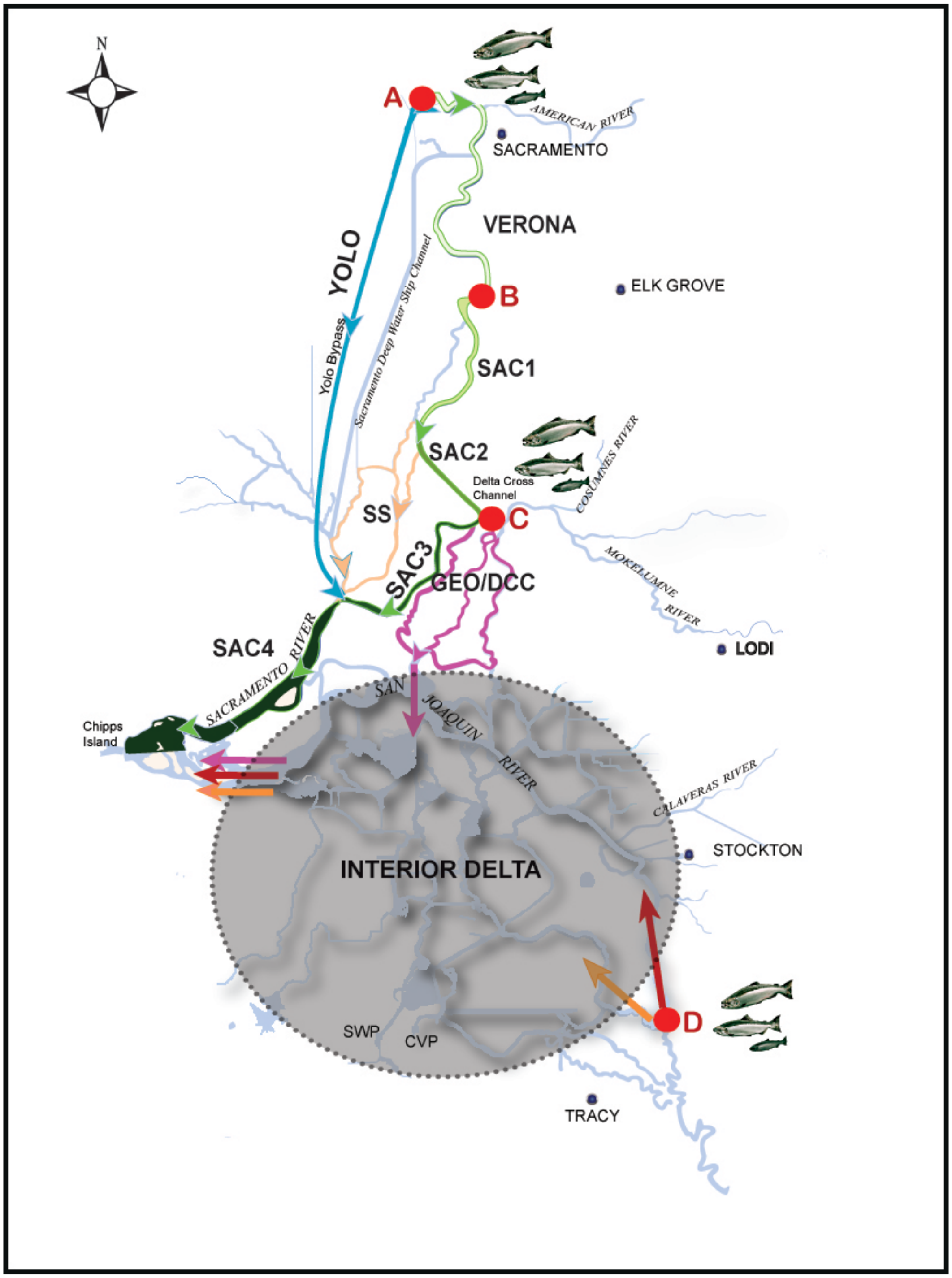
Table 5.D-35. Description of Modeled Reaches and Junctions in the Delta Passage Model

Reach/ Junction	Description	Reach Length (km)
Sac1	Sacramento River from Freeport to junction with Sutter/Steamboat Sloughs	19.33
Sac2	Sacramento River from Sutter/Steamboat Sloughs junction to junction with Delta Cross Channel/Georgiana Slough	10.78
Sac3	Sacramento River from Delta Cross Channel junction to Rio Vista, California	22.37
Sac4	Sacramento River from Rio Vista, California to Chipps Island	23.98
Yolo	Yolo Bypass from entrance at Fremont Weir to Rio Vista, California	NA[a]
Verona	Fremont Weir to Freeport	57
SS	Combined reach of Sutter Slough and Steamboat Slough ending at Rio Vista, California	26.72
Geo/DCC	Combined reach of Georgiana Slough, Delta Cross Channel, and South and North Forks of the Mokelumne River ending at confluence with the San Joaquin River in the Interior Delta	25.59
Interior Delta	Begins at end of reach Geo/DCC, San Joaquin River via Junction D, or Old River via Junction D, and ends at Chipps Island	NA[b]
A	Junction of the Yolo Bypass[c] and the Sacramento River	NA
B	Combined junction of Sutter Slough and Steamboat Slough with the Sacramento River	NA
C	Combined junction of the Delta Cross Channel and Georgiana Slough with the Sacramento River	NA
D	Junction of the Old River with the San Joaquin River	NA

[a] Reach length for Yolo Bypass is undefined because reach length currently is not used to calculate Yolo Bypass speed and ultimate travel time.

[b] Reach length for the Interior Delta is undefined because salmon can take multiple pathways. Also, timing through the Interior Delta does not affect Delta survival because there are no Delta reaches located downstream of the Interior Delta.

[c] Flow into the Yolo Bypass is primarily via the Fremont Weir but flow via Sacramento Weir is also included.



Bold headings label modeled reaches, and red circles indicate model junctions. Salmonid icons indicate locations where smolts enter the Delta in the DPM. Smolts enter the Interior Delta from the Geo/DCC reach or from Junction D via Old River or from the San Joaquin River. Because of the lack of data informing specific routes through the Interior Delta, and tributary-specific survival, the entire Interior Delta region is treated as a single model reach but survival varies within the Interior Delta depending upon whether fish enter from the Sacramento River, Mokelumne River, the San Joaquin River, or Old River.

Figure 5.D-40. Map of the Sacramento–San Joaquin River Delta Showing the Modeled Reaches and Junctions of the Delta Applied in the Delta Passage Model

5.D.1.2.2.2.3 Flow Input Data

Water movement through the Delta as input to the DPM is derived from daily (tidally averaged) flow output produced by the hydrology module of the Delta Simulation Model II (DSM2-HYDRO; <http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/>) or from CALSIM-II. Although DSM2 does provide daily data for south Delta exports, these data exhibit little intramonth variation and reflect the origin of the calculations, i.e., the hydrologic simulation tool CALSIM II. The nodes in the DSM2-HYDRO and CALSIM II models that were used to provide flow for specific reaches in the DPM are shown in Table 5.D-36. Technical details for DSM2-HYDRO and CALSIM II models are described in Appendix 5.A, *CALSIM Methods and Results*, and Appendix 5.B, *DSM Methods and Results.* DSM2 flow data output for the NAA and PA scenarios was used to inform the daily conditions experienced by migrating salmonids in the model.

Table 5.D-36. Delta Passage Model Reaches and Associated Output Locations from DSM2-HYDRO and CALSIM II Models

DPM Reach or Model Component	DSM2 Output Locations	CALSIM Node
Sac1	rsac155	
Sac2	rsac128	
Sac3	rsac123	
Sac4	rsac101	
Yolo		d160[a]+d166a[a]
Verona		C160[a]
SS	slsbt011	
Geo/DCC	dcc+georg_sl	
South Delta Export Flow	Clifton Court Forebay + Delta Mendota Canal	
Interior Delta via San Joaquin River	rsan058	
San Joaquin River flow at Head of Old River	rsan112	
Interior Delta via Old River	rold074	
Sacramento River flow at Fremont Weir (Notch[b] spills)		C129[a]

[a] Disaggregated into daily data based on historical patterns.
[b] "Notch" refers to the proposed notching of the Fremont Weir as part of Yolo Bypass enhancements, which were assumed to occur under NAA and PA.

In order to capture the effect of changed flows within the Sac1 reach being altered by the proposed NDD before the start of the Sac2 reach and the junction with reach SS, a modification was applied to the flows in reach Sac1. The modification reflected the location of the proposed NDD (intake 2 = RM 41, intake 3 = RM 39.5, and intake 5 = RM 37). The weighted average distance of the three intakes from the start of Sac1 (i.e., RM 47) is 56% of the length downstream from the start of Sac1. Flows in Sac1 were then modified as follows:

Modified Sac1 flows = 0.56 × flows into Sac1 + 0.44 × flows at bottom of Sac1

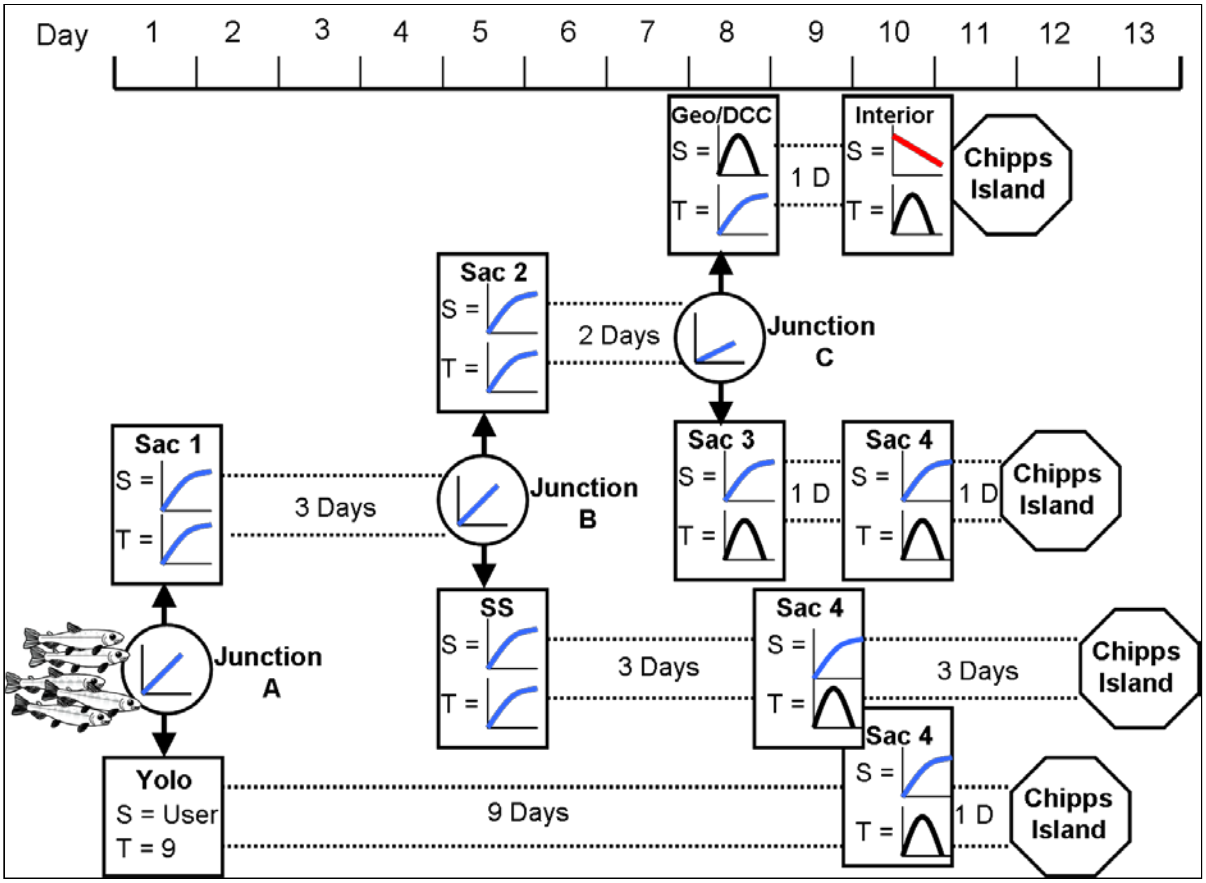
where flows into Sac1 are represented by DSM2 outputs from RSAC155 (Freeport) and flows at bottom of Sac1 are represented by DSM2 outputs from 418_mid (Sacramento River upstream of Sutter/Steamboat Sloughs and downstream of the north Delta intakes).

An illustrative hypothetical example of the computations for flows into Sac1 is for flows into Sac1 of 10,000 cfs, of which 2,000 cfs is diverted by the three north Delta intakes and therefore 8,000 cfs remains at the bottom of Sac1:

Modified Sac1 flows = 0.56 × 10,000 cfs + 0.44 × 8,000 cfs = 9,120 cfs.

5.D.1.2.2.2.4 Illustrative Example

To help illustrate the series of operations performed by the DPM, Figure 5.D-41 depicts the migration of a single daily cohort of smolts entering from the Sacramento River and migrating through the DPM. It is important to remember that cohorts of differing numbers of smolts are entering the Delta each day during the migration period of each salmon run. As fish encounter junctions in the Delta, they are routed down one of two paths dependent on the proportion of flow entering each downstream reach. In some cases (Junctions A and B) fish movement is directly proportional with flow movement, while at other junctions (Junction C) fish movement, although linear, is not directly proportional with flow movement. As fish enter Delta reaches, their reach survival and migration speed (and therefore migration time) are calculated on the day they enter the reach. All subsequent days that the fish are migrating through a given reach, they are not exposed to mortality, nor is their migration speed adjusted. For reaches where data were available to inform a relationship with flow, reach survival and migration speed are calculated as a function of the flow during the initial day of reach entry. Likewise, where data were available to inform a relationship with Delta exports (Interior Delta), reach survival is calculated as a function of exports as fish enter the reach. Because portions of a single cohort of fish migrate through different routes in the Delta, portions of the cohort will experience differing overall survival rates, differing migration rates, and differing arrival times at Chipps Island. See Section 5.D.1.2.2.2.5, *Model Functions*, for detailed descriptions of DPM functional relationships.



Day of the model run is indicated at the top of the diagram. Circles indicate Delta junctions, where the proportion of fish moving to each downstream reach is calculated, and rectangles indicate Delta reaches. The shape of the relationship for each reach-specific survival (S), reach-specific migration speed (T), and proportional fish movement at junctions is depicted. Relationships that are influenced by flow (x variable) are blue, relationships influenced by exports are red, and relationships that are calculated from a probability distribution (and not influenced by flow or exports) are black. Dotted lines indicate migration time through the previous reach, and the Chipps Island icons indicate when fish from each route exited the Delta. Note that this diagram does not incorporate the recently added Verona reach, which occurs between Junction A and reach Sac1. Note also that travel time for reach Yolo is sampled from a uniform distribution of 4-28 days (i.e., the fixed 9-day travel migration speed depicted here was subsequently changed).

Figure 5.D-41. Conceptual Diagram Depicting the "Migration" of a Single Daily Cohort of Smolts Entering from the Sacramento River and Migrating through the Delta Passage Model

5.D.1.2.2.2.5 Model Functions

5.D.1.2.2.2.5.1 Delta Entry Timing

Recent sampling data on Delta entry timing of emigrating juvenile smolts for six Central Valley Chinook salmon runs were used to inform the daily proportion of juveniles entering the Delta for each run (Table 5.D-37). Because the DPM models the survival of smolt-sized juvenile salmon, pre-smolts were removed from catch data before creating entry timing distributions. The lower 95th percentile of the range of salmon fork lengths visually identified as smolts by the USFWS in Sacramento trawls was used to determine the lower length cutoff for smolts. A lower fork length cutoff of 70 mm for smolts was applied, and all catch data of fish smaller than 70 mm were eliminated. To isolate wild production, all fish identified as having an adipose-fin clip (hatchery production) were eliminated, recognizing that most of the fall-run hatchery fish released upstream of Sacramento are not marked. Daily catch data for each brood year were divided by total annual catch to determine the daily proportion of smolts entering the Delta for each brood year. Sampling was not conducted daily at most stations and catch was not expanded for fish caught but not measured. Finally, the daily proportions for all brood years were plotted for each race, and a normal distribution was visually approximated to obtain the daily proportion of smolts entering the DPM for each run (Figure 5.D-42). Because a bi-modal distribution appeared evident for winter-run entry timing, a generic probability density function was fit to the winter-run daily proportion data using the package "sm" in R software (R Core Team 2012). The R fitting procedure estimated the best-fit probability distribution of the daily proportion of fish entering the DPM for winter-run. A sensitivity analysis of this assumption was undertaken and showed that patterns in results would be expected to be similar for a range of entry distribution assumptions.

Table 5.D-37. Sampling Gear Used to Create Juvenile Delta Entry Timing Distributions for Each Central Valley Run of Chinook Salmon

Chinook Salmon Run	Gear	Agency	Brood Years
Sacramento River Winter Run	Trawls at Sacramento	USFWS	1995–2009
Sacramento River Spring Run	Trawls at Sacramento	USFWS	1995–2005
Sacramento River Fall Run	Trawls at Sacramento	USFWS	1995–2005
Sacramento River Late Fall Run	Trawls at Sacramento	USFWS	1995–2005
Mokelumne River Fall Run	Rotary Screw Trap at Woodbridge	EBMUD	2001–2007
San Joaquin River Fall Run	Kodiak Trawl at Mossdale	CDFW	1996–2009

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

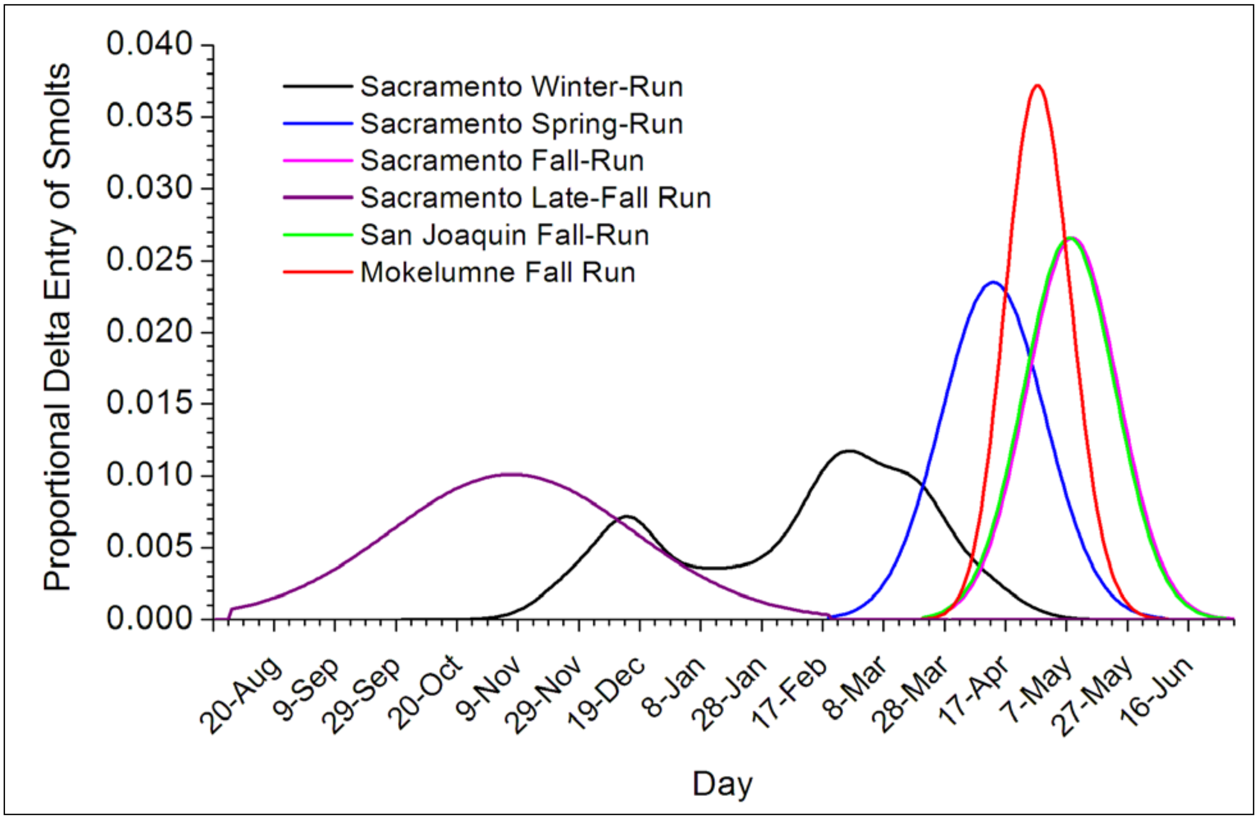


Figure 5.D-42. Delta Entry Distributions for Chinook Salmon Smolts Applied in the Delta Passage Model for Sacramento River Winter-Run, Sacramento River Spring-Run, Sacramento River Fall-Run, Sacramento River Late Fall–Run, San Joaquin River Fall-Run, and Mokelumne River Fall-Run Chinook Salmon

5.D.1.2.2.2.5.2 Migration Speed

The DPM assumes a net daily movement of smolts in the downstream direction. The rate of smolt movement in the DPM affects the timing of arrival at Delta junctions and reaches, which can affect route selection and survival as flow conditions or water project operations change.

Smolt movement in all reaches except Yolo Bypass and the Interior Delta is a function of reach-specific length and migration speed as observed from acoustic-tagging results. Reach-specific length (kilometers [km]) (Table 5.D-35) is divided by reach migration speed (km/day) the day smolts enter the reach to calculate the number of days smolts will take to travel through the reach.

For north Delta reaches Verona, Sac1, Sac2, SS, and Geo/DCC, mean migration speed through the reach is predicted as a function of flow. Many studies have found a positive relationship between juvenile Chinook salmon migration rate and flow in the Columbia River Basin (Raymond 1968; Berggren and Filardo 1993; Schreck et al. 1994), with Berggren and Filardo (1993) finding a logarithmic relationship for Snake River yearling Chinook salmon. Ordinary least squares regression was used to test for a logarithmic relationship between reach-specific migration speed (km/day) and average daily reach-specific flow (cubic meters per second [m^3/sec]) for the first day smolts entered a particular reach for reaches where acoustic-tagging data was available (Sac1, Sac2, Sac3, Sac4, Geo/DCC, and SS):

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

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

Individual smolt reach-specific travel times were calculated from detection histories of releases of acoustically tagged smolts conducted in December and January for three consecutive winters (2006/2007, 2007/2008, and 2008/2009) (Perry 2010). Reach-specific migration speed (km/day) for each smolt was calculated by dividing reach length by travel days (Table 5.D-38). Flow data was queried from the DWR's California Data Exchange website (<http://cdec.water.ca.gov/>).

Table 5.D-38. Reach-Specific Migration Speed and Sample Size of Acoustically-Tagged Smolts Released during December and January for Three Consecutive Winters (2006/2007, 2007/2008, and 2008/2009)

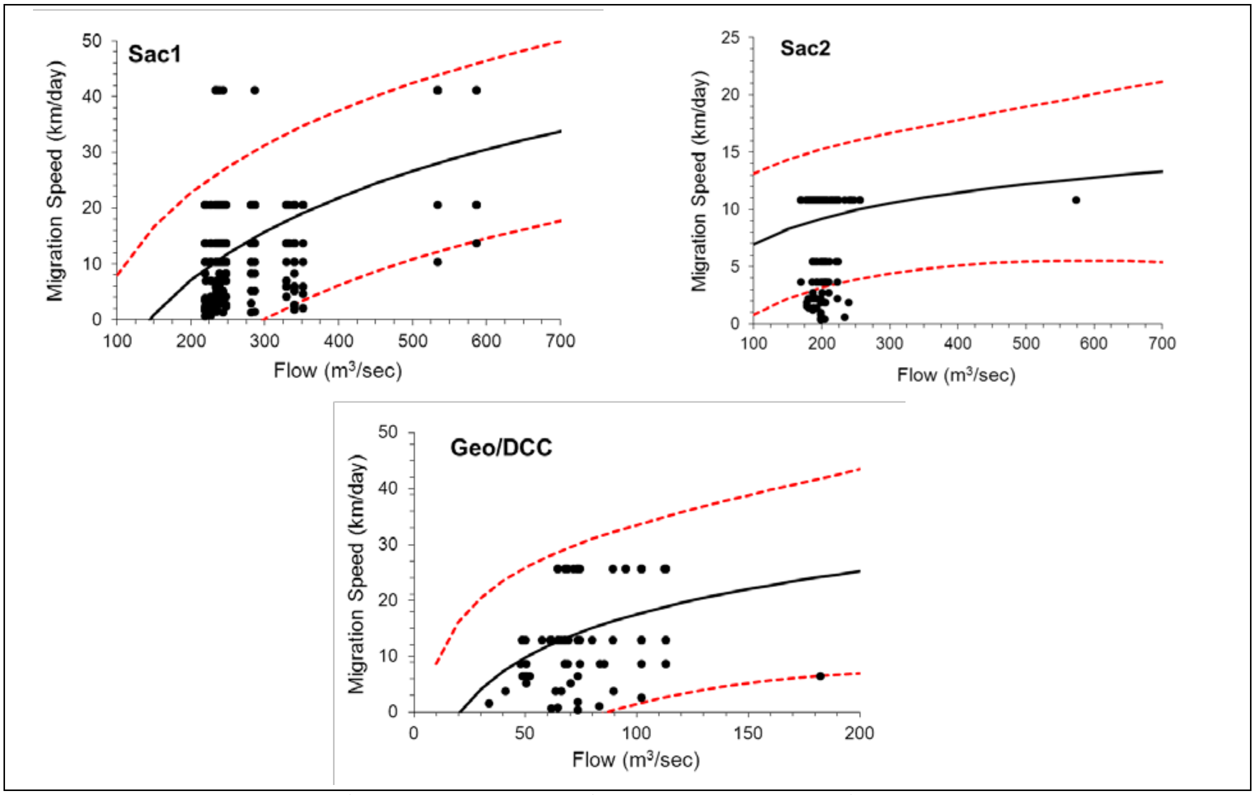
Reach	Gauging Station ID	Release Dates	Sample Size	Speed (km/day)			
				Avg	Min	Max	SD
Sac1	FPT	12/05/06–12/06/06, 1/17/07–1/18/07, 12/04/07–12/07/07, 1/15/08–1/18/08, 11/30/08–12/06/08, 1/13/09–1/19/09	452	13.32	0.54	41.04	9.29
Sac2	SDC	1/17/07–1/18/07, 1/15/08–1/18/08, 11/30/08–12/06/08, 1/13/09–1/19/09	294	9.29	0.34	10.78	3.09
Sac3	GES	12/05/06–12/06/06, 1/17/07–1/18/07, 12/04/07–12/07/07, 1/15/08–1/18/08, 11/30/08–12/06/08, 1/13/09–1/19/09	102	9.24	0.37	22.37	7.33
Sac4	GES[a]	12/05/06–12/06/06, 1/17/07–1/18/07, 12/04/07–12/07/07, 1/15/08–1/18/08, 11/30/08–12/06/08, 1/13/09–1/19/09	62	8.60	0.36	23.98	6.79
Geo/DCC	GSS	12/05/06–12/06/06, 1/17/07–1/18/07, 12/04/07–12/07/07, 1/15/08–1/18/08, 11/30/08–12/06/08, 1/13/09–1/19/09	86	14.20	0.34	25.59	8.66
SS	FPT-SDC[b]	12/05/06–12/06/06, 12/04/07–12/07/07, 1/15/08–1/18/08, 11/30/08–12/06/08, 1/13/09–1/19/09	30	9.41	0.56	26.72	7.42

[a] Sac3 flow is used for Sac4 because no flow gauging station is available for Sac4.
[b] SS flow is calculated by subtracting Sac2 flow (SDC) from Sac1 flow (FPT).

Migration speed was significantly related to flow for reaches Sac1 (df = 450, F = 164.36, P < 0.001), Sac2 (df = 292, F = 4.17, P = 0.042), and Geo/DCC (df = 84, F = 13.74, P <0.001). Migration speed increased as flow increased for all three reaches (Table 5.D-39, Figure 5.D-43). Therefore, for reaches Sac1, Sac2, and Geo/DCC, the regression coefficients shown in Table 5.D-39 are used to calculate the expected average migration rate given the input flow for the reach and the associated standard error of the regressions is used to inform a normal probability distribution that is sampled from the day smolts enter the reach to determine their migration speed throughout the reach. The minimum migration speed for each reach is set at the minimum reach-specific migration speed observed from the acoustic-tagging data (Table 5.D-39). The flow-migration rate relationship that was used for Sac1 also was applied for the Verona reach.

Table 5.D-39. Sample Size and Slope (β_0) and Intercept (β_1) Parameter Estimates with Associated Standard Error (in Parenthesis) for the Relationship between Migration Speed and Flow for Reaches Sac1, Sac2, and Geo/DCC

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



Circles are observed migration speeds of acoustically tagged smolts from acoustic-tagging studies from Perry (2010), solid lines are predicted mean reach survival curves, and dotted lines are 95% prediction intervals used to inform uncertainty.

Figure 5.D-43. Reach-Specific Migration Speed (km/day) as a Function of Flow (m^3/sec) Applied in Reaches Sac1, Sac2, and Geo/DCC

No significant relationship between migration speed and flow was found for reaches Sac3 (df = 100, F = 1.13, P =0.29), Sac4 (df = 60, F = 0.33, P = 0.57), and SS (df = 28, F = 0.86, P = 0.36). Therefore, for these reaches the observed mean migration speed and associated standard deviation (Table 5.D-38) is used to inform a normal probability distribution that is sampled from the day smolts enter the reach to determine their migration speed throughout the reach. As applied for reaches Sac1, Sac2, and Geo/DCC, the minimum migration speed for reaches Sac3, Sac4, and SS is set at the minimum reach-specific migration speed observed from the acoustic-tagging data (Table 5.D-38).

Yolo Bypass travel time data from Sommer et al. (2005) for acoustic-tagged, fry-sized (mean size = 57 mm fork length [FL]) Chinook salmon were used to inform travel time through the

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

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

5.D.1.2.2.2.5.3 Fish Behavior at Junctions (Channel Splits)

For Junction A (entry into the Yolo Bypass at Fremont Weir), the following relationships were used.

- For Fremont Weir spills greater than 6,000 cfs (i.e., flows greater than the upper limit of flows through the notch proposed for Yolo Bypass enhancements, and included under NAA and PA scenarios): Proportion of smolts entering Yolo Bypass = Fremont Weir spill[4] / (Fremont Weir spill + Sacramento River at Verona flows).

- For Fremont Weir spills up to 6,000 cfs (i.e., flows through the notch for Yolo Bypass enhancements, included under NAA and PA scenarios): Proportion of smolts entering Yolo Bypass = Fremont Weir spill / Sacramento River at Wilkins Slough flows.

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

For Junction B (Sacramento River-Sutter/Steamboat Sloughs), Perry et al. (2010) found that smolts generally entered downstream reaches in proportion to the flow being diverted. Therefore, smolts arriving at Junction B in the model were assumed to move proportionally with flow[5]. A proportional relationship between flow and fish movement for Junction D (San Joaquin River–Old River) also was applied[6]. Note that the operation of the Head of Old River gate proposed under the PA is accounted for in the DSM2 flow input data (i.e., with a closed gate, relatively more flow [and therefore smolts] remains in the San Joaquin River).

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[4] As noted in Table C.4-5, Yolo Bypass flow includes spill from both Fremont Weir and Sacramento Weir. The DPM simplifies the occasional entry of fish via Sacramento Weir by adding Sacramento Weir spill to Fremont Weir spill.

[5] A subsequent analysis relating the proportion of fish entering important Delta junctions to the proportion of flow entering these junctions found that, across all junctions combined, the proportion of fish entering the junction was somewhat less than the proportion of flow (Cavallo et al. 2015). Therefore a somewhat lower proportion of fish may enter Sutter and Steamboat Sloughs than the proportion of flow.

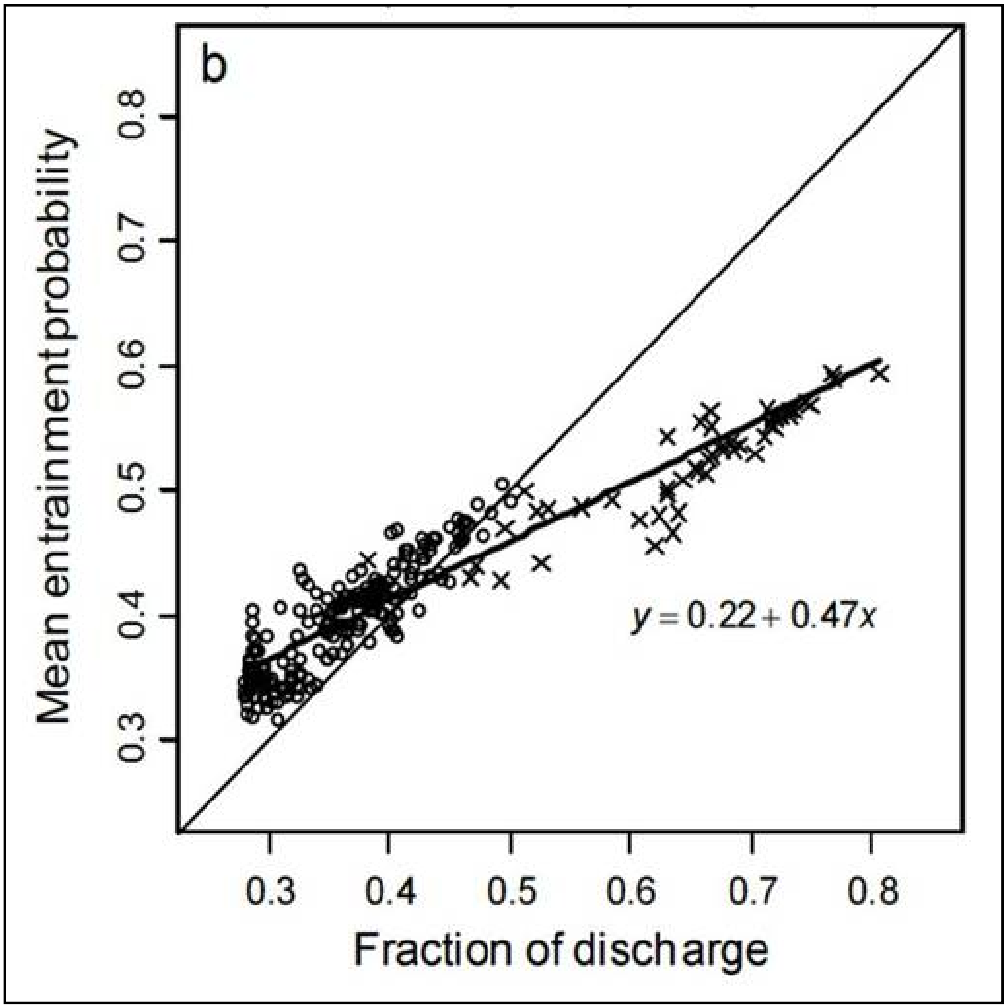
[6] As with Sutter/Steamboat Sloughs, the proportion of fish entering the junction may be somewhat less than the proportion of flow, based on the analysis by Cavallo et al. (2015).

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

$$y = 0.22 + 0.47x;$$

where y is the proportion of fish diverted into Geo/DCC and x is the proportion of flow diverted into Geo/DCC (Figure 5.D-44).

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



Note: Circles Depict DCC Gates Closed, Crosses Depict DCC Gates Open.

Figure 5.D-44. Figure from Perry (2010) Depicting the Mean Entrainment Probability (Proportion of Fish Being Diverted into Reach Geo/DCC) as a Function of Fraction of Discharge (Proportion of Flow Entering Reach Geo/DCC)

5.D.1.2.2.2.5.4 Route-Specific Survival

Survival through a given route (individual reach or several reaches combined) is calculated and applied the first day smolts enter the reach. For reaches where literature showed support for reach-level responses to environmental variables, survival is influenced by flow (Sac1, Sac2, Sac3 and Sac4 combined, SS and Sac 4 combined, Interior Delta via San Joaquin River, and Interior Delta via Old River) or south Delta water exports (Interior Delta via Geo/DCC). For these reaches, daily flow or exports occurring the day of reach entry are used to predict reach survival during the entire migration period through the reach (Table 5.D-40). For all other reaches (Geo/DCC and Yolo), reach survival is assumed to be unaffected by Delta conditions and is informed by means and standard deviations of survival from acoustic-tagging studies.

Table 5.D-40. Route-Specific Survival and Parameters Defining Functional Relationships or Probability Distributions for Each Chinook Salmon Run and Methods Section Where Relationship is Described

Route	Chinook Salmon Run	Survival[a]	Methods Section Description
Verona	All Sacramento runs	0.931 (0.02)	This section
Sac1	All Sacramento runs	Function of flow	Flow-Dependent Survival
Sac2	All Sacramento runs	Function of flow	Flow-Dependent Survival
Sac3 and Sac4 combined	All Sacramento runs	Function of flow	Flow-Dependent Survival
Yolo	All Sacramento runs	Various	This section
Sac4 via Yolo[b]	All Sacramento runs	0.698 (0.153)	This section
SS and Sac4 combined	All Sacramento runs	Function of flow	Flow-Dependent Survival
Geo/DCC	Mokelumne fall-run	0.407 (0.209)	This section
	All Sacramento runs	0.65 (0.126)	This section
Interior Delta	All Sacramento runs	Function of exports	Export-Dependent Survival
	San Joaquin fall-run via Old River	Function of flow	Flow-Dependent Survival
	San Joaquin fall-run via San Joaquin River	Function of flow	Flow-Dependent Survival

[a] For routes where survival is uninfluenced by Delta conditions, mean survival and associated standard deviation (in parentheses) observed during acoustic-tagging studies (Michel 2010; Perry 2010) are used to define a normal probability distribution that is sampled from the day smolts enter a reach to calculate reach survival.

[b] Although flow influences survival of fish migrating through the combined routes of SS–Sac4 and Sac3–Sac4, flow does not influence Sac4 survival for fish arriving from Yolo.

For reaches Geo/DCC, Yolo, and Sac4 via Yolo, no empirical data were available to support a relationship between survival and Delta flow conditions (channel flow, exports). Therefore, for these reaches mean reach survival is used along with reach-specific standard deviation to define a normal probability distribution that is sampled from when smolts enter the reach to determine reach survival (Table 5.D-40).

Mean reach survival and associated standard deviation for Geo/DCC are informed by survival data from smolt acoustic-tagging studies from Perry (2010). Separate acoustic-study survival data are applied for smolts migrating through Geo/DCC via the Sacramento River (Sacramento River runs) or Mokelumne River (Mokelumne River fall-run) (Table 5.D-41). Smolts migrating down the Sacramento River during the acoustic-tagging studies could enter the DCC or Georgiana Slough when the DCC was open (December releases), therefore, group survivals for both routes are used to inform the mean survival and associated standard deviation for the Geo/DCC reach for Sacramento River runs. For Mokelumne River fall-run, only the DCC route group survivals are used to inform Geo/DCC survival because Mokelumne River fish are not exposed to Georgiana Slough.

Smolt survival data for the Yolo Bypass were obtained from the UC Davis Biotelemetry Laboratory (Myfanwy Johnston pers. comm.). These data included survival estimates for five reaches from release near the head of the bypass to the base of the bypass. The means (and standard errors) of these estimates defined normal probability distributions from which daily value for the DPM were drawn, and were as follows: reach 1 (release site): 1.00; reach 2 (release site to I-80): 0.96 (SE = 0.059); reach 3 (I-80 to screw trap): 0.96 (0.064); reach 4 (screw trap to base of Toe Drain): 0.94 (0.107); reach 5 (base of Toe Drain to base of Bypass): 0.88 (0.064). Fish leaving the Yolo reach in the model then entered Sac4 and were subject to survival at the rate shown in Table 5.D-40.

Mean survival and associated standard deviation for the Verona reach between Fremont Weir and Yolo Bypass were derived from the 2007–2009 acoustic-tag study reported by Michel (2010), who did not find a flow-survival relationship for that reach.

Table 5.D-41. Individual Release-Group Survival Estimates, Release Dates, Data Sources, and Associated Calculations Used to Inform Reach-Specific Mean Survivals and Standard Deviations Used in the Delta Passage Model for Reaches Where Survival Is Uninfluenced by Delta Conditions

DPM Reach	Survival	Release Dates	Survival Calculation	Mean	Standard Deviation
Geo/DCC via Mokelumne River	0.648	12/05/06	$S_{C1}*S_{C2}$	0.407	0.209
	0.286	12/04/07–12/06/07	S_{C1}		
	0.286	11/31/08–12/06/08	S_{C1}		
Geo/DCC via Sacramento River	0.648	12/05/06	S_{D1}	0.559	0.194
	0.600	12/04/07–12/06/07	$S_{D1,SAC}*S_{D2}$		
	0.762	1/15/08–1/17/08	$S_{D1,SAC}*S_{D2}$		
	0.774	11/31/08–12/06/08	$S_{D1,SAC}*S_{D2}$		
	0.467	1/13/08–1/19/09	$S_{D1,SAC}*S_{D2}$		
	0.648	12/05/06	$S_{C1}*S_{C2}$		
	0.286	12/04/07–12/06/07	S_{C1}		
	0.286	11/31/08–12/06/08	S_{C1}		
Sac4 via Yolo	0.714	12/5/2006	$S_{A6}*S_{A7}$	0.698	0.153
	0.858	1/17/2007	$S_{A6}*S_{A7}$		
	0.548	12/4/07-12/6/07	$S_{A7}*S_{A8}$		
	0.488	1/15/08-1/17/08	$S_{A7}*S_{A8}$		
	0.731	11/31/08-12/06/08	$S_{A7}*S_{A8}$		
	0.851	1/13/09-1/19/09	$S_{A7}*S_{A8}$		
Source: Perry 2010.					

5.D.1.2.2.2.5.5 Flow-Dependent Survival

For reaches Sac1, Sac2, Sac3 and Sac4 combined, SS and Sac4 combined, Interior Delta via San Joaquin River, and Interior Delta via Old River, flow values on the day of route entry are used to predict route survival (Figure 5.D-45). Perry (2010) evaluated the relationship between survival among acoustically-tagged Sacramento River smolts and Sacramento River flow measured below Georgiana Slough (DPM reach Sac3) and found a significant relationship between survival and flow during the migration period for smolts that migrated through Sutter and Steamboat Sloughs to Chipps Island (Sutter and Steamboat route; SS and Sac4 combined) and smolts that migrated from the junction with Georgiana Slough to Chipps Island (Sacramento River route; Sac3 and Sac4 combined). Therefore, for route Sac3 and Sac4 combined and route SS and Sac4 combined, the logit survival function from Perry (2010) was used to predict mean reach survival (*S*) from reach flow (*flow*):

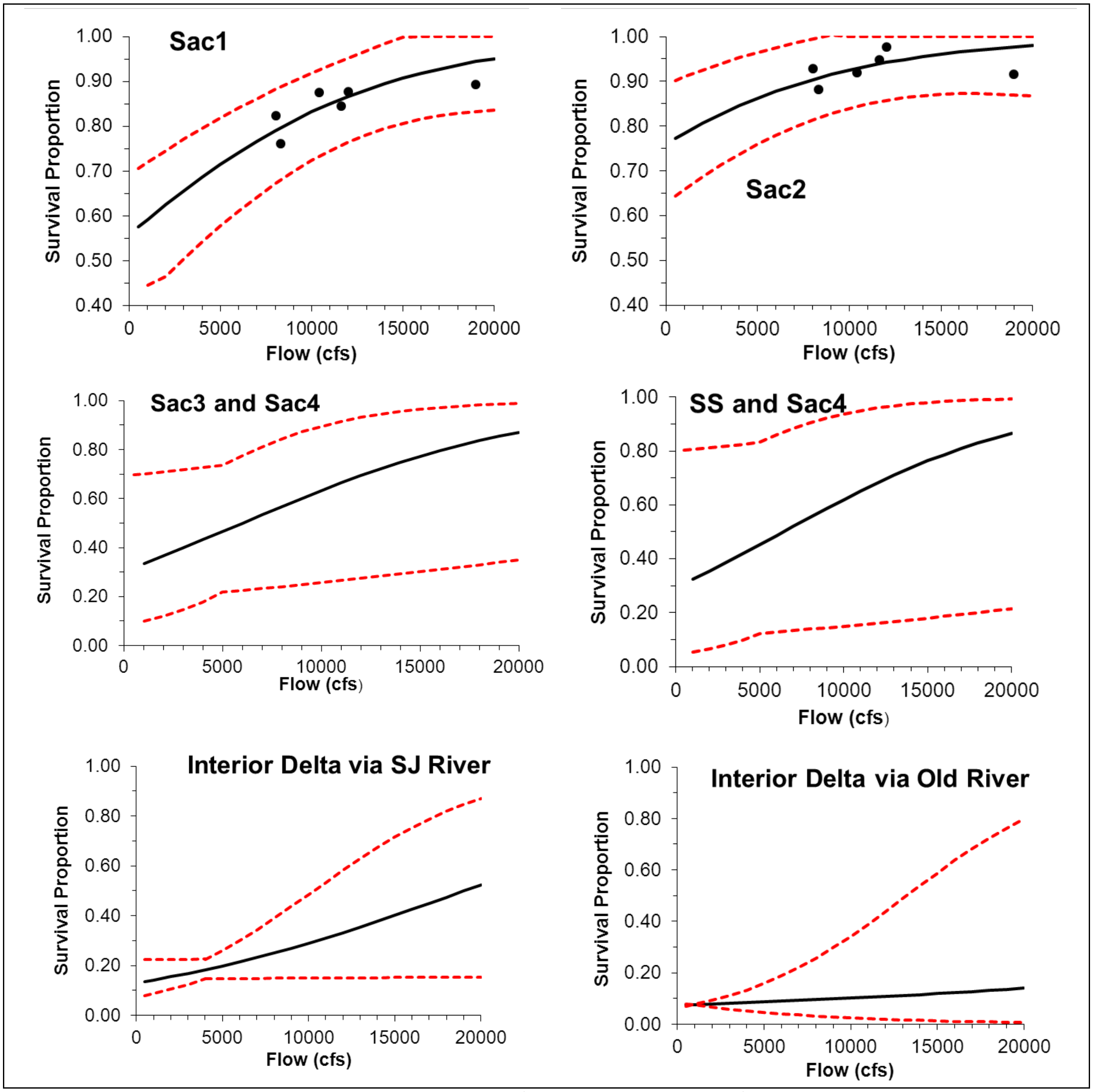
$$S = \frac{e^{(\beta_0 + \beta_1 flow)}}{1 + e^{(\beta_0 + \beta_1 flow)}}$$

where β_0 (SS and Sac4 = -0.175, Sac3 and Sac4 = -0.121) is the reach coefficient and β_1 (0.26) is the flow coefficient, and *flow* is average Sacramento River flow in reach Sac3 during the experiment standardized to a mean of 0 and standard deviation of 1.

Perry (2010) estimated the global flow coefficient for the Sutter Steamboat route and Sacramento River route as 0.52. For the Sac3 and Sac4 combined route and the SS and Sac4 combined route, mean survival and associated standard error predicted from each flow-survival relationship is used to inform a normal probability distribution that is sampled from the day smolts enter the route to determine their route survival.

With a flow-survival relationship appearing evident for group survival data of acoustically-tagged smolts in reaches Sac1 and Sac2, Perry's (2010) relationship was applied to Sac1 and Sac2 while adjusting for the mean reach-specific survivals for Sac1 and Sac2 observed during the acoustic-tagging studies[7] (Figure 5.D-45; Table 5.D-42). The flow coefficient was held constant at 0.52 and the residual sum of squares of the logit model was minimized about the observed Sac1 and Sac2 group survivals, respectively, while varying the reach coefficient. The resulting reach coefficients for Sac1 and Sac2 were 1.27 and 2.16, respectively. Mean survival and associated standard error predicted from the flow-survival relationship is used to inform a normal probability distribution that is sampled from the day smolts enter the reach to determining Sac1 and Sac2 reach survival.

[7] Perry (2010) did not attempt to correlate survival to flow in these reaches because survival was generally high.



For Sac1, Sac2, Sac3, and Sac4, circles are observed group survivals from acoustic-tagging studies from Perry (2010). Raw data are not available from Newman (2010) for Interior Delta via San Joaquin River and Interior Delta via Old River from Newman (2010). Solid lines are predicted mean route survival curves, and dotted lines are 95% confidence bands used to inform uncertainty.

Figure 5.D-45. Route Survival as a Function of Flow Applied in Reaches Sac1, Sac2, Sac3 and Sac4 combined, SS and Sac4 combined, Interior Delta via the San Joaquin River, and Interior Delta via Old River

Table 5.D-42. Group Survival Estimates of Acoustically-Tagged Chinook Salmon Smolts from Perry (2010) and Associated Calculations Used to Inform Flow-Dependent Survival Relationships for Reaches Sac1 and Sac2

DPM Reach	Survival	Release Dates	Source	Survival Calculation
Sac1	0.844	12/5/06	Perry 2010	S_{A1} *S_{A2}
Sac1	0.876	1/17/07	Perry 2010	S_{A1} *S_{A2}
Sac1	0.874	12/4/07-12/6/07	Perry 2010	S_{A1} *S_{A2}
Sac1	0.892	1/15/08-1/17/08	Perry 2010	S_{A1} *S_{A2}
Sac1	0.822	11/31/08-12/06/08	Perry 2010	S_{A1} *S_{A2}
Sac1	0.760	1/13/09-1/19/09	Perry 2010	S_{A1} *S_{A2}
Sac2	0.947	12/5/06	Perry 2010	S_{A3}
Sac2	0.976	1/17/07	Perry 2010	S_{A3}
Sac2	0.919	12/4/07-12/6/07	Perry 2010	S_{A3}
Sac2	0.915	1/15/08-1/17/08	Perry 2010	S_{A3}
Sac2	0.928	11/31/08-12/06/08	Perry 2010	S_{A3}
Sac2	0.881	1/13/09-1/19/09	Perry 2010	S_{A3}

For smolts originating in the San Joaquin River that migrate through the Interior Delta via San Joaquin River or Old River, survival is modeled as a function of flow and exports as modeled by Newman (2010).

$$S_{SJ,OR} = \frac{e^{(\beta_0 + \beta_1 flow + \beta_2 \exp orts)}}{1 + e^{(\beta_0 + \beta_1 flow + \beta_2 \exp orts)}}$$

Where $S_{SJ,\ OR}$ is survival through the Interior Delta via the San Joaquin River or Old River, *flow* is average San Joaquin River flow downstream of the head of Old River or flow in Old River during the coded-wire tagging study standardized to a mean of 0 and standard deviation of 1, and *exports* is the combined export flow from the state and federal facilities in the south Delta during the study.

Exports are standardized as described for flow. Uncertainty in these parameters is accounted for by using model-averaged estimates for the intercept, flow coefficient, and export coefficient (Table 5.D-43; Figure 5.D-45). The model-averaged estimates and their standard deviations are used to define a normal probability distribution that is resampled each day in the model. San Joaquin River flows downstream of the head of Old River that were modeled by Newman (2010) ranged from -49 cfs to 10,756 cfs, with a median of 3,180 cfs. Exports modeled by Newman (2010) ranged from 805 cfs to 10,295 cfs, with a median of 2,238 cfs.

Table 5.D-43. Model Averaged Parameter Estimates and Standard Deviations Used to Describe Survival through the Interior Delta via the San Joaquin River and Old River Routes

Parameter	San Joaquin Route	Old River Route
Intercept	-1.577 (0.275)	-2.297 (0.537)
Flow	0.376 (0.289)	0.166 (0.524)
Exports	0.291 (0.290)	0.279 (0.363)

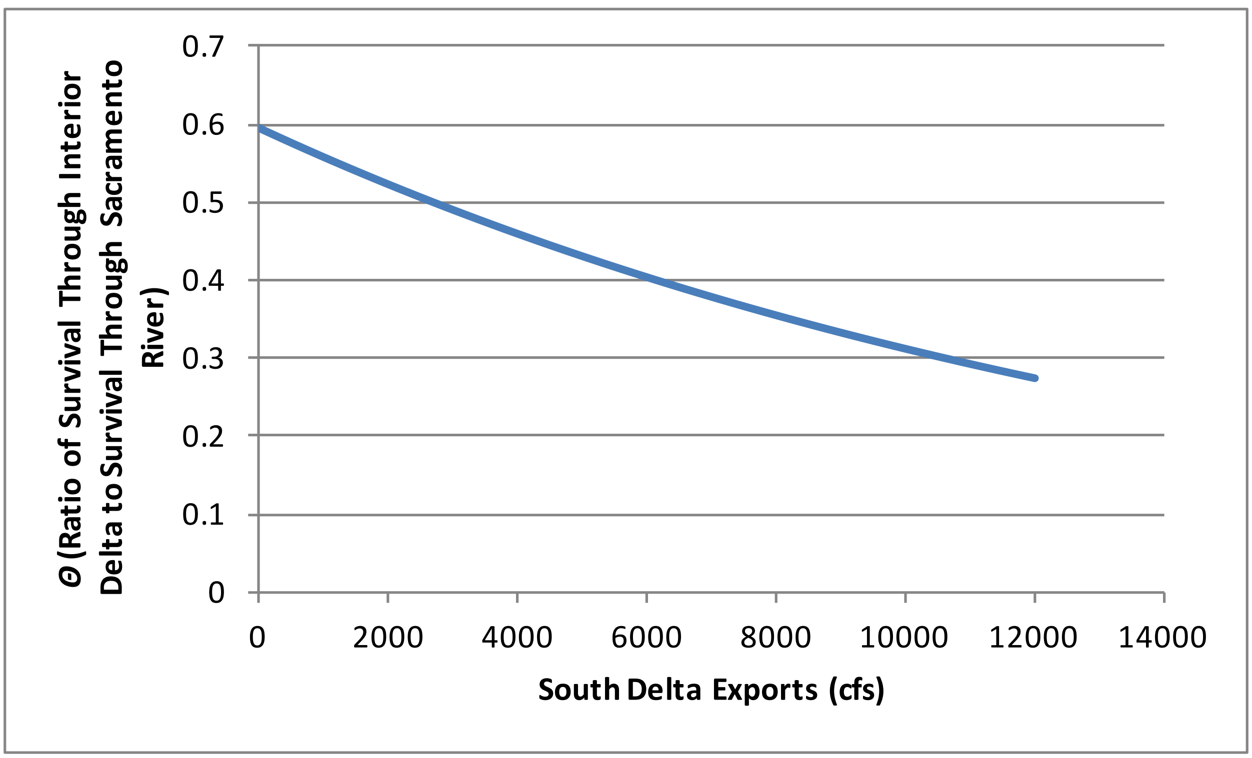
5.D.1.2.2.2.5.6 Export-Dependent Survival

As migratory juvenile salmon enter the Interior Delta from Geo/DCC for Sacramento races or Mokelumne River fall-run Chinook salmon, they transition to an area strongly influenced by tides and where south Delta water exports may influence survival. The export–survival relationship described by Newman and Brandes (2010) was applied as follows:

$$\theta = 0.5948 * e^{(-0.000065 * Total\_Exports)};$$

where θ is the ratio of survival between coded wire tagged smolts released into Georgiana Slough and smolts released into the Sacramento River and Total_Exports is the flow of water (cfs) pumped from the Delta from the State and Federal facilities.

θ is a ratio and ranges from just under 0.6 at zero south Delta exports to ~0.27 at 12,000-cfs south Delta exports (Figure 5.D-46).



Source: Newman and Brandes 2010

Figure 5.D-46. Relationship between θ (Ratio of Survival through the Interior Delta to Survival through Sacramento River) and South Delta Export Flows

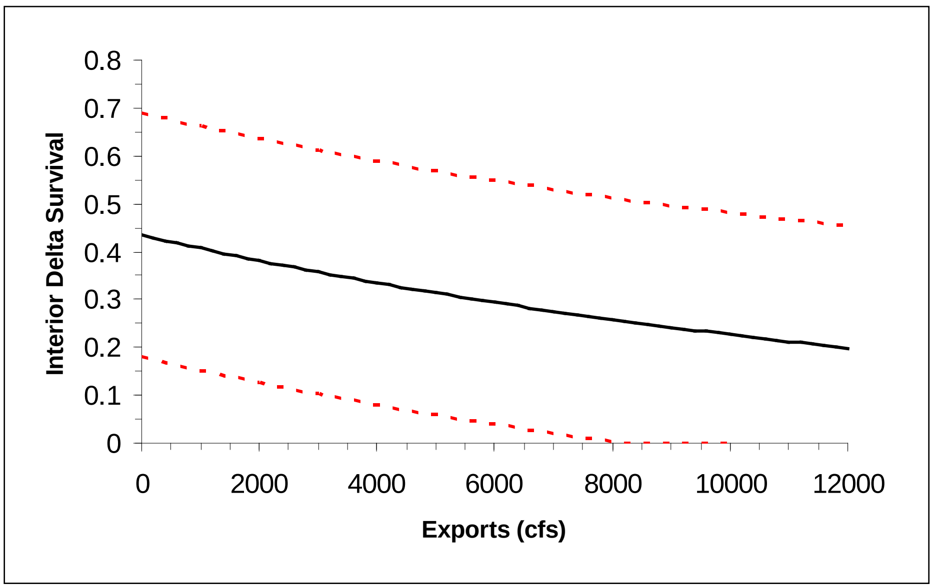
θ was converted from a ratio into a value of survival through the Interior Delta using the equation:

$$S_{ID} = \frac{\theta}{S_{Geo/DCC}} * (S_{Sac3} * S_{Sac4});$$

where S_{ID} is survival through the Interior Delta, θ is the ratio of survival between Georgiana Slough and Sacramento River smolt releases, $S_{Geo/DCC}$ is the survival of smolts in the Georgiana Slough/Delta Cross Channel reach, $S_{Sac3} * S_{Sac4}$ is the combined survival in reaches Sac 3 and Sac 4 (Figure 5.D-47)[8].

Uncertainty is represented in this relationship by using the estimated value of θ and the standard error of the equation to define a normal distribution bounded by the 95% prediction interval of the model that is then re-sampled each day to determine the value of θ.

The export-dependent survival relationship for San Joaquin-origin fish was described above in Section 5.D.1.2.2.2.5.5, *Flow-Dependent Survival*.



Survival values in reaches Sac3, Sac4, and Geo/DCC were held at mean values observed during acoustic-tag studies (Perry 2010) to depict export effect on Interior Delta survival in this plot. Dashed lines are 95% prediction bands used to inform uncertainty in the relationship.

Figure 5.D-47. Interior Delta Survival as a Function of Delta Exports (Newman and Brandes 2010) as Applied for Sacramento Races of Chinook Salmon Smolts Migrating through the Interior Delta via Reach Geo/DCC

[8] Note that the Mokelumne River fall-run does not occur in the Sacramento River but daily survival values in Sac3/Sac4 are calculated in order to inform interior Delta survival for this run according to the equation above; the Sac3/Sac4 daily survival values for this run are used solely for this purpose. Although daily survivals in Sac3/Sac4 are used to calculate Sacramento River survival for Sacramento River runs (winter-run, spring-run, Sacramento fall-run, and late fall–run), the combined Sac3/Sac4 survival used to calculate Sacramento River survival would be slightly different than that used to calculate interior Delta survival because of the travel time required for smolts to reach the interior Delta via Geo/DCC.

5.D.1.2.2.3 Postprocessing of Model Outputs for Effects Analysis

To facilitate the interpretation of overall DPM survival results in the effects analysis of the PA, summaries of the percentage of smolts taking different migration pathways and the percentage survival down those pathways was calculated for each scenario in each water year (1922–2003) using the average proportion of smolts surviving in each reach and the average proportion of fish entering the various junctions. For the Sacramento River-origin smolts, there are four migration pathways represented in the DPM:

- Chipps Island via Yolo Bypass (Yolo → Sac4)
    - Percentage of smolts taking Yolo pathway = Proportion entering Yolo Bypass at Fremont Weir * 100%
    - Percentage survival down Yolo pathway = (Survival in Yolo) * (survival in Sac4) * 100%
- Chipps Island via mainstem Sacramento River (Verona → Sac1 → Sac2 → Sac3 → Sac4)
    - Percentage of smolts taking mainstem Sacramento River pathway = (1 - proportion entering Yolo Bypass)*(1 - proportion entering Sutter or Steamboat Sloughs)*(1 - proportion entering Georgiana Slough or Delta Cross Channel)*100%
    - Percentage survival of smolts down mainstem Sacramento River pathway = (Survival in Verona)*(Survival in Sac1)*(Survival in Sac2)*(Survival in combined Sac3 & Sac4)*100%
- Chipps Island via Sutter & Steamboat Sloughs (Verona → Sac1 → SS → Sac4)
    - Percentage of smolts taking Sutter & Steamboat Sloughs pathway = (1 - proportion entering Yolo Bypass)*(Proportion entering Sutter or Steamboat Sloughs)*100%
    - Percentage survival of smolts down Sutter & Steamboat Sloughs pathway = (Survival in Verona)*(Survival in Sac1)*(Survival in combined SS and Sac4)* 100%
- Chipps Island via Georgiana Slough & Delta Cross Channel pathway (Verona → Sac1 → Sac2 → Geo/DCC → Interior Delta)
    - Percentage of smolts taking Georgiana Slough & Delta Cross Channel pathway = (1 - proportion entering Yolo Bypass)*(1 - proportion entering Sutter or Steamboat Sloughs)*(Proportion entering Georgiana Slough & Delta Cross Channel)*100%
    - Percentage survival of smolts down Georgiana Slough & Delta Cross Channel pathway = (Survival in Verona)*(Survival in Sac1)*(Survival in Sac2)*(Survival in Geo/DCC)*(Survival in Interior Delta)*100%

For the San Joaquin River-origin smolts the DPM has two migration pathways to Chipps Island through the Interior Delta, i.e., via the San Joaquin River and via Old River. The division of smolts into the two migration pathways was based on the junction split at the Head of Old River discussed above in *Fish Behavior at Junctions (Channel Splits)* and the calculation of survival of smolts down each pathway was based on outputs derived from the model coefficients in Table 5.D-43 of Section 5.D.1.2.2.2.5.5, *Flow-Dependent Survival*. Mokelumne River smolts have only one possible migration pathway to Chipps Island in the DPM (Geo/DCC → Interior Delta), so only survival in each of the two reaches along their pathway was reported along with overall survival.

5.D.1.2.2.4 Randomization to Illustrate Uncertainty

As described previously, various DPM model functions incorporate uncertainty in relationships between fish response and physical parameters, e.g., survival in response to river flow; re-sampling from these relationships on each modeled day allows this uncertainty to be captured in the model effects. In order to illustrate the uncertainty in modeled annual estimates of through-Delta survival, 75 iterations of the DPM were run, each with different randomizations of the model functions. It was found that 75 iterations were sufficient to allow the error in the estimates to stabilize so that no additional iterations were required. The 75 iterations gave 75 estimates of through-Delta survival for each year in the simulation period, from which 95% confidence intervals (the 2.5^{th} and 97.5^{th} percentiles of the 75 iterations) were calculated for each annual estimate. The confidence intervals provided perspective on the range of uncertainty in each annual estimate, and allowed comparison of the number of years that the confidence intervals overlapped for the NAA and PA scenarios.

5.D.1.2.2.5 Sensitivity Analysis

A working group consisting of consultants and agency staff coordinated with the model developers to develop a sensitivity analysis in order to examine the influence of DPM structural uncertainty and parameter uncertainty on model outputs, in addition to demonstrating how changes in model inputs (flows and exports) influence model outputs. The methods and results for this sensitivity analysis are described in this section. Note that the sensitivity analysis was run using existing biological conditions DSM2 data (1976–1991) from the public draft BDCP DPM analysis and used the non-Fremont Weir notch implementation for entry into Yolo Bypass (i.e., Proportion of smolts entering Yolo Bypass = Fremont Weir spill / (Fremont Weir spill + Sacramento River at Verona flows); the entry timing was that of winter-run Chinook salmon.

5.D.1.2.2.5.1 Methods

5.D.1.2.2.5.1.1 Structural uncertainty

Different forms of both winter run entry timing and Yolo survival in the Delta Passage Model were evaluated. To understand how variation in these functions affected model output, they were evaluated separately. Thus, each function had a “default” structure that was used when the other function was being evaluated. Table 5.D-44 lists the specific functions evaluated the candidate structures and the default value.

Table 5.D-44. DPM Sensitivity Analysis Structural Uncertainty: Model functions with alternative structures that were evaluated and default structures that were used.

Function	Alternate structures	Default structure
Winter-run Chinook salmon entry timing	1. One bimodal distribution	One bimodal distribution
	2. Two bimodal distributions. One for Wet and above normal years and one for critical dry and below normal years.	
	3. One bimodal distribution triggered by a 400 $m^3 * s^{-1}$ flow pulse.	
Yolo survival	1. Constant 80% survival	Constant 80% survival
	2. Ted Sommer's new coded wire tag data by low flow year (<2000 $ft^3 * s^{-1}$ in Yolo) and high flow year (>2000 $ft^3 * s^{-1}$ in Yolo)	
	3. Acoustic data from 2012	

For each candidate structure of a function, 1000 Monte Carlo simulations of the model were run for one year of model time. Flow and export inputs for this exercise were average daily flow and exports by water year type calculated from DSM2 data over 1976–1991. The water year type used for each Monte Carlo simulation was chosen based on their probability of occurrence over the last 100 years. The output evaluated was the percentage of fish surviving to Chipps Island. Output values were summarized by calculating the 5^{th} -95^{th} percentile of output values for each structure and the percent overlap in output values among the three different structures.

5.D.1.2.2.5.1.2 Parameter Uncertainty

To understand how uncertainty in key model parameters affected model output, Sobol sensitivity indices were calculated. Sobol' indices provide a way to account for the direct effect of variation in individual parameters and their first order interactions on model output. A single model was used to calculate Sobol' indices that used the Yolo survival and winter run entry timing functions identified in the structural uncertainty analysis (a single bi-modal winter run entry distribution and acoustic survival estimates for Yolo Bypass survival).

Parameters examined in this analysis included water year-type and survival and travel time in all reaches including Verona, Sac1, Sac2, Steamboat/Sutter, Sac3, Geo/DCC and Interior Delta. This represents all model parameters that are resampled each day in the model. If the final model includes a stochastic function for Yolo survival, that parameter will also be included in the analysis. No other parameters can be examined with Sobol' indices because there is no variation in their values.

One thousand Monte Carlo simulations will be run to obtain data for the Sobol' analysis. Flows and exports will be randomly selected by water year type averages as described above. Once the data are obtained, they will be exported to the R statistical program and analyzed with the package "sensitivity". Two Sobol' indices will be calculated; a main index that describes the effect of an individual parameter on model output independent of all other parameters and a total index that incorporates first order interaction with other model parameters. The model output for this analysis will be total Delta survival. If confidence intervals of Sobol' indices do not include zero, they will be considered to have a significant effect on model output.

5.D.1.2.2.5.1.3 Model Demonstration

To demonstrate how changes in model inputs (flow and exports) affect model output, a model demonstration exercise was performed. The flow and export data described above were used to calculate 10, 20, 30, 40, 50, 60, 70, 80, and 90th percentile values in each water year-type. To demonstrate flow effects, exports were held at the 50th percentile value and 100 iterations of the model were run at each flow percentile from the 10th to the 90th. Similarly, for the export effect demonstration, flow values in each reach were held at the 50th percentile value while 100 iterations of the model were run at each percentile of exports from the 10th to the 90th.

5.D.1.2.2.5.2 Results and discussion

5.D.1.2.2.5.2.1 Structural uncertainty

Evaluation of winter run entry timing suggested that none of the alternative entry functions provided more explanatory power than the default bi-model distribution. When entry into the Delta was modeled as a function of water year-type, there was a 3.7% difference in through-Delta survival relative to the baseline. This was less than the 5% threshold for including this as the entry timing function. When entry timing was triggered by flow, there was a 0% difference in through-Delta survival. This also did not meet the criteria to replace the default bimodal function. Thus, no change was made to winter run entry timing.

Uncertainty in the Yolo survival function was evaluated with two alternate functions. The default function was a fixed survival value of 80%, which was based on professional opinion (Ted Sommer, personal communication). The alternative functions included; 1) the ratio of recoveries of coded wire tagged (CWT) fish released the Yolo Bypass and CWT fish released in the Sacramento River (relative survival) and 2) Estimates of survival for acoustically tagged late-fall run smolts released into the Toe Drain. Implementation of the CWT data resulted in a 0% difference in total through-Delta survival. Use of the acoustic survival data resulted in a 3.4% difference in total through-Delta survival. Although this value is below the 5% threshold to replace the function, the workgroup felt that the acoustic data was a better representation of survival that the 80% constant based on professional opinion. Thus, the fixed value was replaced with acoustic survival data.

5.D.1.2.2.5.2.2 Parameter uncertainty

The main index produced by Sobol' sensitivity analysis characterizes the effect of individual parameters without considering interactions. The most influential parameters indicated by the main index were; 1) survival in reach Sac 3, 2) survival in the reach Steamboat/Sutter Sloughs, 3) the proportion of fish entering Steamboat/Sutter Sloughs and 4) survival in reach Sac2 (Figure 5.D-48). All other main index values were very low or the confidence interval overlapped with zero.

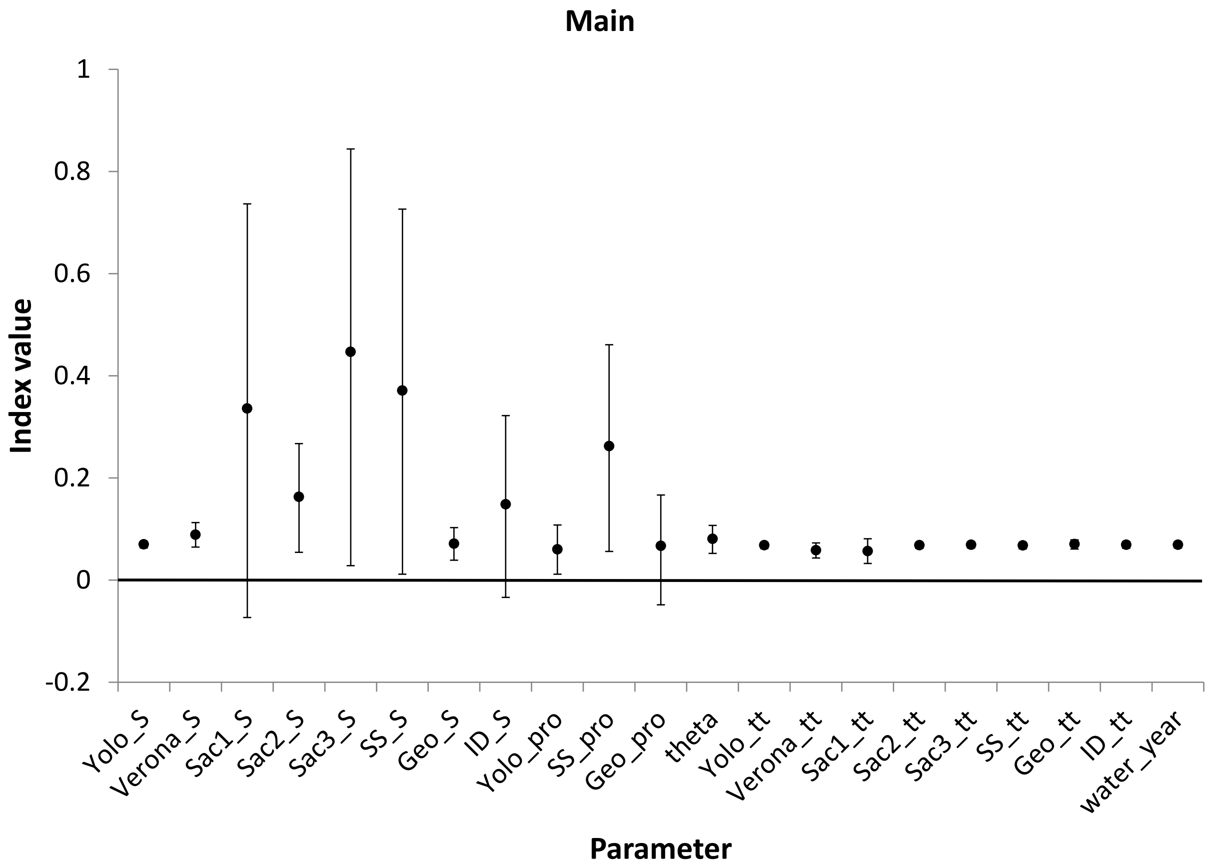


Figure 5.D-48. DPM Sensitivity Analysis Parameter Uncertainty: Main index values from Sobol' sensitivity indices. Confidence intervals that cross zero indicate that parameter did not have a disproportionate effect of model output.

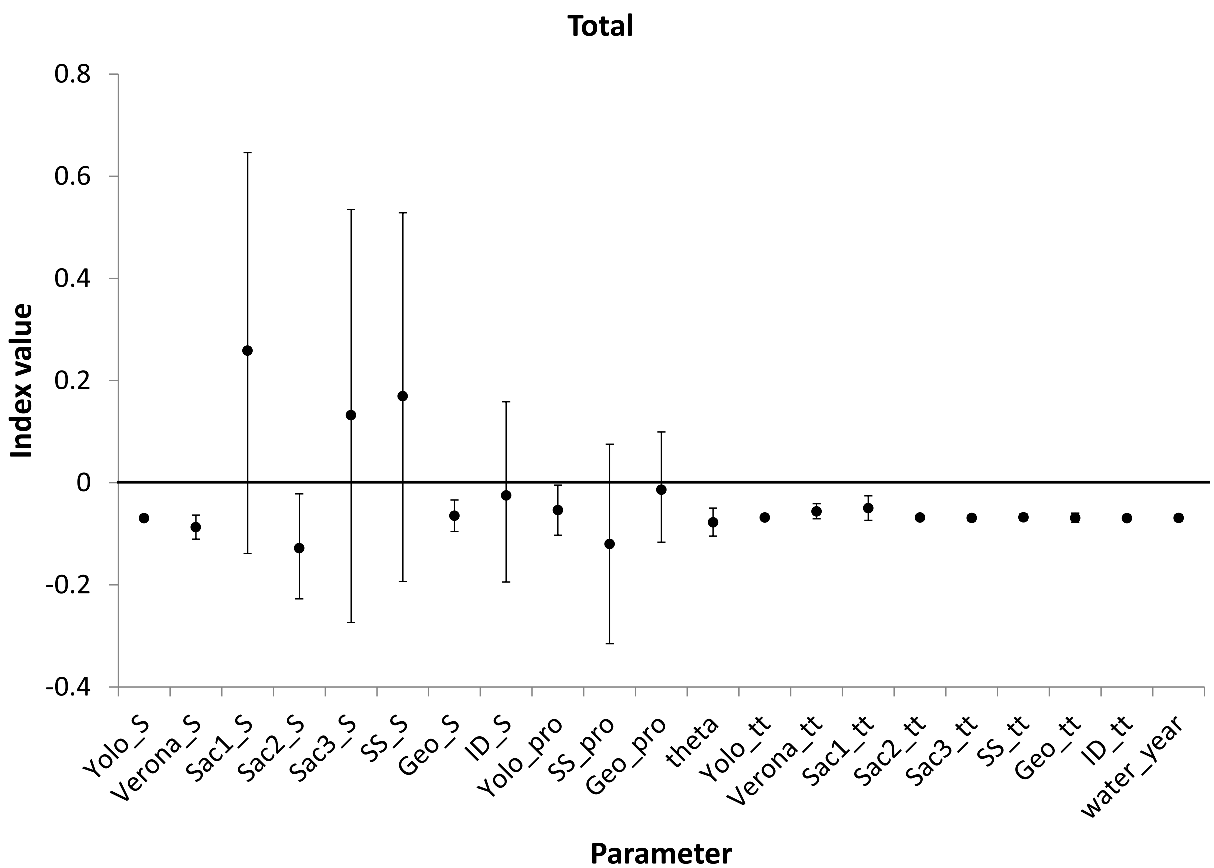


Figure 5.D-49. DPM Sensitivity Analysis Parameter Uncertainty: Total index values from Sobol' sensitivity indices. Confidence intervals that cross zero indicate that parameter did not have a disproportionate effect of model output.

The total index indicated that when first-order interactions were considered, none of the variables had a disproportionate influence on total through-Delta survival (Figure 5.D-49). Negative values for the total index were observed; however, negative values of Sobol' indices are interpreted as having no effect (Fieberg and Jenkins 2005).

5.D.1.2.2.5.2.3 Model demonstration

Mean through-Delta survival for fish entering from the Sacramento River increased approximately 10% as flows increased from 10 to 90th percentile values in each water year (Figure 5.D-50). Initial screening of the survival values indicated the data were not normal so we employed the non-parametric Kruskal-Wallis test to determine if there were significant differences between the different percentile flow treatments. This test revealed significant differences between the treatment groups ($\chi^2 = 101.38$, $p < 0.001$). To determine where the differences existed, Wilcoxon's pairwise comparisons were performed. This comparison indicated that the first significant difference in survival occurred between the 10th and 20th percentile values. The increase in survival from the 10th to 20th percentile flow was greater than the increase between the 10th and 30th percentile value. This effect can happen because juvenile salmon are only affected by flow when they are present in the Delta. Thus, the timing of flows is just as important as the absolute magnitude. Even in years classified as "critical" or "dry" can produce high through-Delta survival values if pulses occurred during the time when salmon were passing through the Delta. Similarly, flows could be low during the migration period in a “wet” or “above normal” year and produce a relatively low survival value.

Variation in exports produced much less variation in through-Delta survival with a decline of less than 2.5% between the 10th and 90th percentile values (Figure 5.D-51). A Kruskal-Wallis test indicated a significant difference between the treatments ($\chi^2 = 30.63$, $P < 0.001$) and the Wilcoxon’s pairwise test revealed that the first significant difference was between the 10th and 90th percentile values. The lack of a large export effect is likely for several reasons. First, the total proportion of fish entering the interior Delta is low. Fish entering the model can enter the Yolo Bypass and the Steamboat/Sutter Slough route where they are no exposed to routes entering the interior Delta (Georgiana Slough, Delta Cross Channel). Second, the effect of exports on survival is weak and highly variable. Thus, there is unlikely to be a strong effect of exports on total survival of juvenile Chinook migrating through the Delta from the Sacramento River.

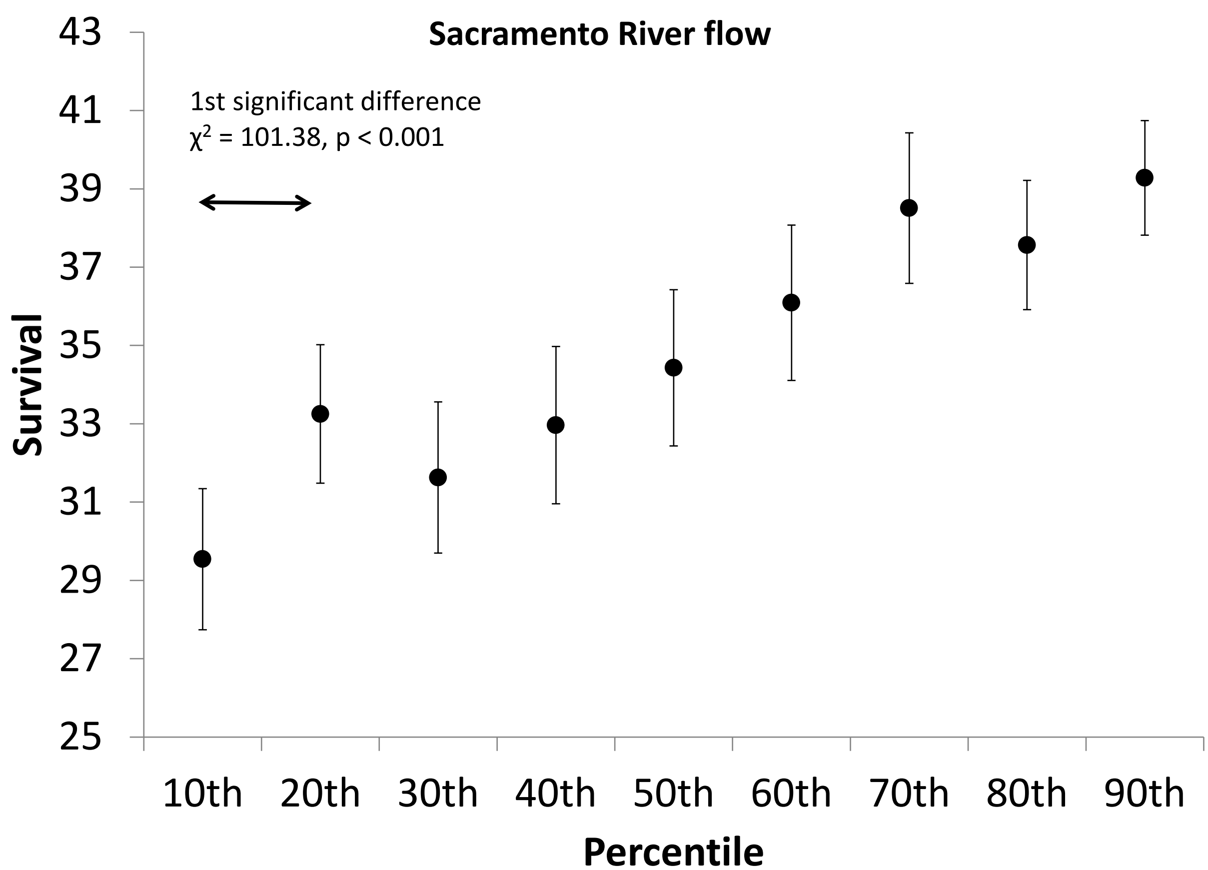


Figure 5.D-50. Means and standard errors of total through-Delta survival for winter run Chinook salmon at 10th – 90th percentile flow values in each reach with exports held at the 50th percentile values.

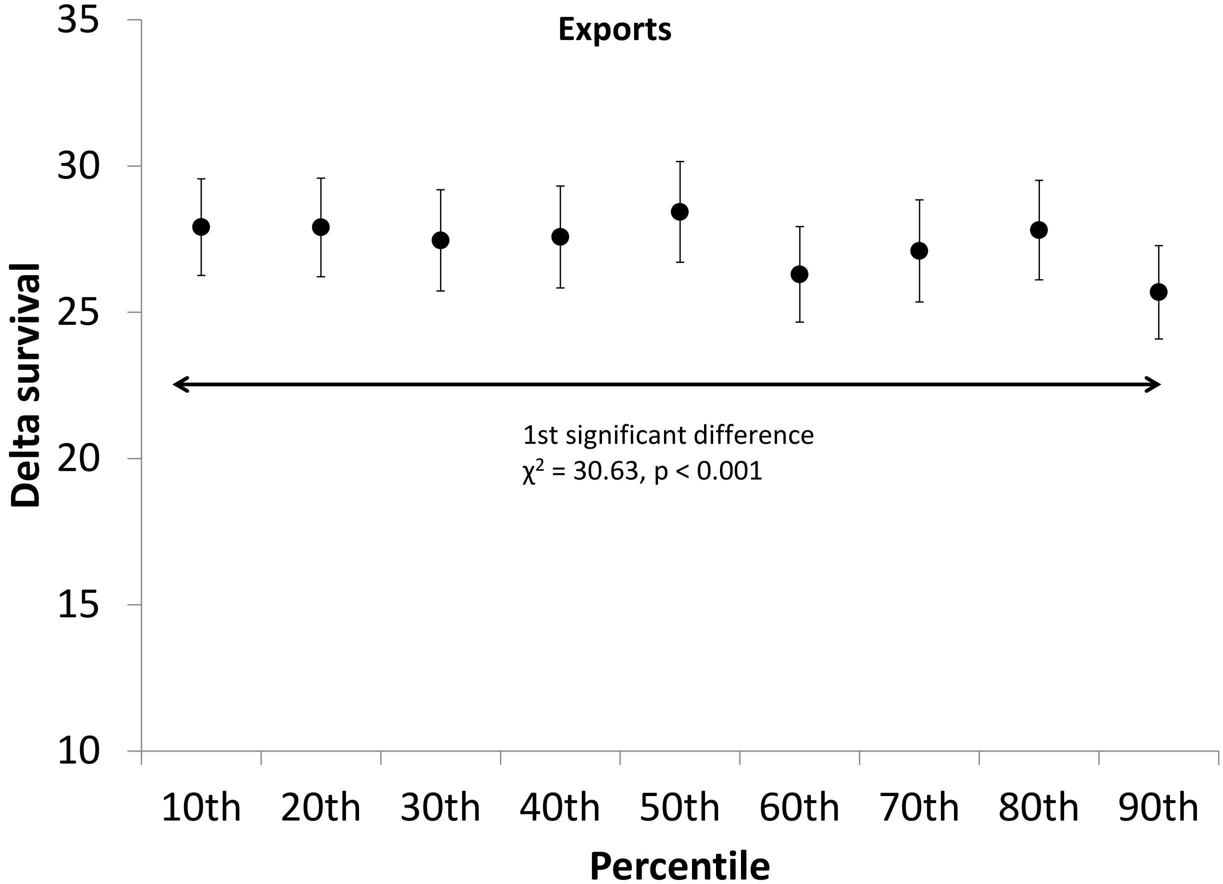


Figure 5.D-51. Means and standard errors of total through-Delta survival for winter run Chinook salmon at 10th – 90th percentile export values in each reach with flows held at the 50th percentile values.

To examine the flow and export ranges used in the sensitivity analyses, the 10th – 90th percentile values of flow in reach Sac 3 and exports were plotted for each water year type with the exception of years that were categorized as "Below Normal". This year-type was excluded because there was only one below normal year in the range of years used. Thus, percentile values could not be calculated and the flow and export values for this year type were always the same.

Examining the plots of each water year-type revealed that there was a considerably greater range between 10th and 90th percentile values in wet (Figure 5.D-52) and above normal (Figure 5.D-53) years relative to dry (Figure D_flow_sens) and critical (Figure C_flow_sens) years. Even in dry years, there were occasional flow pulses, whereas these were attenuated in critical years.

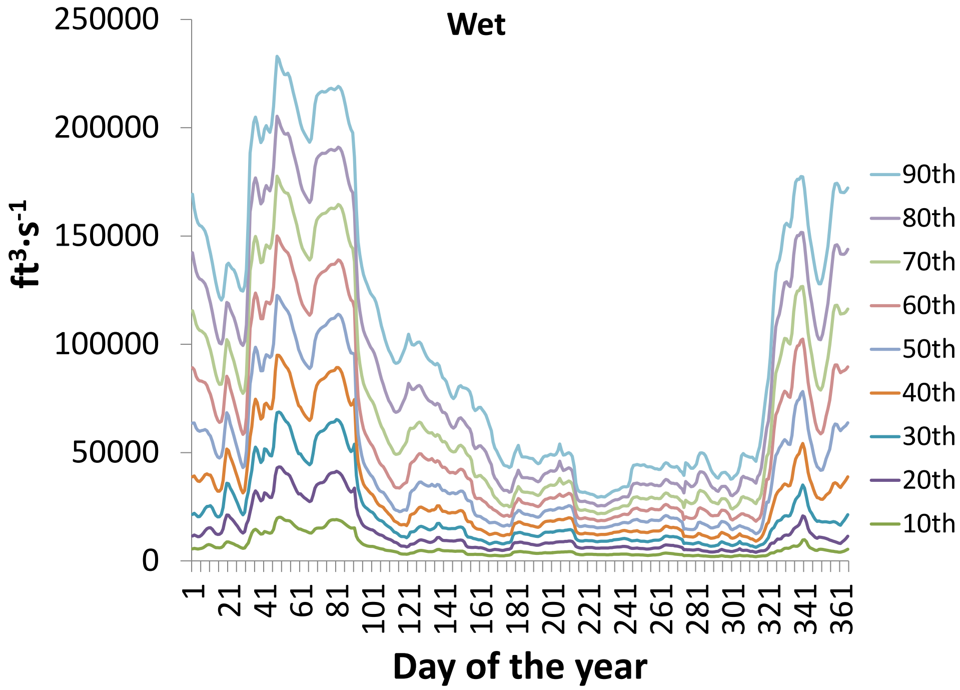


Figure 5.D-52. Ranges of Daily Flows in the Sacramento River below Georgiana Slough (DPM Reach Sac 3) in Wet Years, Used in the Sensitivity Analysis's Model Demonstration.

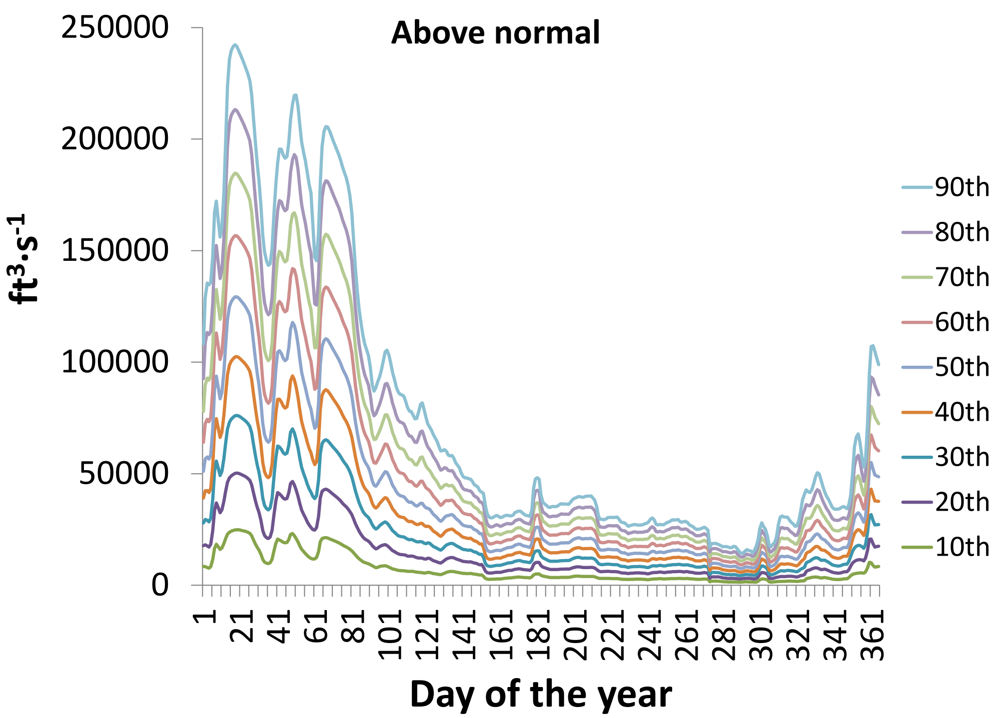


Figure 5.D-53. Ranges of Daily Flows in the Sacramento River below Georgiana Slough (DPM Reach Sac 3) in Above Normal Years, Used in the Sensitivity Analysis's Model Demonstration.

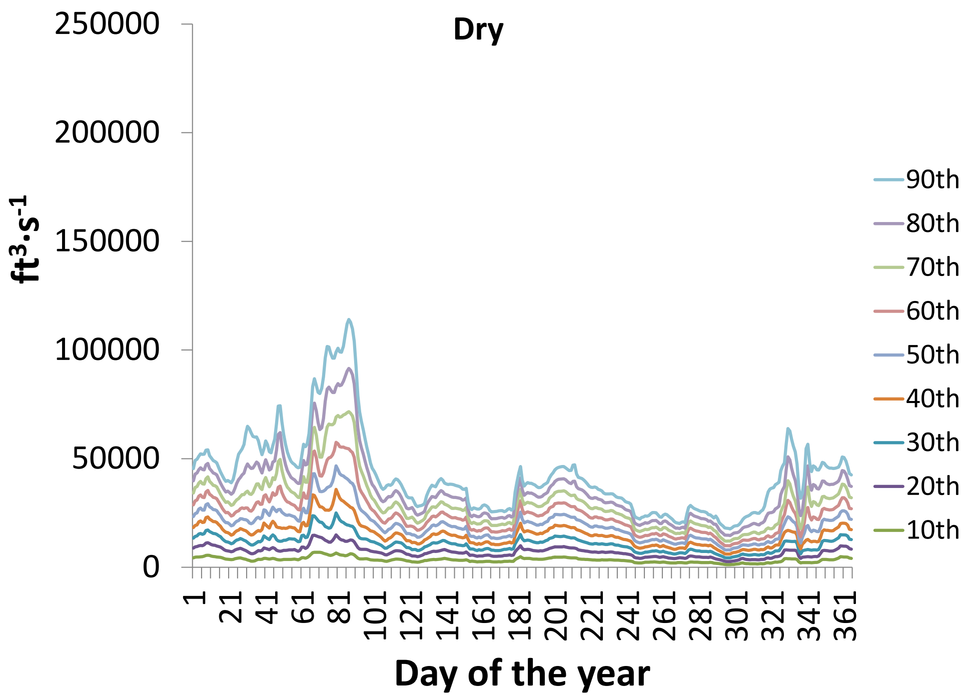


Figure 5.D-54. Ranges of Daily Flows in the Sacramento River below Georgiana Slough (DPM Reach Sac 3) in Dry Years, Used in the Sensitivity Analysis's Model Demonstration.

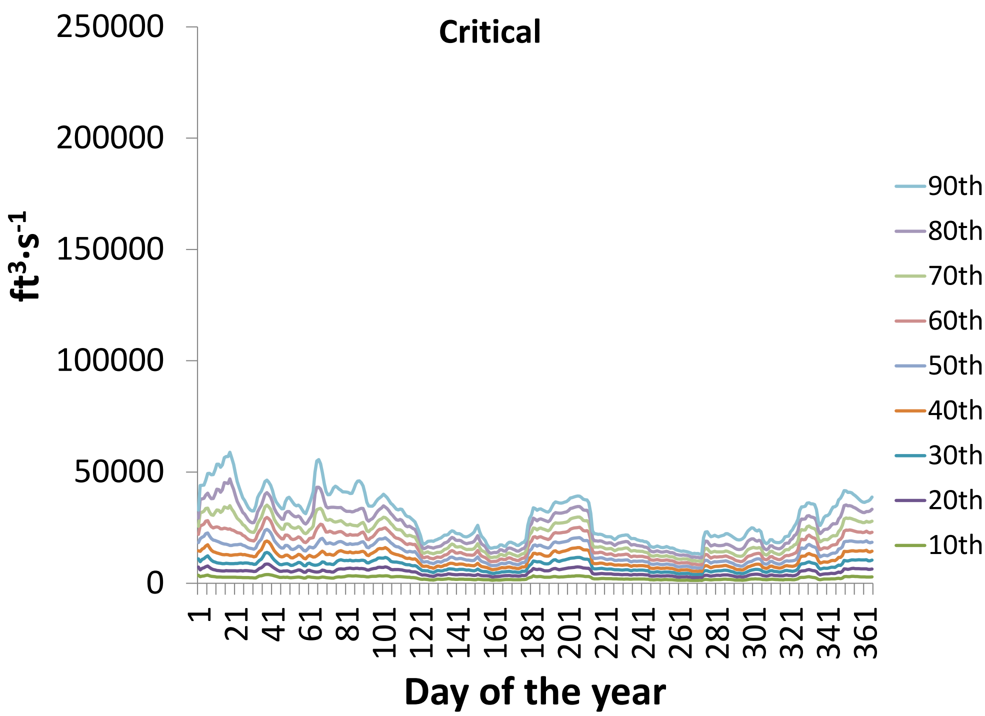


Figure 5.D-55. Ranges of Daily Flows in the Sacramento River below Georgiana Slough (DPM Reach Sac 3) in Critical Years, Used in the Sensitivity Analysis's Model Demonstration.

Variation in exports among water year largely reflected regulatory policy and water demand (Figure 5.D-56, Figure 5.D-57, Figure 5.D-58, Figure 5.D-59). Among all water years, exports were lowest in April and May because of restrictions related to protective actions for migrating juvenile salmon. Exports were highest during the summer-fall irrigation season. The sensitivity analysis was performed on winter run Chinook salmon in the DPM. This race moves through the Delta between November and March when there is considerably more variation in exports among water year-types.

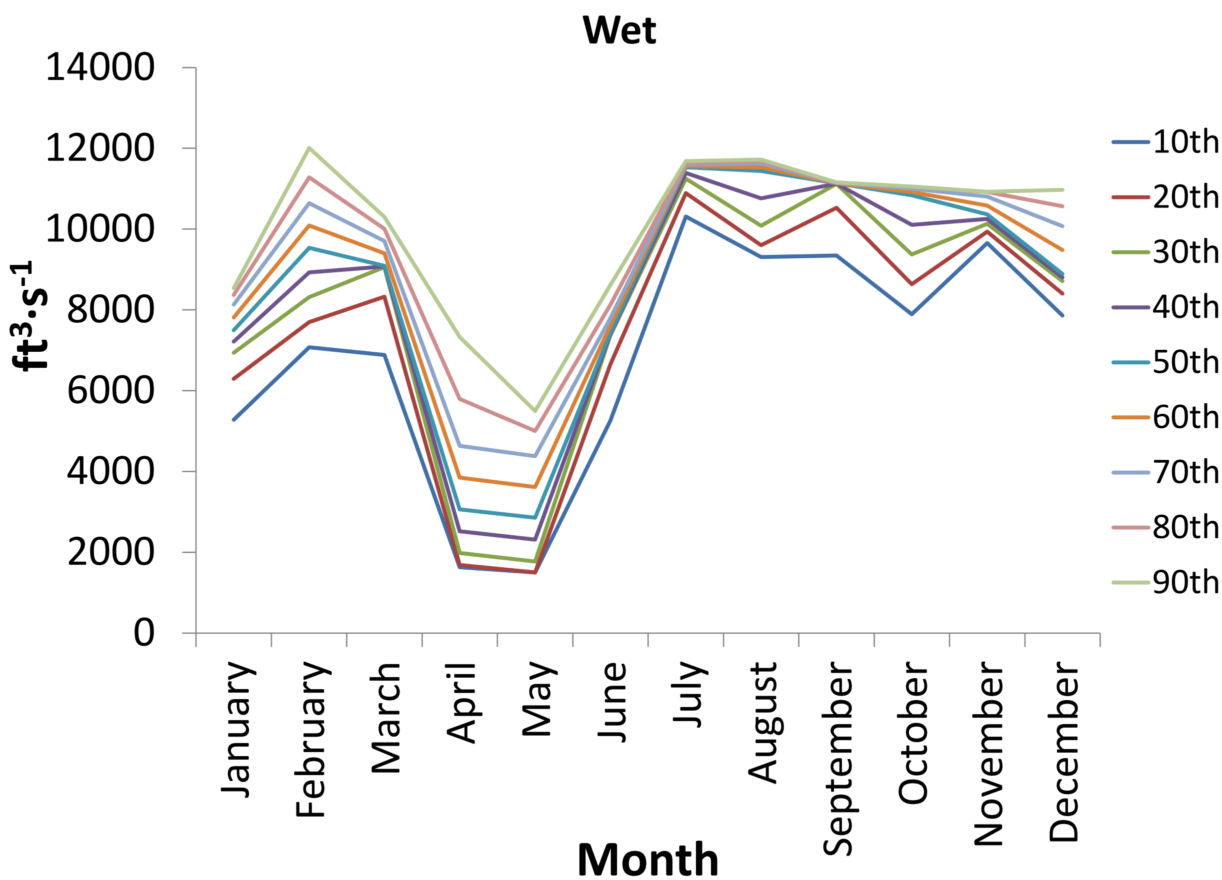


Figure 5.D-56. Ranges of Daily South Delta Exports in Wet Years, Used in the Sensitivity Analysis's Model Demonstration.

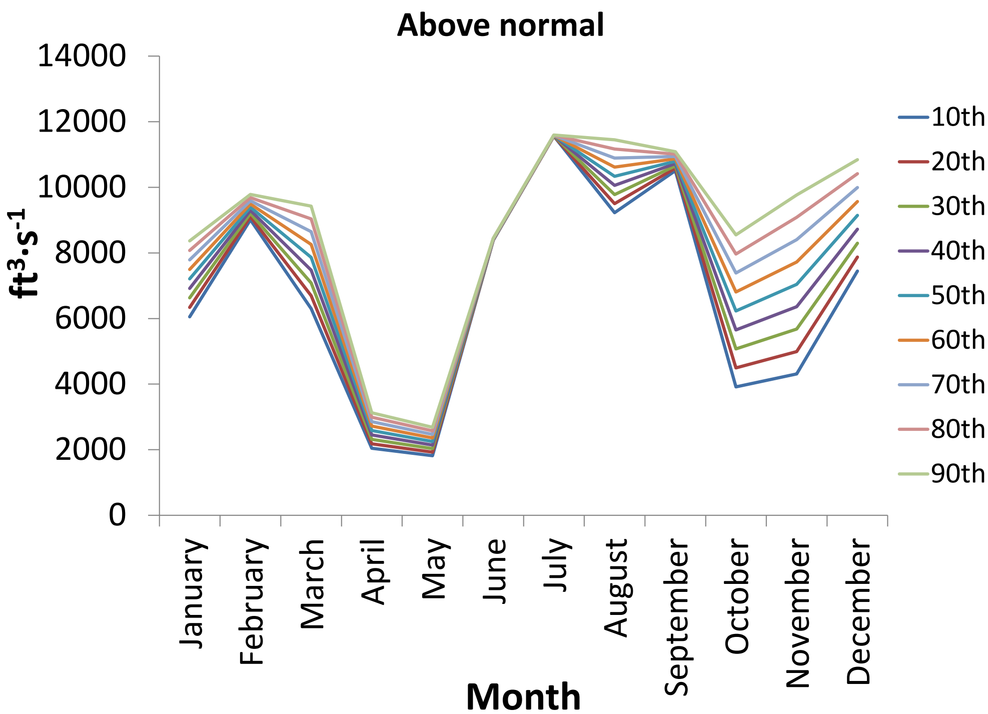


Figure 5.D-57. Ranges of Daily South Delta Exports in Above Normal Years, Used in the Sensitivity Analysis's Model Demonstration.

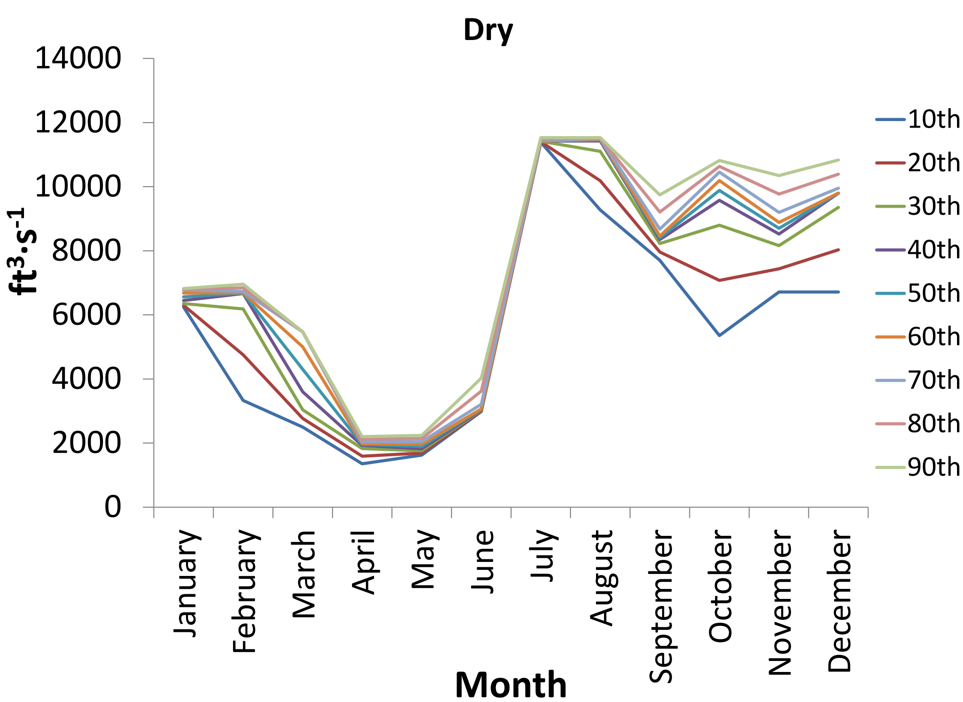


Figure 5.D-58. Ranges of Daily South Delta Exports in Dry Years, Used in the Sensitivity Analysis's Model Demonstration.

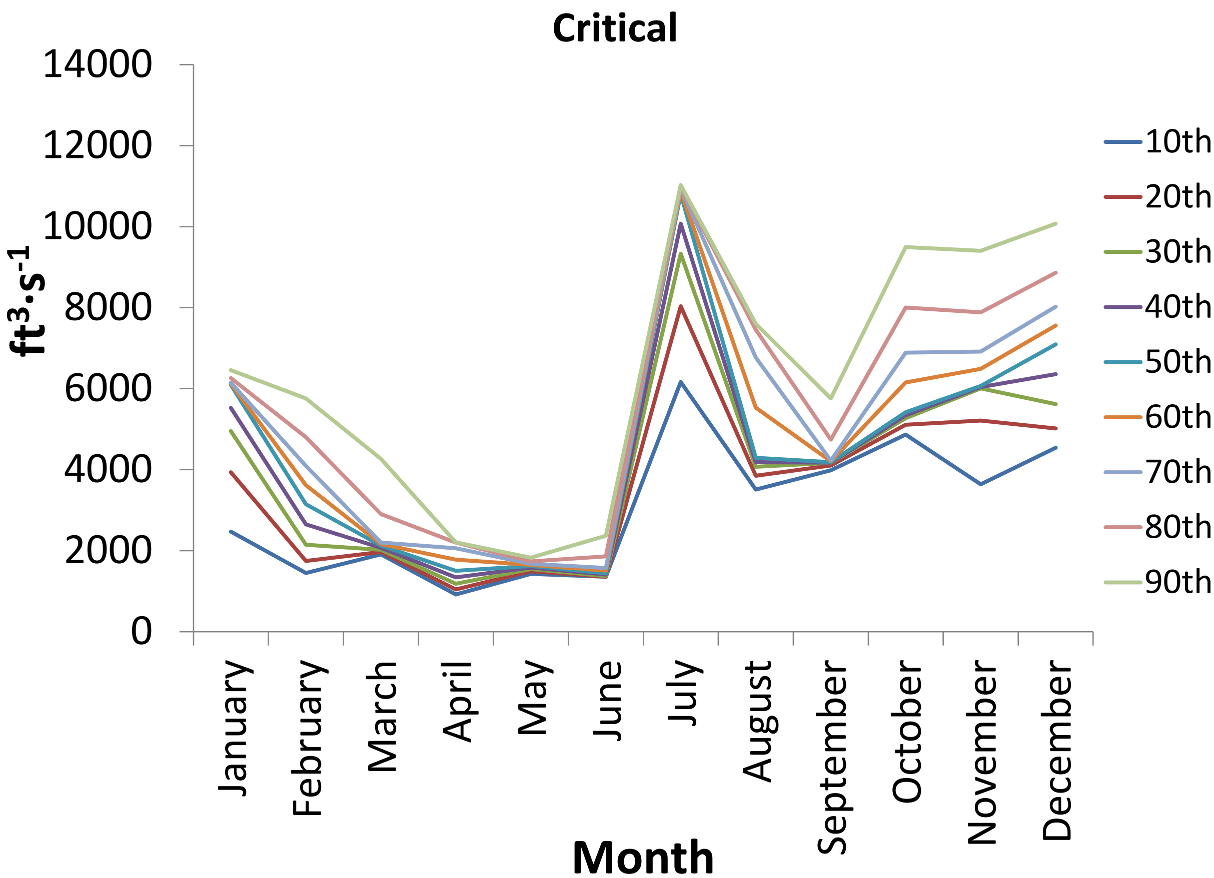


Figure 5.D-59. Ranges of Daily South Delta Exports in Critical Years, Used in the Sensitivity Analysis's Model Demonstration.

5.D.1.2.3 Analysis Based on Newman (2003)

5.D.1.2.3.1 Introduction

Newman (2003) investigated through-Delta Chinook salmon survival of hatchery-origin coded-wire tagged fall-run Chinook salmon smolts released between 1979 and 1994 as a function of various biological and environmental variables using Bayesian hierarchical nonlinear modeling, as well as two additional model formulations. The coefficients of the Bayesian hierarchical modeling were used for the present effects analysis because Newman (2003:176) noted that this approach yielded a similar predictive ability to a pseudo-likelihood approach but the "hierarchical model was considerably more stable, however, and the signs of the coefficients were more sensible given the nature of the physical and biological process involved in survival and capture."

A through-Delta Chinook smolt survival model based on Newman (2003) was applied in this effects analysis to spring-run and fall-run Chinook salmon because the studies upon which the model is based were conducted during the spring migration period of these two runs and do not overlap the main migration periods of winter-run late fall-run Chinook salmon.

5.D.1.2.3.2 Model Structure and Covariates

The basic model of through-Delta survival developed by Newman (2003) is the logit (probability) of survival in relation to a number of covariates:

$$Survival = \frac{e^{x'\beta}}{1 + e^{x'\beta}}$$

Where $x'\beta = \beta_0 + \beta_1$Sacramento + β_2Courtland + β_3Size + β_4Log Flow + β_5Salinity + β_6Release Temperature + β_7Hatchery Temperature + β_8Tide + β_9Exports + β_{10}Gate + β_{11}Turbidity

The definitions of these covariates, their coefficients, their ranges in the modeling conducted by Newman (2003), and other relevant details are summarized in Table 5.D-45. Note that the analysis conducted for the current effects analysis was based on a deterministic implementation using the coefficients from Newman's (2003) Bayesian hierarchical modeling (Table 5.D-45); standard errors are provided in Table 5.D-45 to provide an indication of the likely statistical significance of each covariate (e.g., based on the ratio of the coefficient to its standard error being greater than about 2). This analysis is a straightforward examination based on changes in survival caused by environmental variation, whereas the full analysis by Newman (2003) was a more complex effort that included consideration of parameter uncertainty and demographic uncertainty. As such, the present analysis presents only annual point estimates of survival, without calculations of uncertainty around the estimates.

Newman (2003) standardized continuous (nonindicator) covariates to zero mean and unit standard deviation in order to facilitate comparison between covariates in terms of the magnitudes of coefficients. This illustrates that log flow and release temperature had by far the greatest correlation with through-Delta survival, with lesser effects for turbidity, south Delta exports, salinity[9], and smolt size (Table 5.D-45). Hatchery temperature and tide had little to no correlation with survival and were not included in the modeling for this effects analysis. The effect on estimated survival of varying each covariate over the range of data modeled by Newman (2003) while holding other standardized covariates constant emphasizes the relative difference in coefficients of each covariate (Figure 5.D-60): for example, survival would be estimated to vary from 0.18 from the lowest flow to 0.93 at the highest flow (holding other covariates at mean values and assuming DCC is closed and fish were released from Sacramento), whereas across the range of released fish sizes survival would be estimated to vary from 0.41at the smallest size to 0.66 at the largest size. Of direct relevance to the present effects analysis is the estimated survival effect of changes in Sacramento River flow and south Delta exports because of the implementation of dual conveyance with the construction of the proposed NDD. Application of Newman's (2003) coefficients while holding other covariates constant at mean values, assuming DCC is closed, and fish were released at Sacramento, then back-transforming

[9] Newman (2003) noted that flow and salinity were quite strongly negatively correlated (r = -0.74), but not in a strictly linear fashion. In a similar analysis of many of the same data, Newman and Rice (2002: 989) noted: "When using the model for comparing releases under two different flow regimes, for example, reasonable levels of salinity need to be selected." For the present analysis, salinity values were from the DSM2-QUAL modeling and flow values were from the DSM2-HYDRO modeling; therefore salinity reflects flow, as recommended by Newman and Rice (2002).

the standardized flow and exports covariates to their original units of measurement gives the following rates of change in survival.

- For south Delta exports (across the range modeled by Newman [2003] = ~1,300–8,600 cfs), a change in through-Delta survival of 0.01 (i.e., 1% of the migrating juveniles) would occur per ~280-cfs change in south Delta exports.
- For Sacramento River flow of ~6,000–14,700 cfs, a change in through-Delta survival of 0.01 would occur per ~240-cfs change in river flow.
- For Sacramento River flow of ~14,700–28,000 cfs, a change in through-Delta survival of 0.01 would occur per ~520-cfs change in river flow.
- For Sacramento River flow of ~28,000–51,000 cfs, a change in through-Delta survival of 0.01 would occur per ~3,000-cfs change in river flow.

Spring-run and fall-run Chinook salmon smolt survival was calculated on a daily basis under the assumption that smolts were 80-mm fork length (i.e., close to the mean of the data used by Newman [2003]) and took 10 days to migrate through Delta (Brandes pers. comm.). Covariates used to estimate survival that required computations over the 10-day outmigration period (i.e., Log flow, salinity, exports, gate, and turbidity) were based on values for a given day and the following nine days. Daily survival was multiplied by the assumed proportion of the spring-run and fall-run Chinook salmon smolt populations entering the Delta on each day, which was the same distribution developed from Sacramento trawl data for the DPM (Figure 5.D-62). For each Chinook salmon run, daily survival multiplied by the proportion of fish entering the Delta on that day was summed for each water year in order to facilitate comparisons between scenarios (NAA and PA) over the water years 1922–2003 DSM2 simulation period.

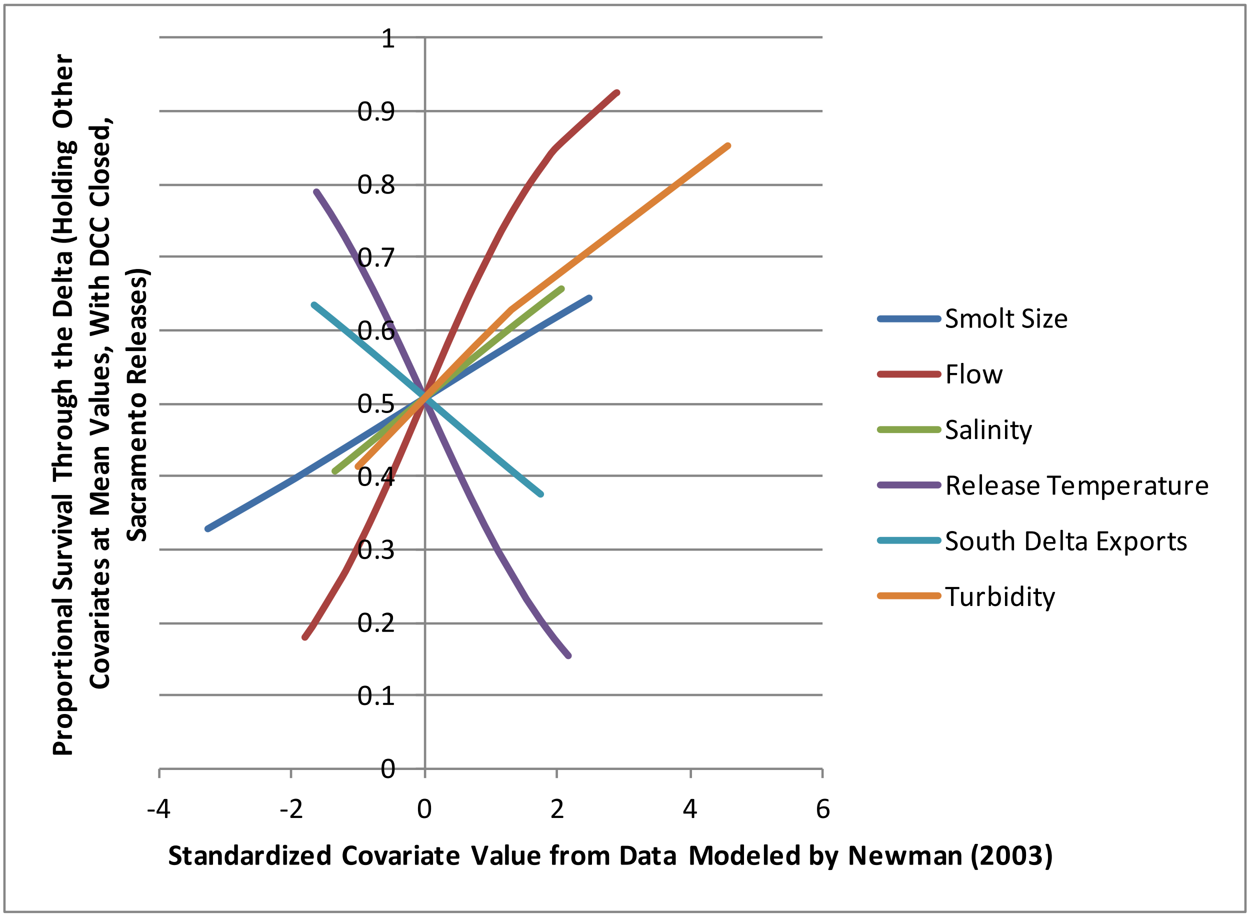
As noted in Table 5.D-45, log flow covariate data were based on DSM2-HYDRO modeling for the Sacramento River above Sutter and Steamboat Sloughs (downstream of the NDD) in order to account for the potential effects of the PA on flow-related survival because of the proposed north Delta diversions. Flow at this location is quite similar to flow at Freeport with no north Delta diversions, suggesting that this is a reasonable proxy for Sacramento River flows at Freeport for EBC scenarios.

No turbidity modeling data were available for input into the through-Delta survival calculations. Turbidity covariate data were estimated from a regression of river flow at Freeport against turbidity from Newman's (2003) original modeling data (Figure 5.D-63). For implementation in the present effects analysis, the turbidity data were estimated from the flow below the NDD (i.e., from 418_MID) in order to capture the potential effect of the intakes in terms of reducing water velocity and therefore decreasing suspended sediment concentration.

The results of the analysis are presented in Chapter 5, *Effects Analysis for Chinook Slamon, Central Valley Steelhead, Green Sturgeon, and Killer Whale*, and are summarized by overall annual through-Delta survival and by NDD bypass flow level.

Table 5.D-45. Covariates and other Model Terms Used in Through Delta-Survival Modeling of Spring-Run Chinook Salmon Smolts Based on Newman (2003)

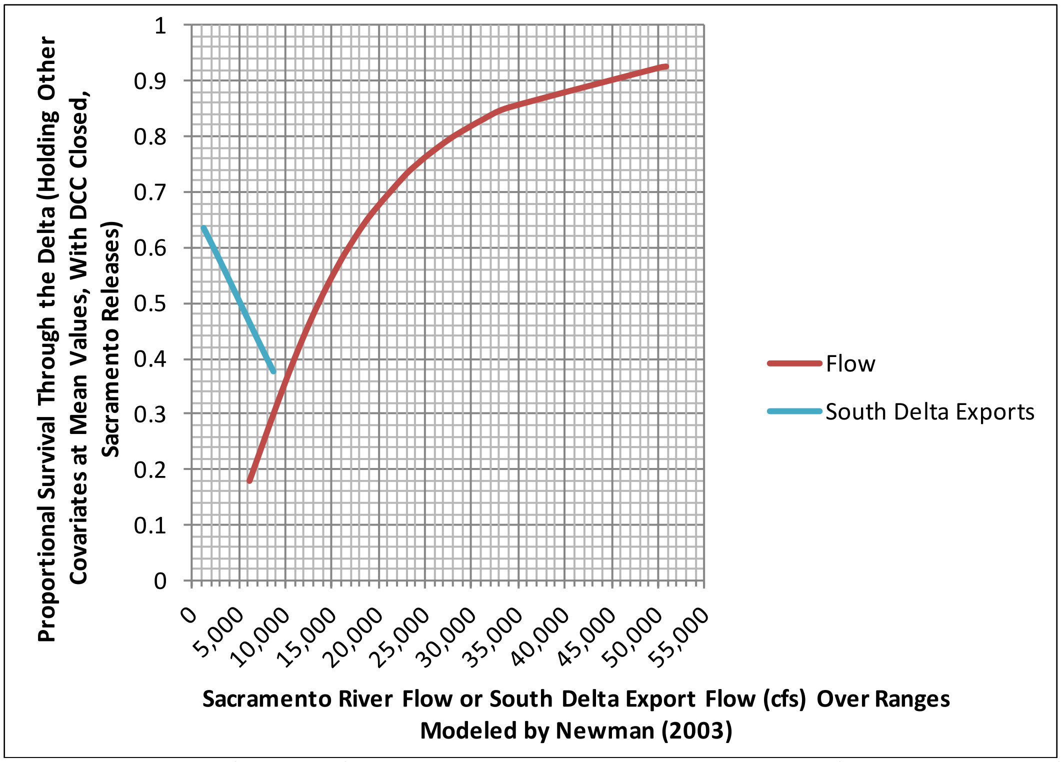
Covariate or Model Term	Definition	Coefficient (Subscript = Standard Error)	Modeled Mean and Range (Newman 2003)	Summary of Covariate Data for BDCP Effects Analysis	
				Source of Data (Details)	Comments
Intercept	Intercept	β_0: $0.59_{0.10}$	–	–	
Sacramento	Indicator of release at Sacramento (Yes = 1, No = 0)	β_1: $-0.56_{0.16}$	–	–	All smolts assumed to be released at Sacramento
Courtland	Indicator of release at Courtland (Yes = 1, No = 0)	β_2: $-0.02_{0.17}$	–	–	No smolts assumed to be released at Courtland
Size	Average fork length (mm) of smolts release group	β_3: $0.23_{0.06}$	80.92 mm (61–96 mm)	Newman (2003) (Close to mean value)	All smolts assumed to be 80 mm
Log flow	Log-transformed median Freeport flow (cfs) during outmigration	β_4: $0.86_{0.12}$	9.53 (8.71–10.84); 15,379 cfs (6,085–50,800 cfs) when untransformed	DSM2-HYDRO (Sacramento River Upstream of Sutter and Steamboat Slough [downstream of North Delta Diversion], i.e., output location 418_MID)	Used data for Sacramento River below the proposed NDD to assess flow effect on survival
Salinity	Median conductivity (µ mho/cm) at Collinsville during outmigration	β_5: $0.30_{0.09}$	5,219.79 µ mho/cm (160-12,873 µ mho/cm)	DSM2-QUAL (Collinsville, RSAC081)	–
Release Temperature	River water temperature on day of release (°F)	β_6: $-0.80_{0.09}$	65.71°F (58–76°F)	DSM2-QUAL (Freeport, RSAC155)	–
Hatchery Temperature	Hatchery water temperature on day of release (°F)	β_7: $0.00_{0.09}$	54.55°F (49–60°F)	–	Not included in analysis because of little evidence of effect and lack of modeling data
Tide	Magnitude of change in low-low and high-low tides and whether Delta was filling/draining	β_8: $-0.04_{0.06}$	1.59 (0–2.7)	–	Not included in analysis because of little evidence of effect and lack of modeling data
Exports	Median rate of south Delta exports (cfs) during outmigration period	β_9: $-0.31_{0.10}$	4,888.23 cfs (1,289–8,621 cfs)	DSM2-HYDRO (Sum of Clifton Court and absolute value of Delta Mendota Canal flows)	–
Gate	Indicator of position of Delta Cross Channel during outmigration (Open = 1, Closed = 0)	β_{10}: $-0.78_{0.15}$	0.61 (0–1)	DSM2-HYDRO (Delta Cross Channel)	Assumed open if 10-day median position > 0.5 (where 0 = closed and 1 = open)
Turbidity	Median water turbidity near Courtland during outmigration (formazine turbidity units, FTU)	β_{11}: $0.38_{0.13}$	8.18 FTU (4.5–25.0 FTU)	Based on regression of flow at Freeport vs. turbidity at Courtland from raw data of Newman (2003)	Estimated from flow below the NDD (418_MID) in order to capture possible flow-related effect on turbidity



Note: Standardized covariate values were plotted from range of values modeled by Newman (2003).

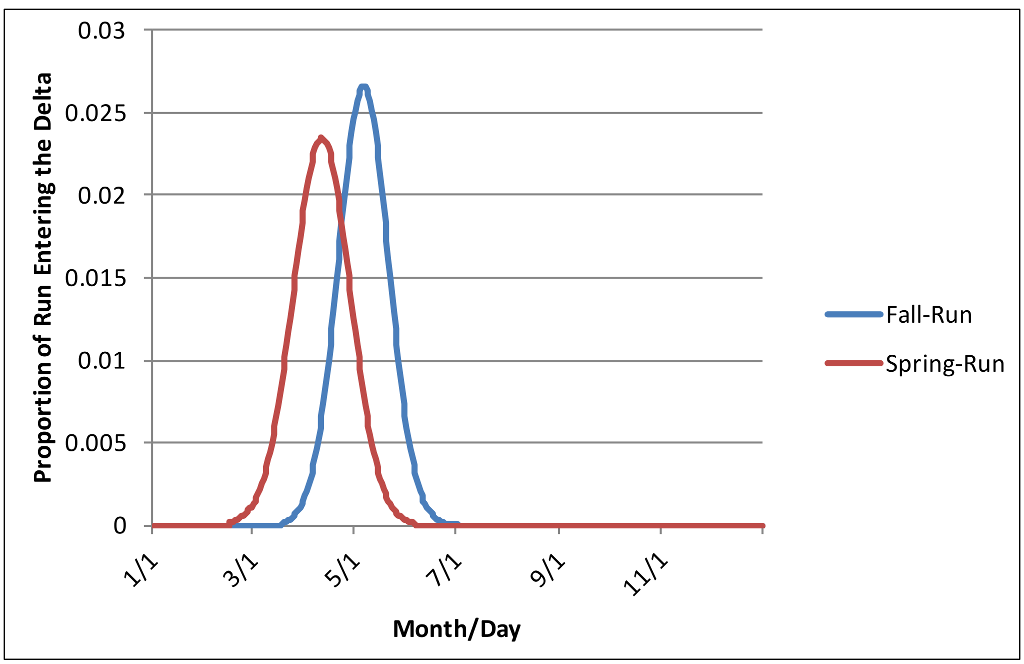
Figure 5.D-60. Effect of Varying Each Covariate Across the Range of Data Modeled by Newman (2003), Holding Other Covariates at Mean Values[10], Assuming Closed Delta Cross Channel Gates, and Fish Releases From Sacramento

[10] Note, however, that there was some correlation between covariates, with flow and salinity having the greatest correlation (r = -0.74; Newman 2003). Therefore it is not strictly correct to illustrate the effects of these covariates as if they are independent.



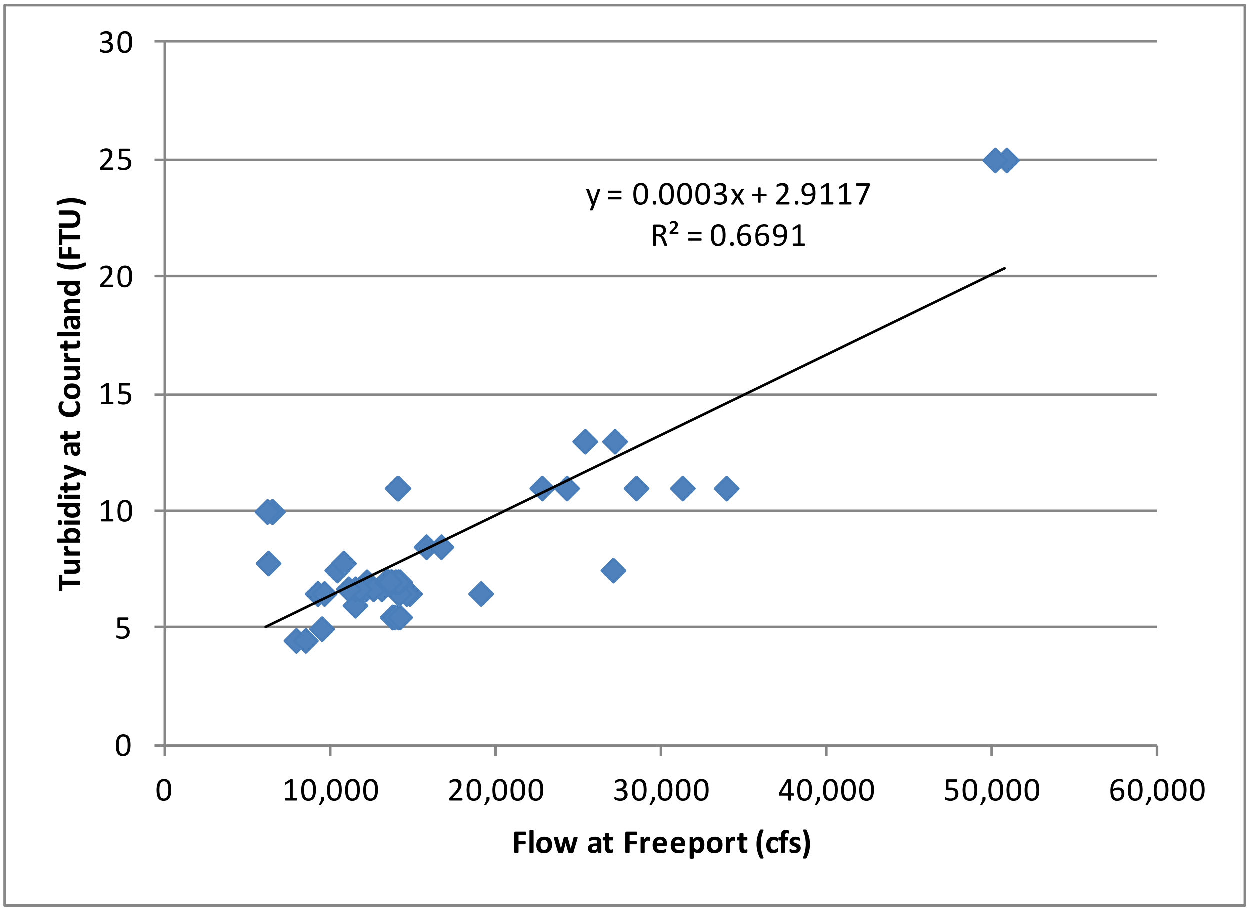
Note: Values were plotted from range of values modeled by Newman (2003) and were back-transformed to original scale of measurement.

Figure 5.D-61. Effect of Varying Sacramento River Flow and South Delta Exports Across the Range of Data Modeled by Newman (2003), Holding Other Covariates at Mean Values, Assuming Closed Delta Cross Channel Gates, and Fish Releases From Sacramento



Note: Based on assumed distribution for the Delta Passage Model.

Figure 5.D-62. Assumed Proportional Distribution of Fall-Run and Spring-Run Chinook Salmon Smolts Entering the Delta For the Through-Delta Survival Analysis



Note: Using data from Newman 2003.

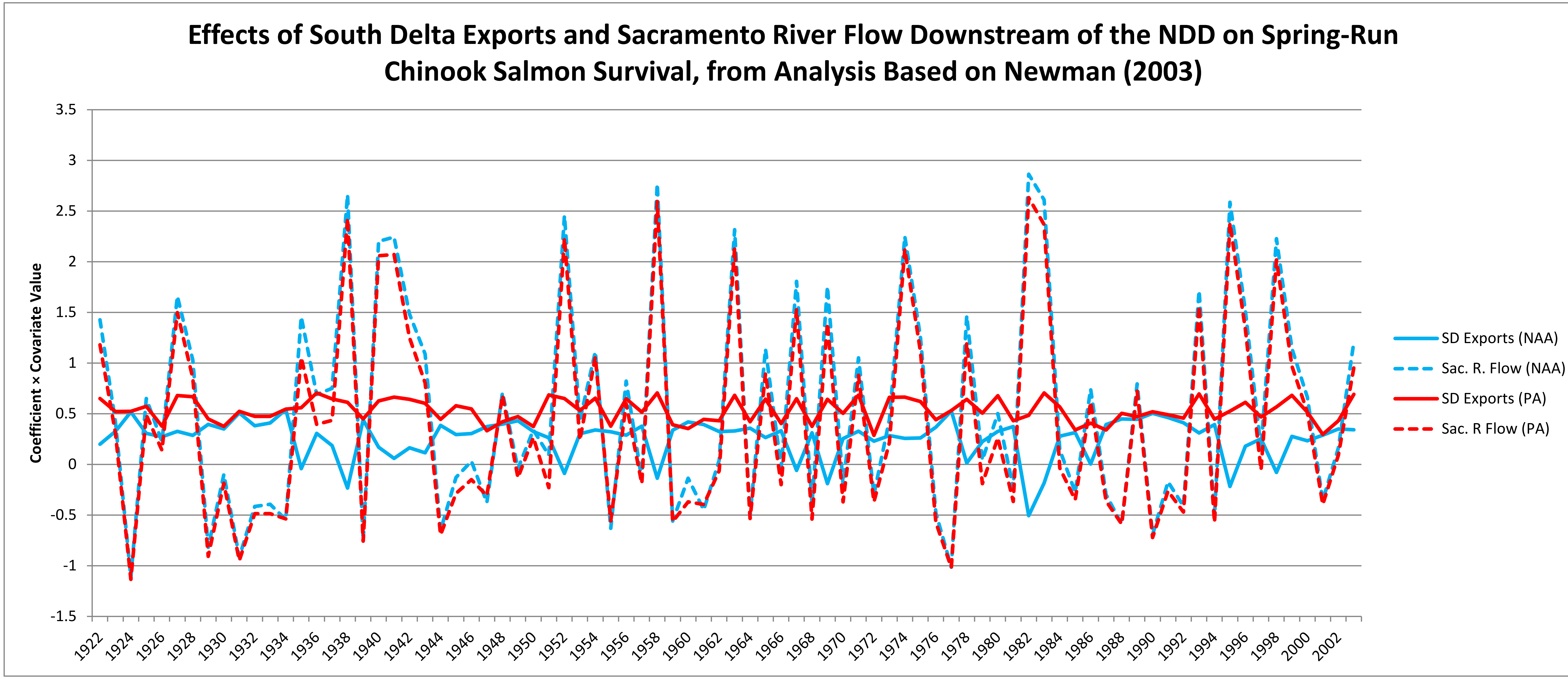
Figure 5.D-63. Relationship between Sacramento River Flow at Freeport and Turbidity at Courtland

5.D.1.2.3.3 Results

Most results of the analysis based on Newman (2003) are presented in Chapter 5, Section 5.4.1.3, *Assess Species Response to the Proposed Action*. Selected results presented here were created in response to agency comments on a draft of the analysis (Table 5.D-46and Figure 5.D-64).

Table 5.D-46. Mean Annual Chinook Salmon Through-Delta Survival Estimated from the Analysis Based on Newman (2003) During the Spring-Run Chinook Salmon Migration Period, Divided into Each NDD Bypass Flow Level.

WY	Pulse Protection Flows			Level 1 Bypass Flows			Level 2 Bypass Flows			Level 3 Bypass Flows		
	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
W	0.99	0.99	0.00 (0%)	0.96	0.97	0.01 (1%)	0.91	0.92	0.01 (1%)	0.84	0.84	0.00 (0%)
AN	0.99	0.99	0.01 (1%)	0.99	0.98	0.00 (0%)	0.93	0.93	0.00 (0%)	0.74	0.74	0.00 (0%)
BN	0.92	0.92	0.00 (0%)	0.81	0.81	0.00 (0%)	0.66	0.64	-0.02 (-3%)	0.66	0.64	-0.01 (-2%)
D	0.95	0.94	-0.01 (-1%)	0.85	0.84	-0.01 (-1%)	0.66	0.66	0.00 (0%)	0.65	0.65	0.00 (0%)
C	0.92	0.91	-0.01 (-1%)	0.60	0.59	-0.01 (-1%)	0.49	0.49	0.00 (1%)	NA*	NA	NA
Note: *NAA denotes that level 3 bypass flows did not occur in critical years during the spring-run migration period.												



Note: Values are based on the annual sum of daily calculations of (regression coefficient × standardized covariate value × proportion of fish entering the Delta)

Figure 5.D-64. Relative Effect of South Delta Exports and Sacramento River Flow Downstream of the NDD on Spring-Run Chinook Salmon Survival.

5.D.1.2.4 Analysis Based on Perry (2010)

5.D.1.2.4.1 Introduction

Perry (2010) used binomial generalized linear models to estimate survival of acoustically tagged Chinook salmon smolts in relation to flow in the Sacramento River below Georgiana Slough. Survival was estimated from the Sacramento River below its junction with the Delta Cross Channel/Georgiana Slough to Chipps Island[11] (Perry 2010: 107–108). The basic flow-survival relationship from Perry (2010), as implemented in the DPM, was used to assess the potential far-field effect of the PA's proposed NDD on through-Delta survival of Chinook salmon. This section describes the methods used for the analysis, and provides selected detailed results that are not already presented in Chapter 5, *Effects Analysis for Chinook Slamon, Central Valley Steelhead, Green Sturgeon, and Killer Whale*.

5.D.1.2.4.2 Methods

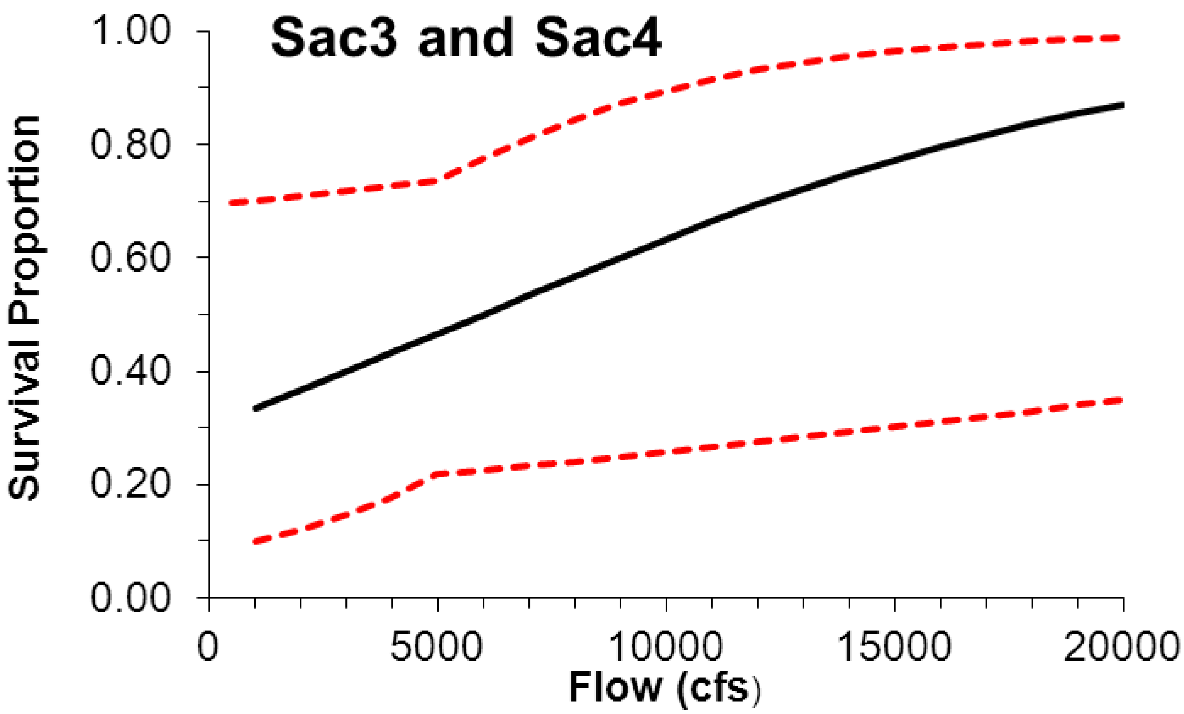
The analysis based on Perry (2010) used the flow-survival relationship for the Sacramento River from Georgiana Slough to Chipps Island, based on the DPM implementation of this relationship (Figure 5.D-65). The proportional survival in reaches Sac3 and Sac4 (i.e., Sacramento River from Georgiana Slough to Chipps Island) for all days in the 1922–2003 DPM simulation period were extracted from the 75 random iterations of the DPM for the NAA and PA scenarios. Each iteration had a different daily value for survival, based on random draws from the flow-survival probability distribution (Figure 5.D-65) for the flow on each day. For each of the 75 iterations, proportional survival on each day was multiplied by the proportion of the juvenile Chinook salmon population assumed to be entering the reach on that day, based on the fixed Delta entry distributions used in the DPM[12]. For each year, the daily weighted survivals were summed for each of the four bypass flow levels (i.e., pulse protection and Level 1-3 bypass flows)[13] as well as the total survival across all flow levels. For each annual value, means and 95% confidence intervals[14] were generated based on the 75 iterations of the summed values. These were compared between scenarios. In addition to the analyses using Chinook salmon run-specific weightings, analyses were also undertaken using an equal weighting for each day between December 1 and June 30 (i.e., 1/213 days = weight of 0.00469 for each day) in order to examine patterns during the main period of interest for juvenile salmonids.

[11] Perry (2010: 108) noted: "The upper reaches in the Sacramento River were excluded because telemetry stations were not implemented consistently in all years and survival in these reaches remained relatively high over all years of study." Perry also assessed survival down the Sutter/Steamboat Slough pathway, although that portion of the analysis is not considered here.

[12] This results in a few days' difference in entry into the Sac3 reach between the method based on Perry (2010) and the DPM itself, because of the travel time between the entry point into the DPM (Sacramento River at Fremont Weir) and the Sac3 reach.

[13] Each date under the NAA scenario was assigned the same bypass flow level as the corresponding date under the PA scenario, to account for the NAA scenario not being subject to bypass flow criteria (there would be no NDD under the NAA).

[14] The 95% confidence intervals were based on the 2.5th and 97.5th percentiles of the 75 iterations extracted from the DPM.

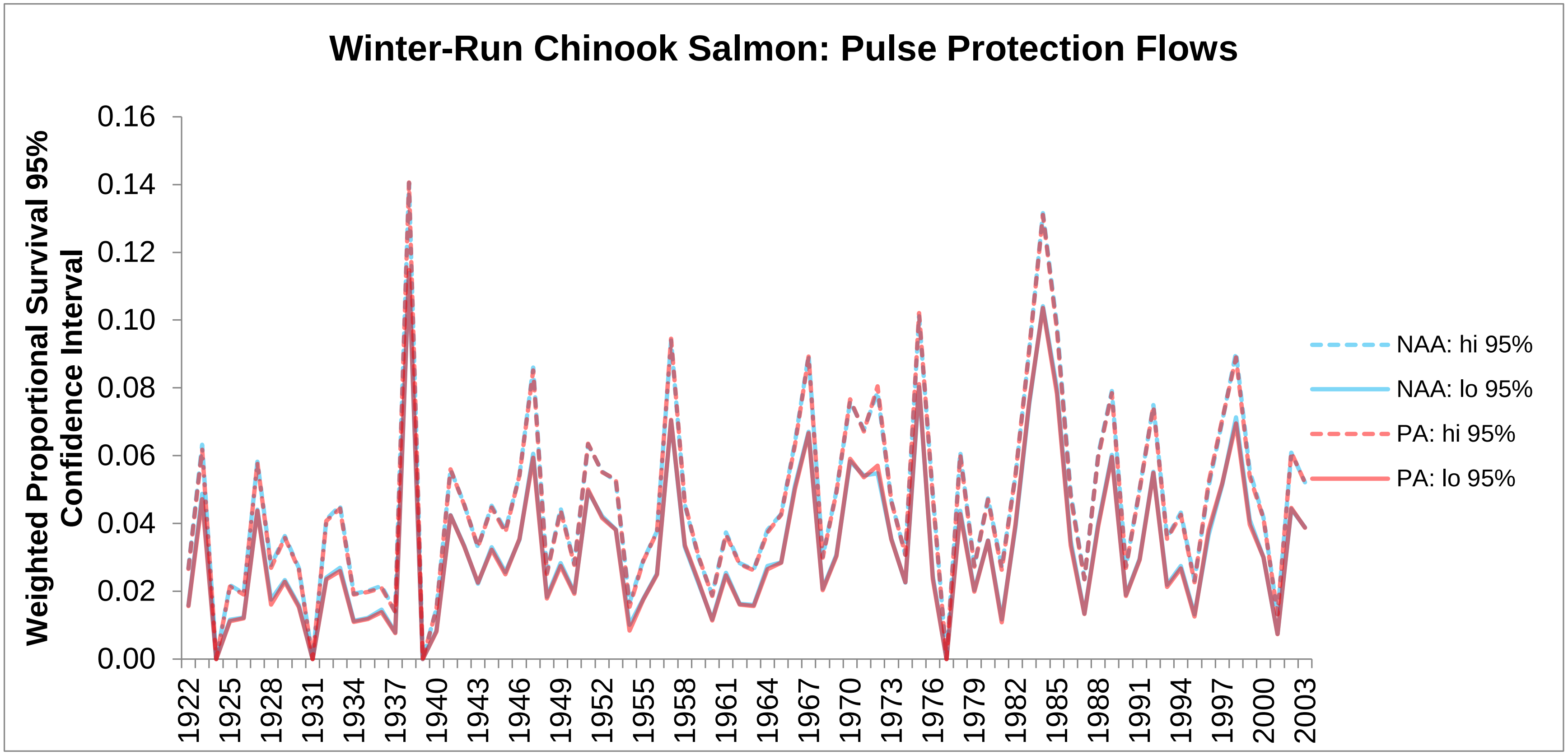


Note: The solid line is the predicted mean route survival curve, with dotted lines representing 95% confidence bands to inform uncertainty.

Figure 5.D-65. Juvenile Chinook Salmon Survival in DPM Reaches Sac3 and Sac4 (Sacramento River at Georgiana Slough to Chipps Island) as a Function of Sacramento River Flow Below Georgiana Slough, As Implemented for the Analysis Based on Perry (2010).

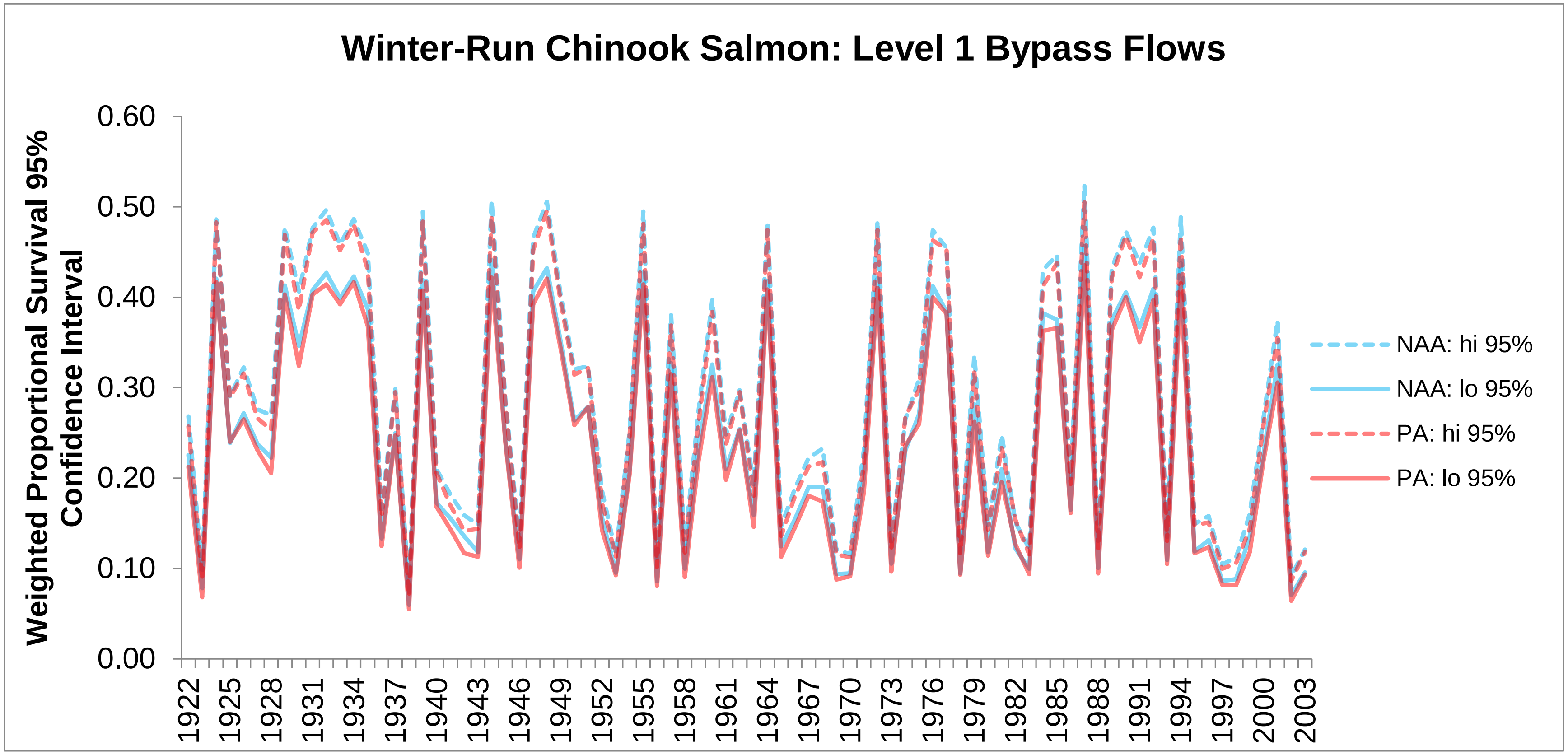
5.D.1.2.4.3 Results

This section is limited to presentation of additional plots to those presented in Chapter 5: time series plots of survival from the Sacramento River at Georgiana Slough to Chipps Island by bypass flow level (weighted by proportion of juvenile Chinook salmon occurring during each flow level) and total survival, with 95% confidence intervals from the 75 iterations of the DPM from which the results were extracted; and exceedance plots of the mean proportional survival by bypass flow level, in addition to total survival. See Figure 5.D-66, etc. Interpretation of these time series plots and other results of the analysis are presented in Chapter 5.



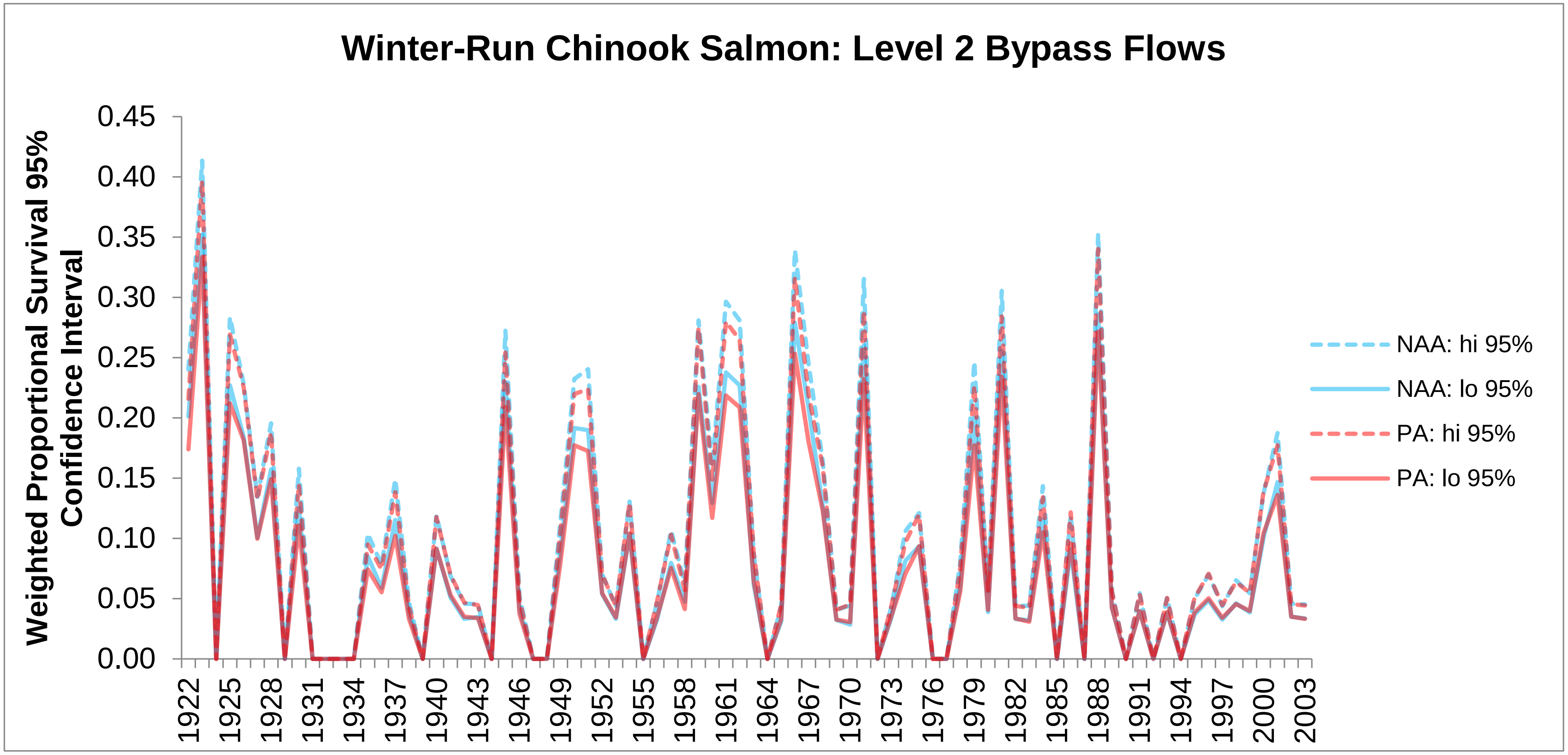
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during pulse protection flows.

Figure 5.D-66. Time Series of 95% Confidence Interval Annual Juvenile Winter-Run Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Pulse Protection Flows.



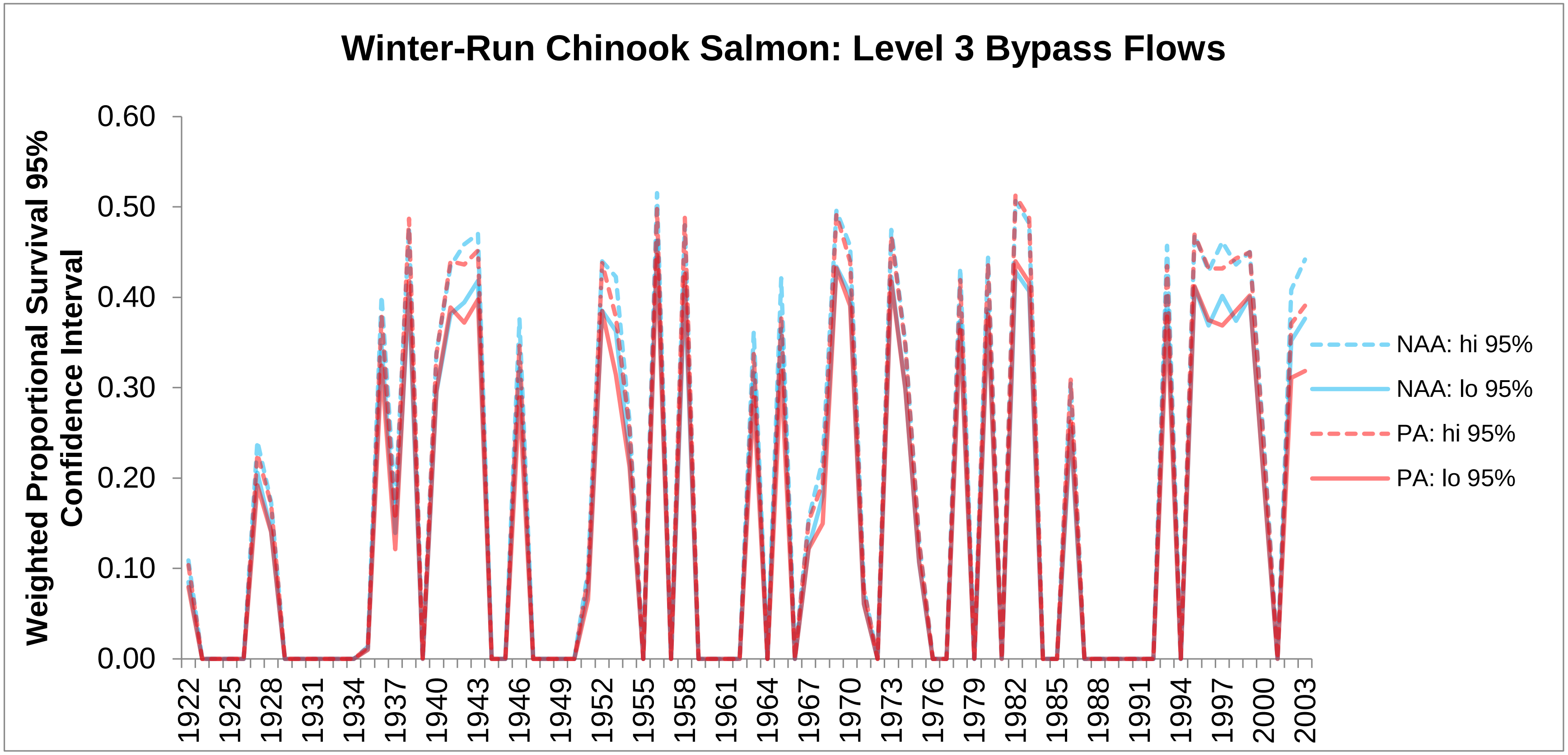
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during Level 1 NDD bypass flows.

Figure 5.D-67. Time Series of 95% Confidence Interval Annual Juvenile Winter-Run Chinook Salmon Through-Delta Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Level 1 NDD Bypass Flows.



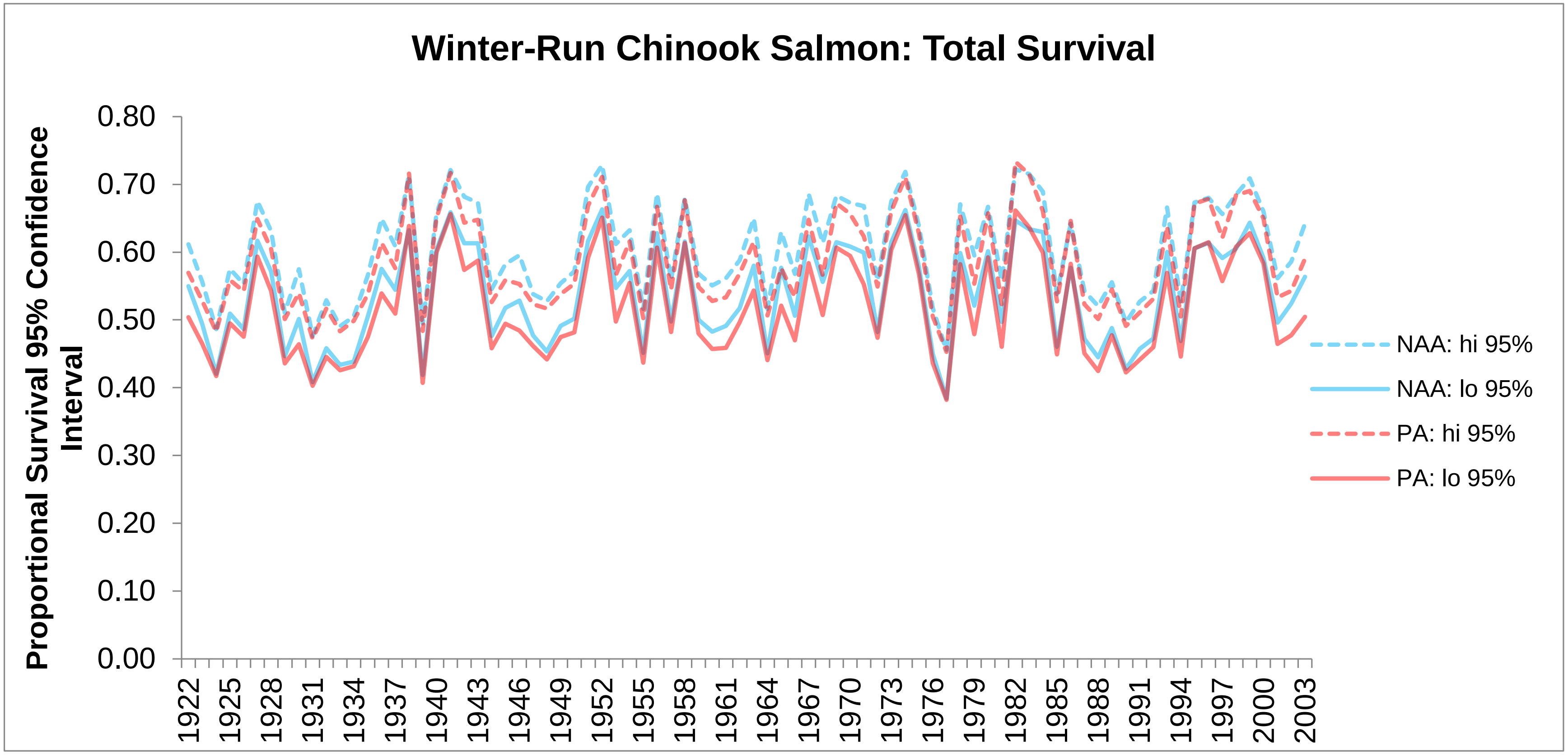
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during Level 2 NDD bypass flows.

Figure 5.D-68. Time Series of 95% Confidence Interval Annual Juvenile Winter-Run Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Level 2 NDD Bypass Flows.



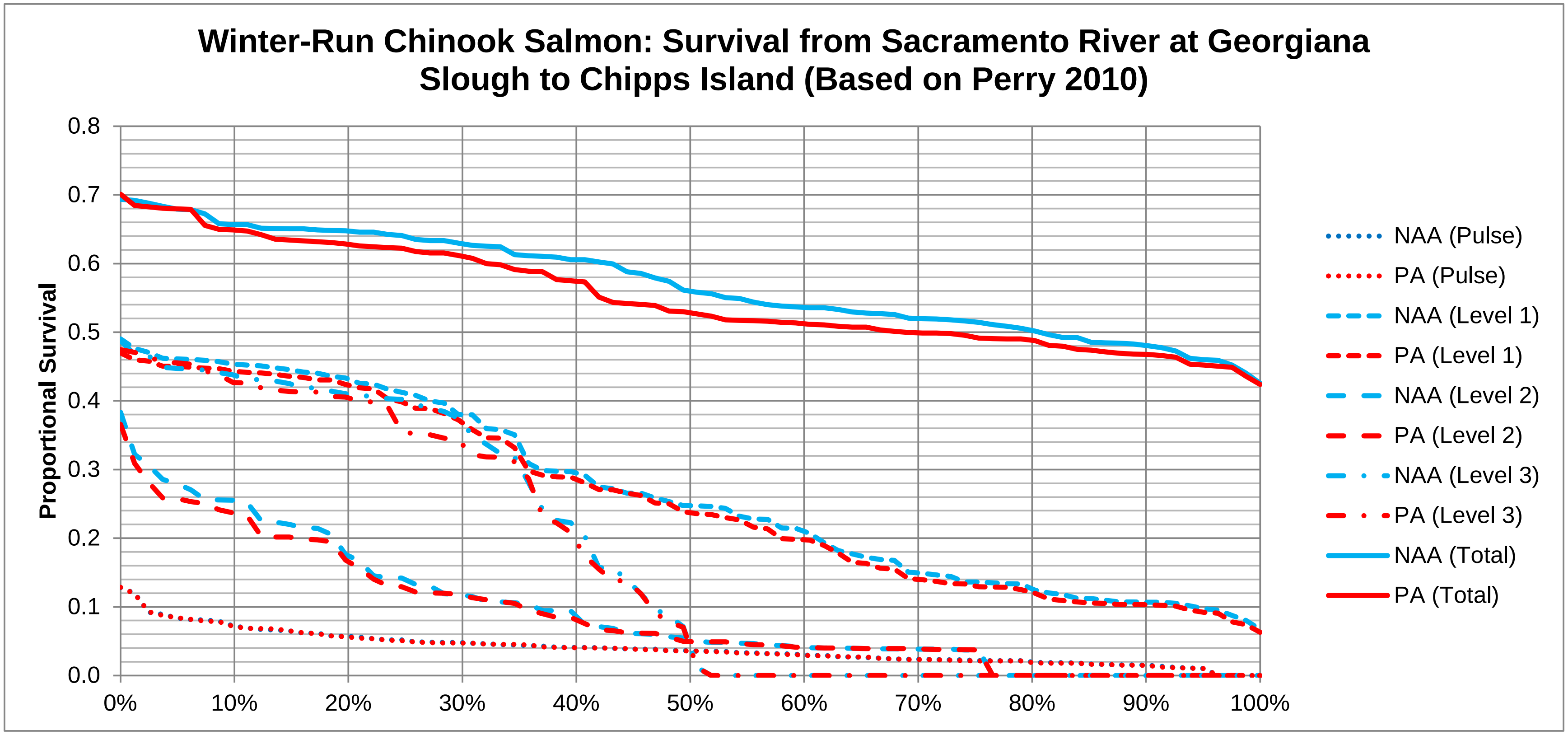
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during Level 3 NDD bypass flows.

Figure 5.D-69. Time Series of 95% Confidence Interval Annual Juvenile Winter-Run Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Level 3 NDD Bypass Flows.



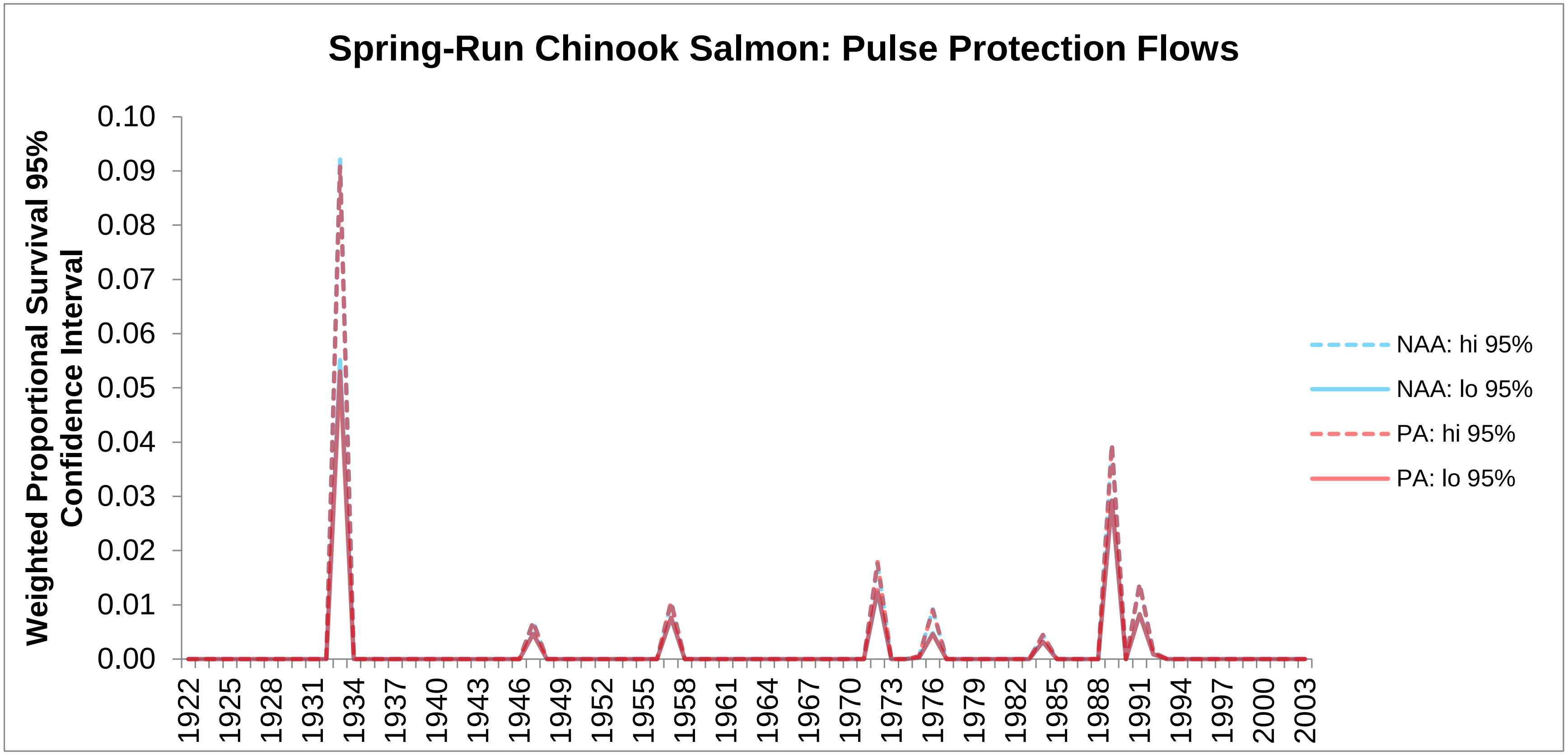
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship.

Figure 5.D-70. Time Series of 95% Confidence Interval Annual Juvenile Winter-Run Chinook Salmon Total Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010).



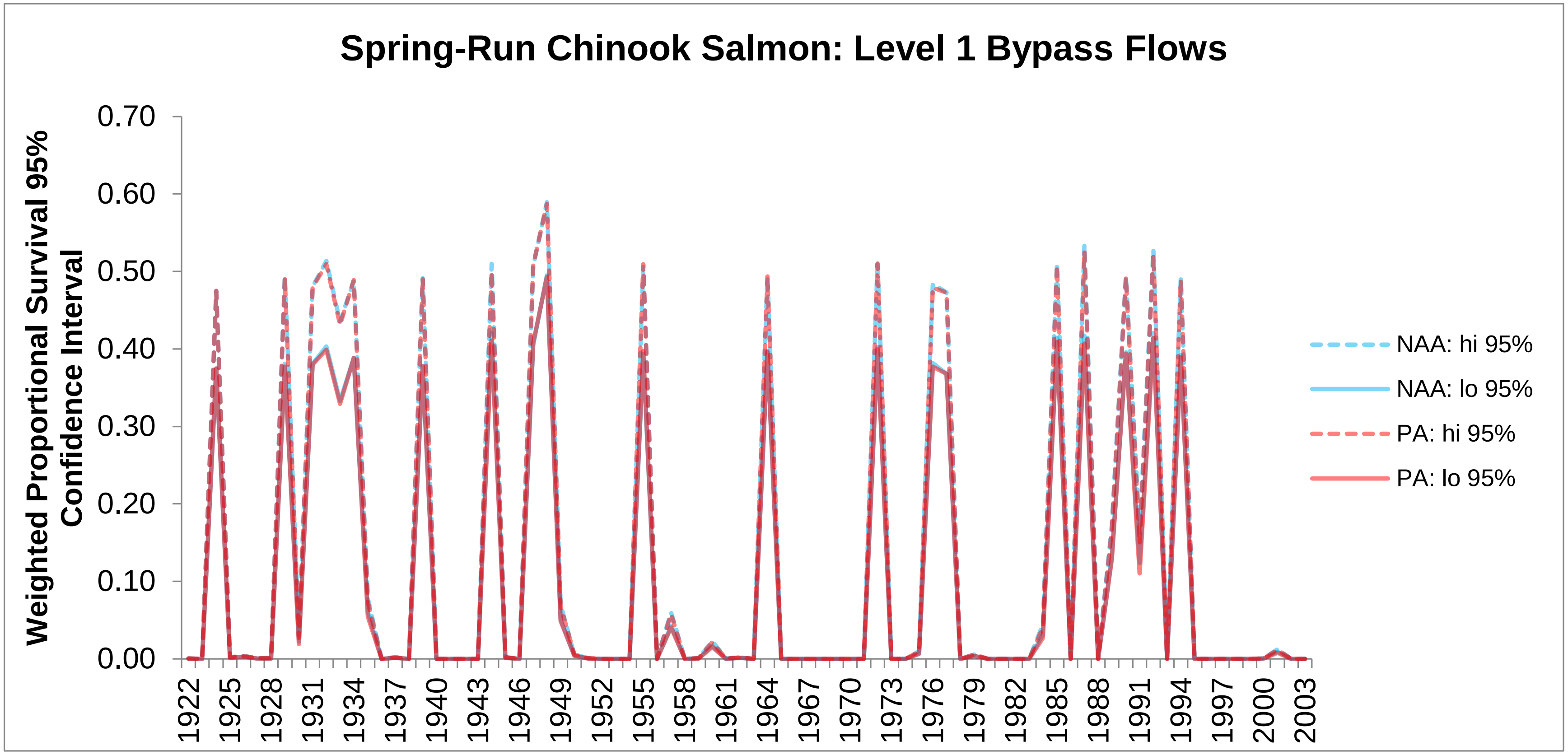
Note: Plot only includes annual mean responses and does not consider model uncertainty.

Figure 5.D-71. Exceedance Plot of Annual Juvenile Winter-Run Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), By NDD Bypass Flow Level.



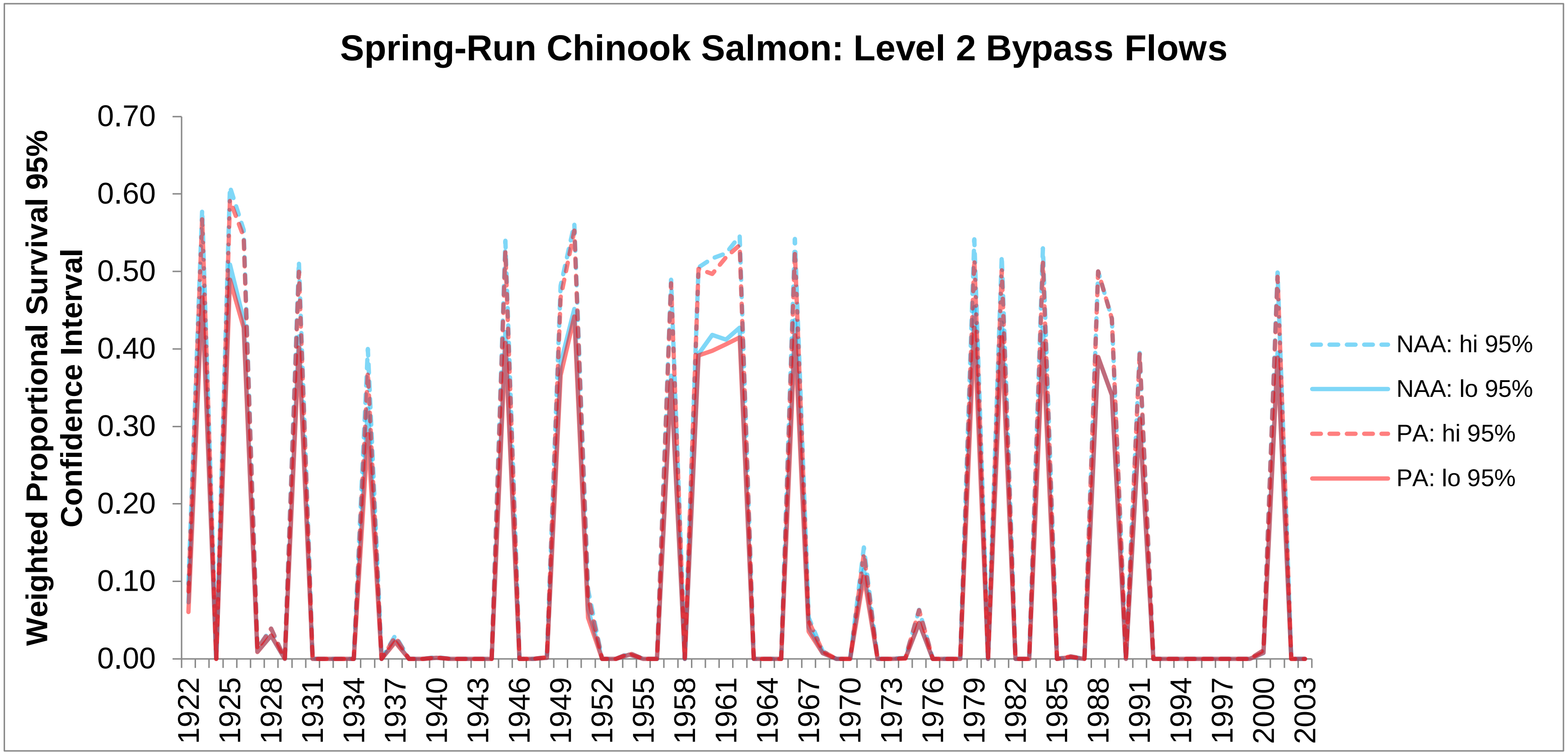
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during pulse protection flows.

Figure 5.D-72. Time Series of 95% Confidence Interval Annual Juvenile Spring-Run Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Pulse Protection Flows.



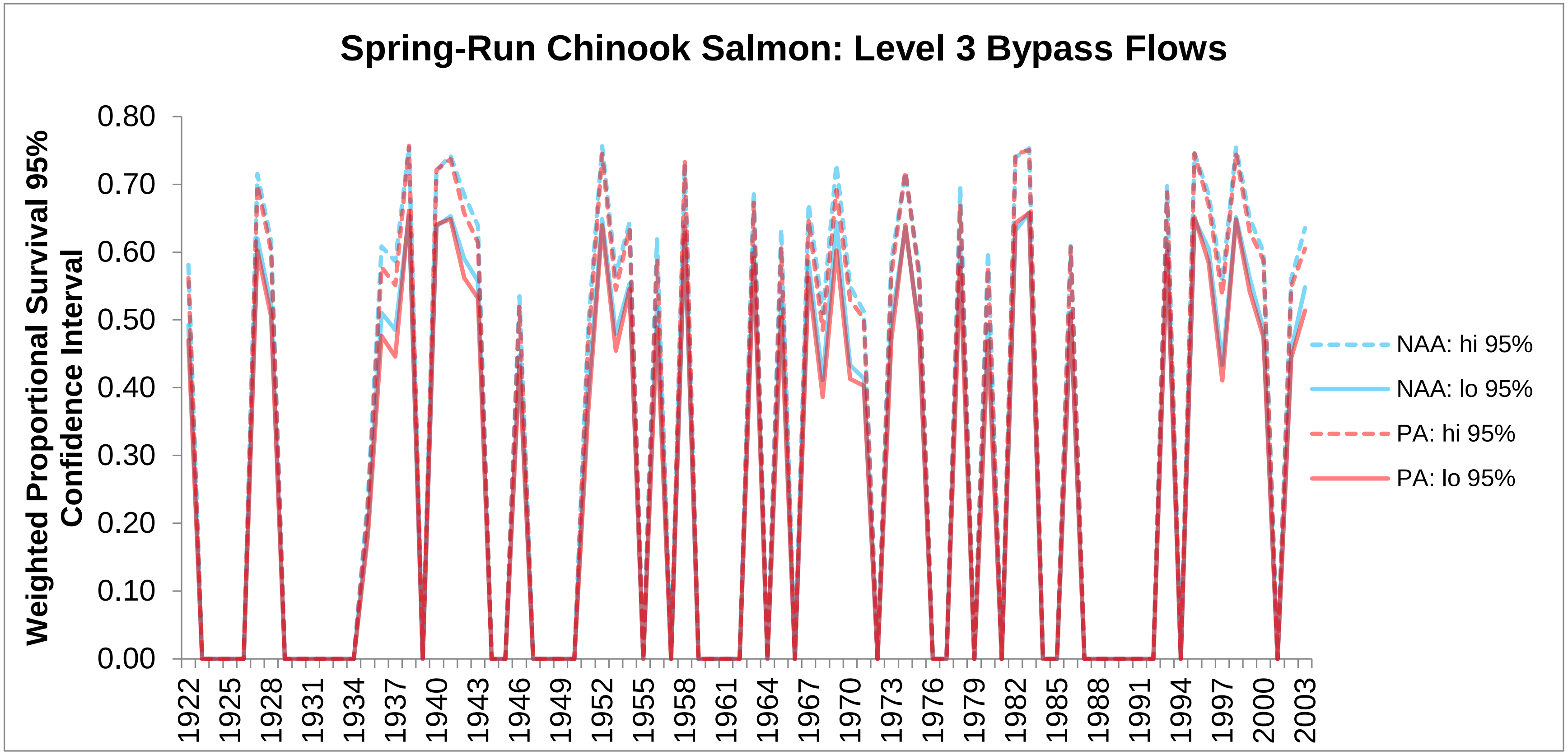
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during Level 1 NDD bypass flows.

Figure 5.D-73. Time Series of 95% Confidence Interval Annual Juvenile Spring-Run Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Level 1 NDD Bypass Flows.



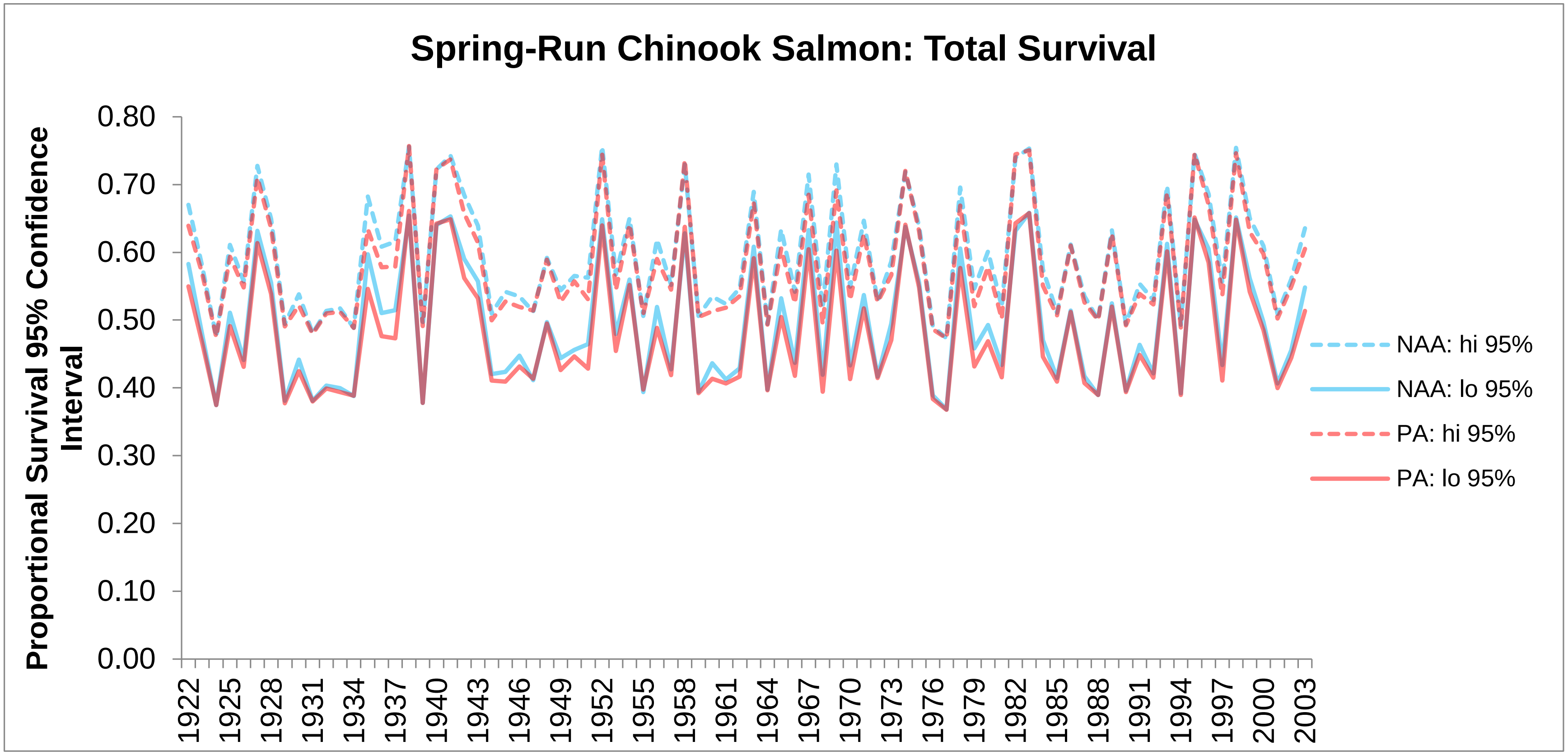
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during Level 2 NDD bypass flows.

Figure 5.D-74. Time Series of 95% Confidence Interval Annual Juvenile Spring-Run Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Level 2 NDD Bypass Flows.



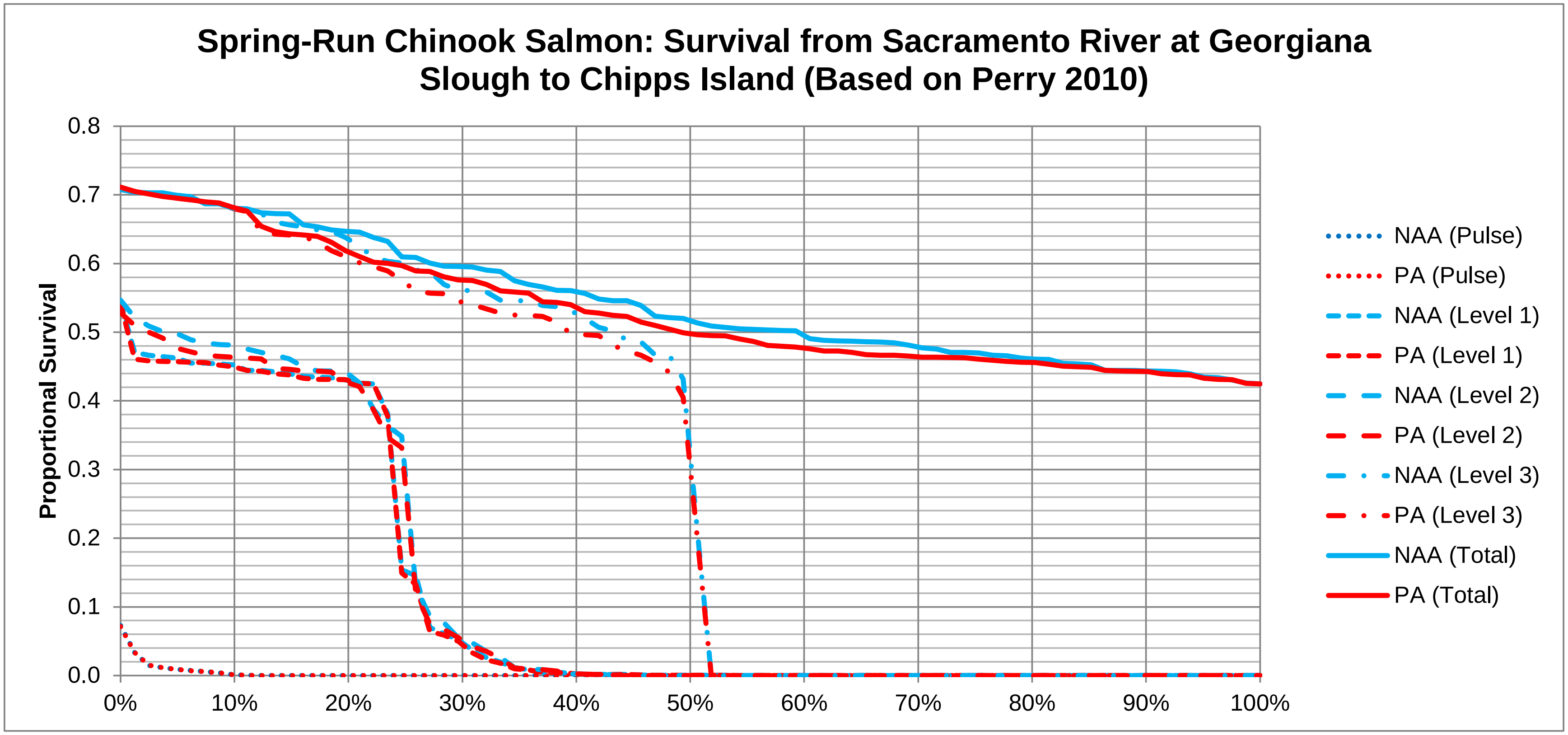
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during Level 3 NDD bypass flows.

Figure 5.D-75. Time Series of 95% Confidence Interval Annual Juvenile Spring-Run Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Level 3 NDD Bypass Flows.



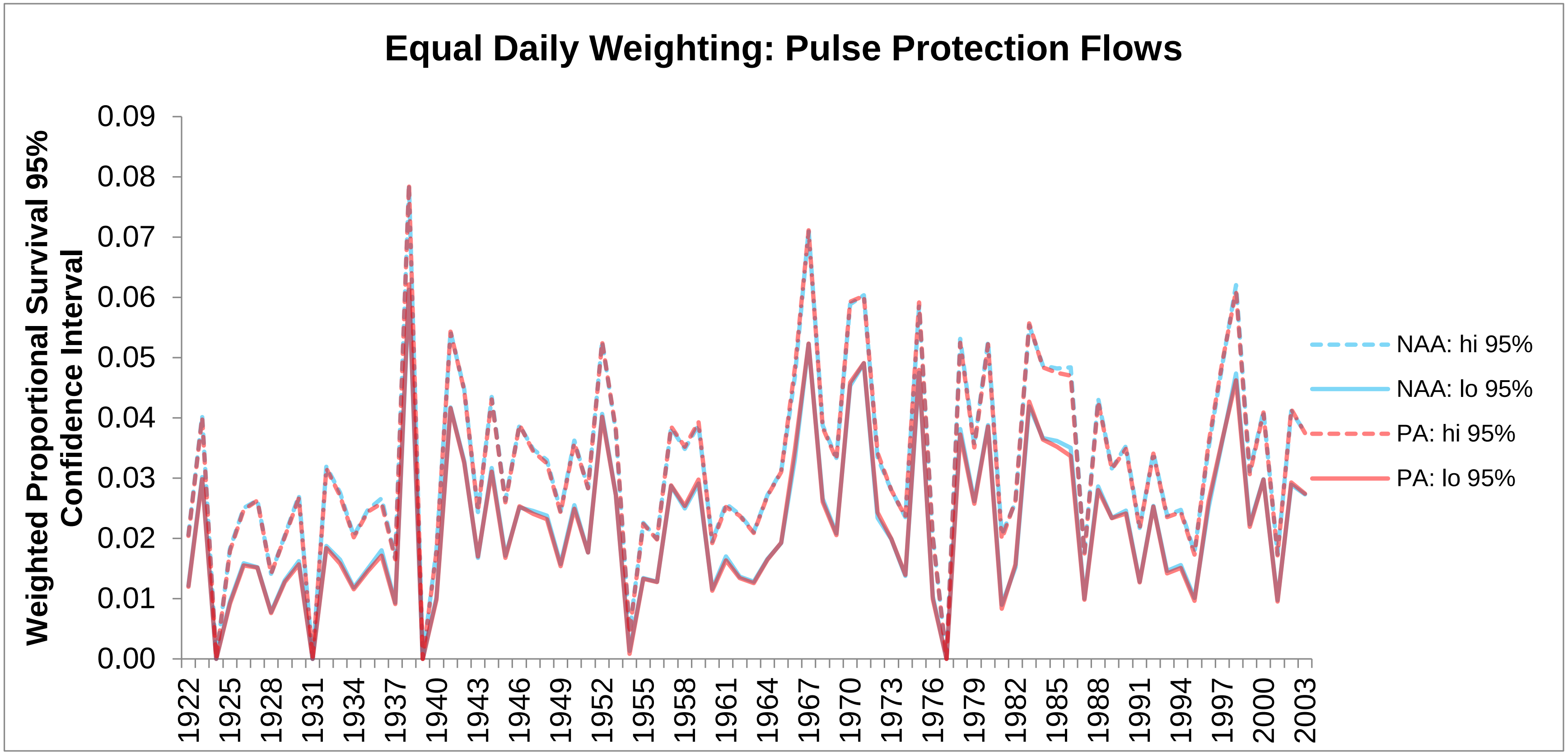
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship.

Figure 5.D-76. Time Series of 95% Confidence Interval Annual Juvenile Spring-Run Chinook Salmon Total Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010).



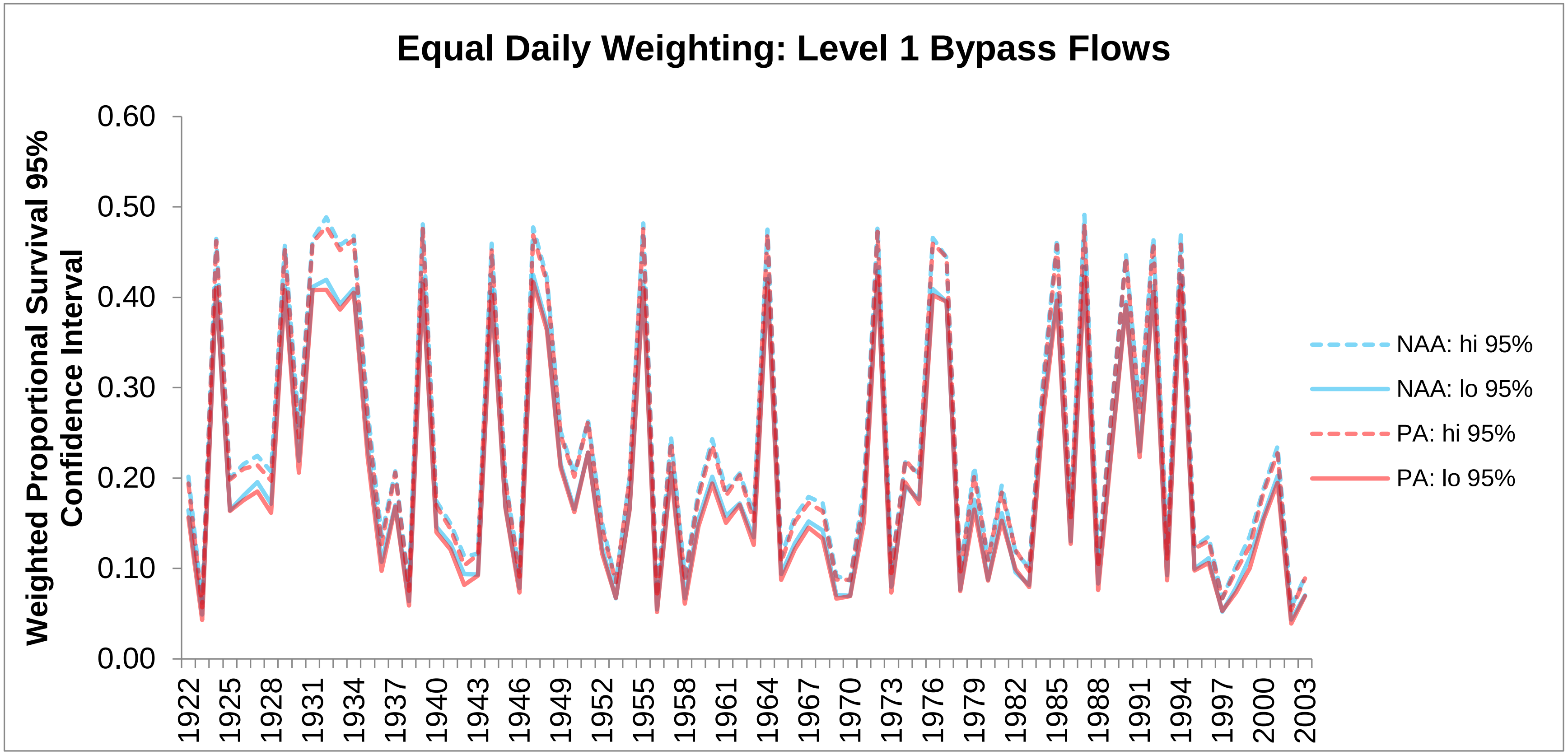
Note: Plot only includes annual mean responses and does not consider model uncertainty.

Figure 5.D-77. Exceedance Plot of Annual Juvenile Spring-Run Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), By NDD Bypass Flow Level.



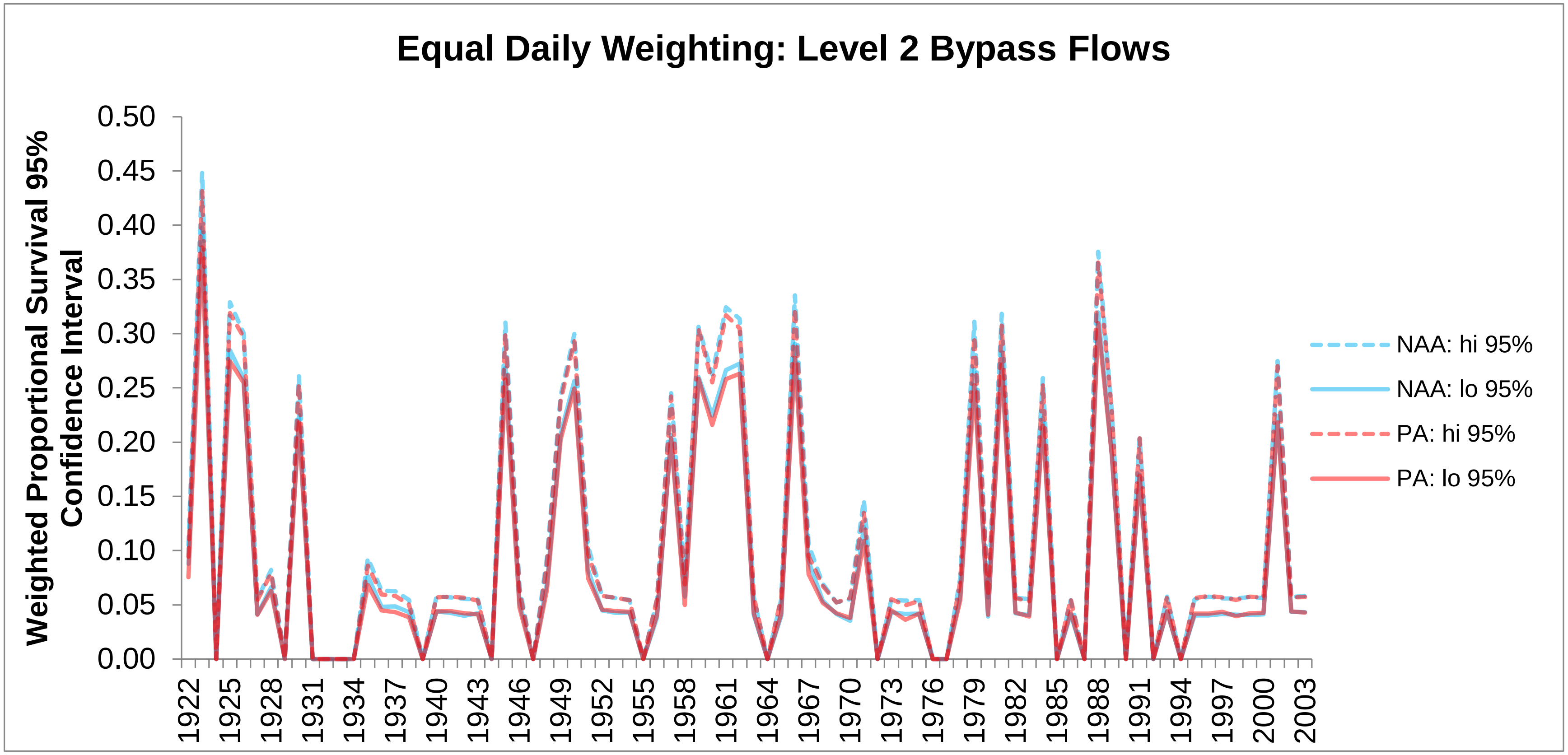
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during pulse protection flows.

Figure 5.D-78. Time Series of 95% Confidence Interval Annual Juvenile Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Pulse Protection Flows, Assuming Equal Daily Weighting from December to June.



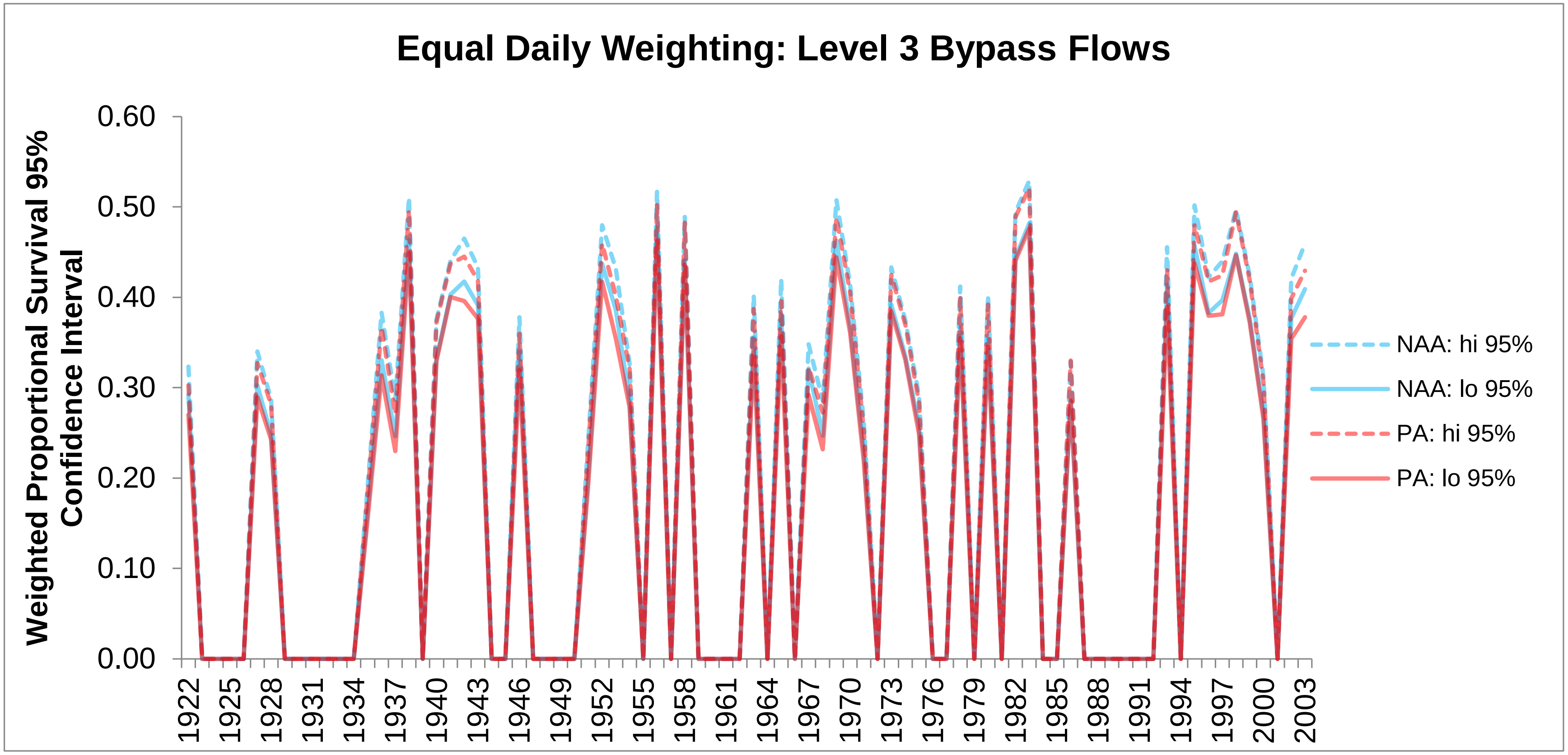
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during Level 1 NDD bypass flows.

Figure 5.D-79. Time Series of 95% Confidence Interval Annual Juvenile Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Level 1 NDD Bypass Flows, Assuming Equal Daily Weighting from December to June.



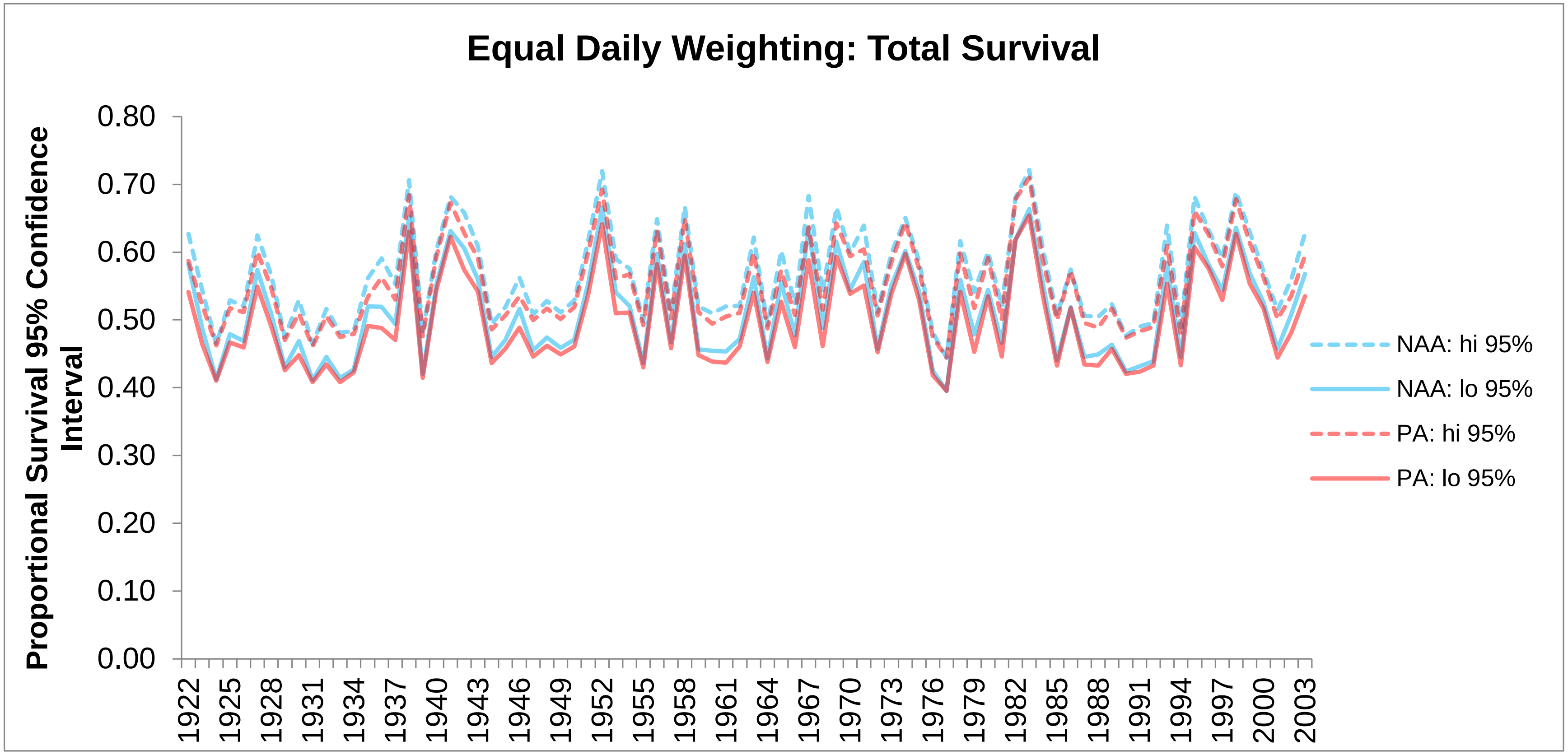
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during Level 2 NDD bypass flows.

Figure 5.D-80. Time Series of 95% Confidence Interval Annual Juvenile Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Level 2 NDD Bypass Flows, Assuming Equal Daily Weighting from December to June.



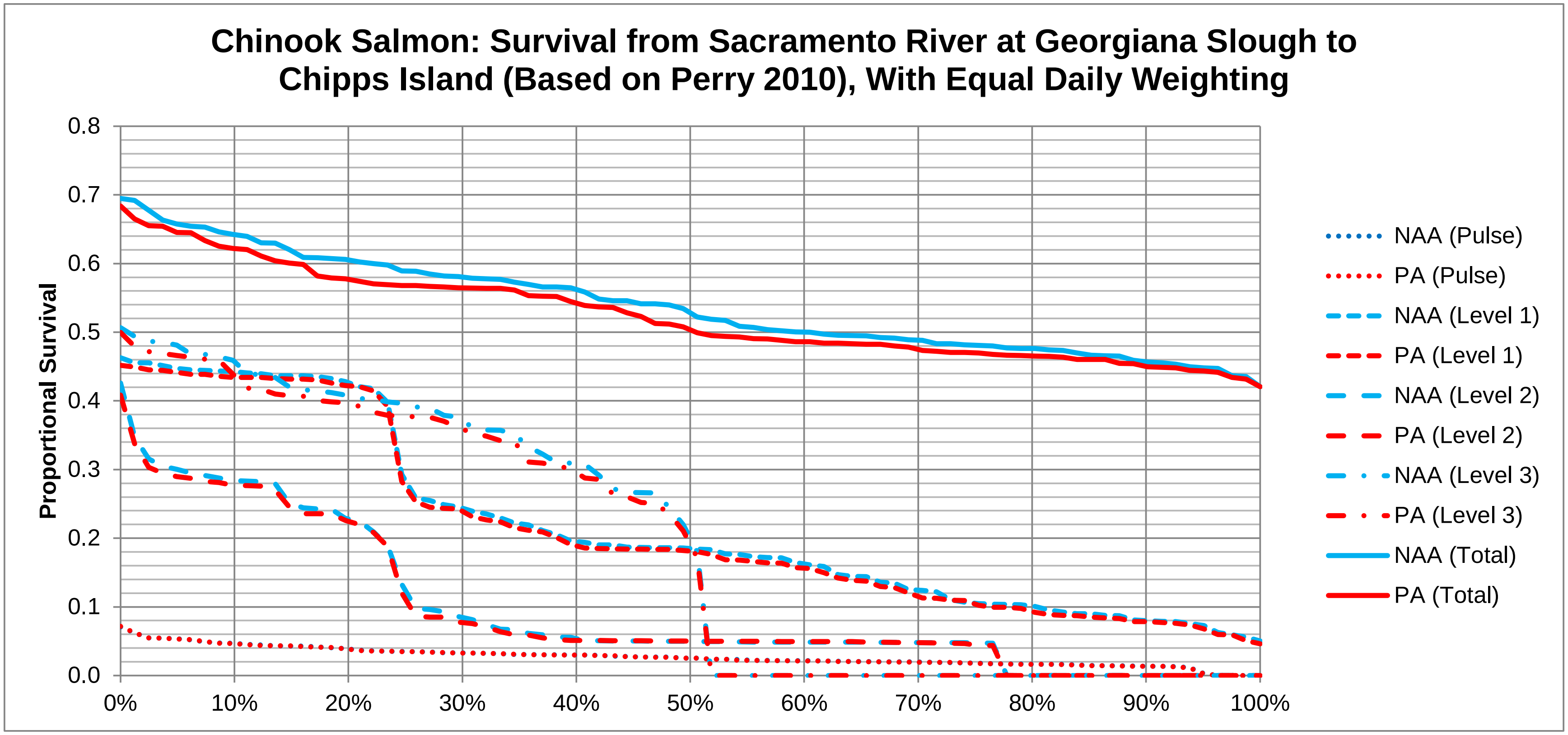
Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship. Survival is weighted by the proportion of the juvenile population occurring during Level 3 NDD bypass flows.

Figure 5.D-81. Time Series of 95% Confidence Interval Annual Juvenile Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), During Level 3 NDD Bypass Flows, Assuming Equal Daily Weighting from December to June.



Note: Lines indicate 95% confidence intervals from the 75 iterations of the DPM's implementation of the Perry (2010) flow-survival relationship.

Figure 5.D-82. Time Series of 95% Confidence Interval Annual Juvenile Chinook Salmon Total Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), Assuming Equal Daily Weighting from December to June.



Note: Plot only includes annual mean responses and does not consider model uncertainty.

Figure 5.D-83. Exceedance Plot of Annual Juvenile Chinook Salmon Weighted Survival from the Sacramento River at Georgiana Slough to Chipps Island, Estimated from the Analysis Based on Perry (2010), By NDD Bypass Flow Level and Assuming Equal Daily Weighting from December to June.

5.D.1.3 Habitat Suitability

5.D.1.3.1 Bench Inundation

As described in Chapter 5, *Effects Analysis for Chinook Slamon, Central Valley Steelhead, Green Sturgeon, and Killer Whale,* PA operations have the potential to affect the extent of riparian and wetland bench inundation (e.g., by lowering water surface elevation downstream of the NDD), thereby affecting the suitability of channel margin habitat for juvenile Chinook salmon. This potential effect was assessed by calculating bench inundation indices for a number of habitat benches in the north Delta.

Data for 37 riparian benches (total length = 31,428 ft; 6.0 miles) and 17 wetland benches (total length = 15,973 ft; 3.0 miles) in the north Delta were obtained (Table 5.D-47). Some riparian and wetland benches were located at the same site (Figure 5.D-84), indicated in Table 5.D-47 by having the same number in their codes. Each bench belonged to one of five grouped geographic locations, and each bench was matched with the nearest DSM2-HYDRO output location for which stage data were available.

In order to represent inundation of differing levels of the benches over their entire elevations, four equally spaced increments were calculated between the minimum and maximum elevations. For example, riparian bench R1 in Cache Slough (minimum elevation = 4.3 ft, maximum elevation = 6.3 ft) was divided into the increments 4.3 ft, 4.8 ft, 5.3 ft, and 5.8 ft. In essence, this process divided each bench into four sub-benches, each of slightly different elevation. This process was adopted because division into regular increments (e.g., every 0.5 ft or every 1 ft) would have been computationally intensive because the difference between maximum and minimum elevations was 5 ft or more in some cases (e.g., riparian bench R5), whereas for others the difference was small (less than 2 ft).

Water depth on each sub-bench was calculated for every 15-minute time step available from the 1922-2003 DSM2-HYDRO simulation. The depth was calculated as the difference between the water surface elevation at the nearest DSM2-HYDRO output location and the sub-bench elevation; if this calculation was negative, it indicated that the water was below the level of the sub-bench, and water depth was zero. Water depth was converted to a habitat suitability score by applying the suitability curve from USFWS (2005) for juvenile Chinook salmon (Figure 5.D-85). USFWS (2005) provides several different curves, but the curve for juvenile Chinook salmon was selected because it represents juveniles >60 mm in length, which is representative of most winter-run-sized juvenile Chinook salmon entering the Delta, for example (del Rosario et al. 2013).

The habitat suitability score for each sub-bench in each 15-minute period was then multiplied by the length of the site at which each sub-bench occurred. An overall bench inundation index was calculated for each bench type in each of the five geographic locations in each season (winter: December-February; spring: March-June) in each water year, by summing all of the applicable 15-minute length-weighted habitat suitability scores, then dividing by the sum of the corresponding site lengths for all of these observations. This final bench inundation index represents the overall suitability of bench habitat for juvenile Chinook salmon, based on water depth. The index ranges from 0 (no water of suitable depth available at any time) to 1 (optimal water depth available at all times on all sub-benches).

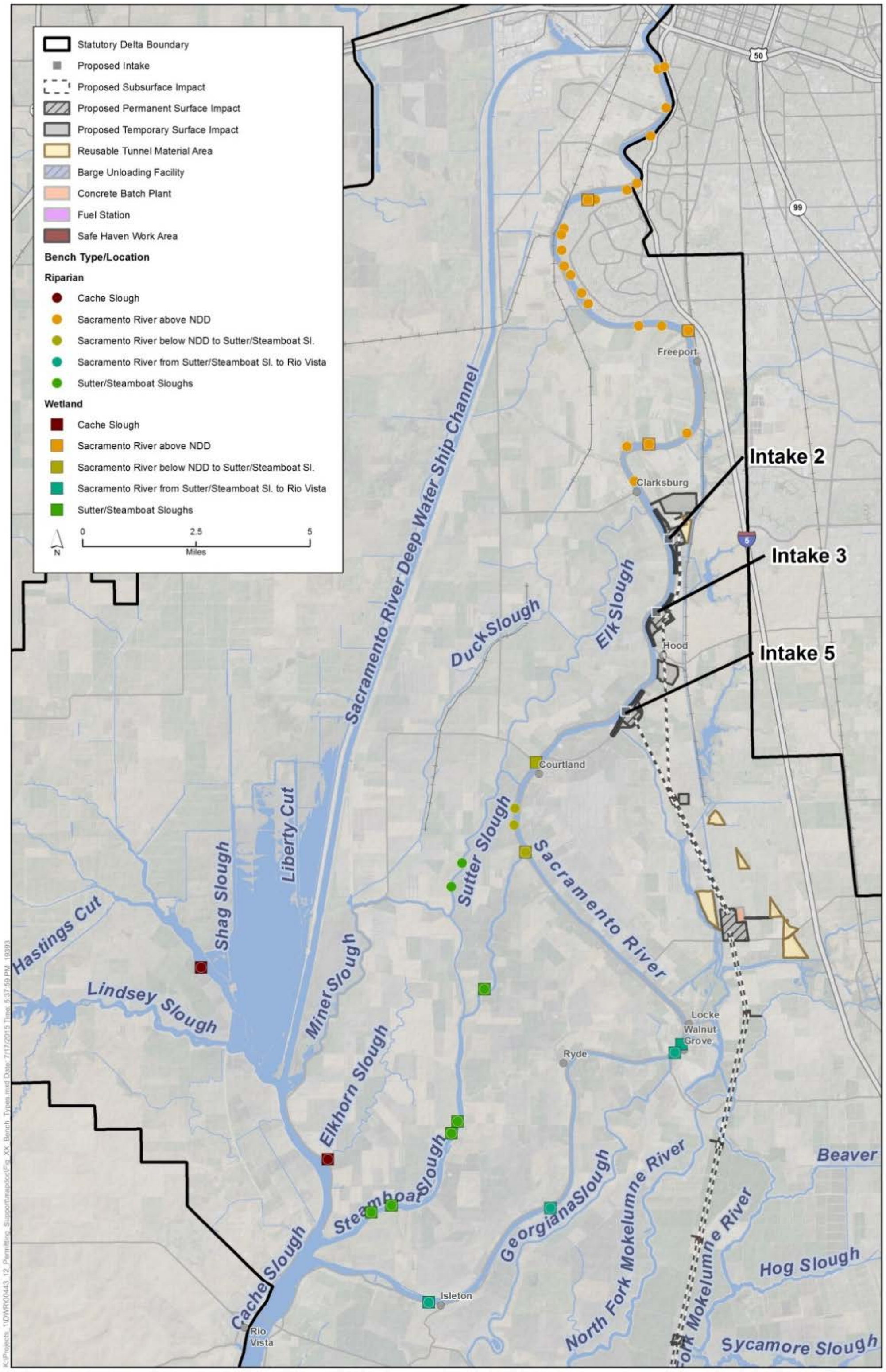
The results of the analysis were summarized by water year type and are presented in Chapter 5.

Table 5.D-47. Characteristics of the Benches Analyzed for Inundation Effects of the PA.

Bench Type	Code	Location	Water body	Length (ft)	Min. Elevation (ft NAVD)	Max. Elevation (ft NAVD)	DSM2-HYDRO Node
Riparian	R1	Cache Slough	Cache Slough	495	4.3	6.3	CACHE_RYER
	R2	Sacramento River above NDD	Sacramento River	268	5.0	10.0	NDD_US
	R3	Sacramento River above NDD	Sacramento River	894	5.0	10.0	NDD_US
	R4	Sacramento River above NDD	Sacramento River	166	5.0	10.0	NDD_US
	R5	Sacramento River above NDD	Sacramento River	322	5.1	10.4	NDD_US
	R6	Sacramento River above NDD	Sacramento River	285	5.8	10.4	NDD_US
	R7	Sacramento River above NDD	Sacramento River	1,254	6.0	8.6	NDD_US
	R8	Sacramento River above NDD	Sacramento River	1,320	6.0	10.6	NDD_US
	R9	Sacramento River above NDD	Sacramento River	730	6.5	7.5	NDD_US
	R10	Sacramento River above NDD	Sacramento River	1,061	7.1	8.3	NDD_US
	R11	Sacramento River above NDD	Sacramento River	1,473	8.0	10.0	NDD_US
	R12	Sacramento River above NDD	Sacramento River	329	8.0	10.0	NDD_US
	R13	Sacramento River above NDD	Sacramento River	888	8.0	10.0	NDD_US
	R14	Sacramento River above NDD	Sacramento River	720	8.0	10.0	NDD_US
	R15	Sacramento River above NDD	Sacramento River	1,566	8.0	10.0	NDD_US
	R16	Sacramento River above NDD	Sacramento River	298	8.0	10.0	NDD_US
	R17	Sacramento River above NDD	Sacramento River	970	8.0	12.0	NDD_US
	R18	Sacramento River above NDD	Sacramento River	770	3.9	3.9	NDD_US
	R19	Sacramento River from Sutter/Steamboat Sl. to Rio Vista	Sacramento River	210	5.0	5.8	RSAC123
	R21	Sacramento River from Sutter/Steamboat Sl. to Rio Vista	Sacramento River	660	4.6	6.6	RSAC123
	R22	Sacramento River from Sutter/Steamboat Sl. to Rio Vista	Sacramento River	815	5.0	7.0	RSAC123
	R24	Sacramento River above NDD	Sacramento River	1,322	4.6	13.9	RSAC155
	R25	Sacramento River above NDD	Sacramento River	198	5.5	8.2	RSAC155
	R26	Sacramento River above NDD	Sacramento River	1,124	6.1	9.1	RSAC155
	R27	Sacramento River above NDD	Sacramento River	1,668	6.3	8.5	RSAC155
	R28	Sacramento River above NDD	Sacramento River	895	8.0	12.0	RSAC155
	R29	Sacramento River below NDD to Sutter/Steamboat Sl.	Sacramento River	292	4.9	5.5	SAC_DS_SUTSL
	R30	Sacramento River below NDD to Sutter/Steamboat Sl.	Sacramento River	420	5.5	6.1	SAC_DS_SUTSL
	R31	Sacramento River below NDD to Sutter/Steamboat Sl.	Sacramento River	2,325	6.2	8.2	SAC_DS_SUTSL

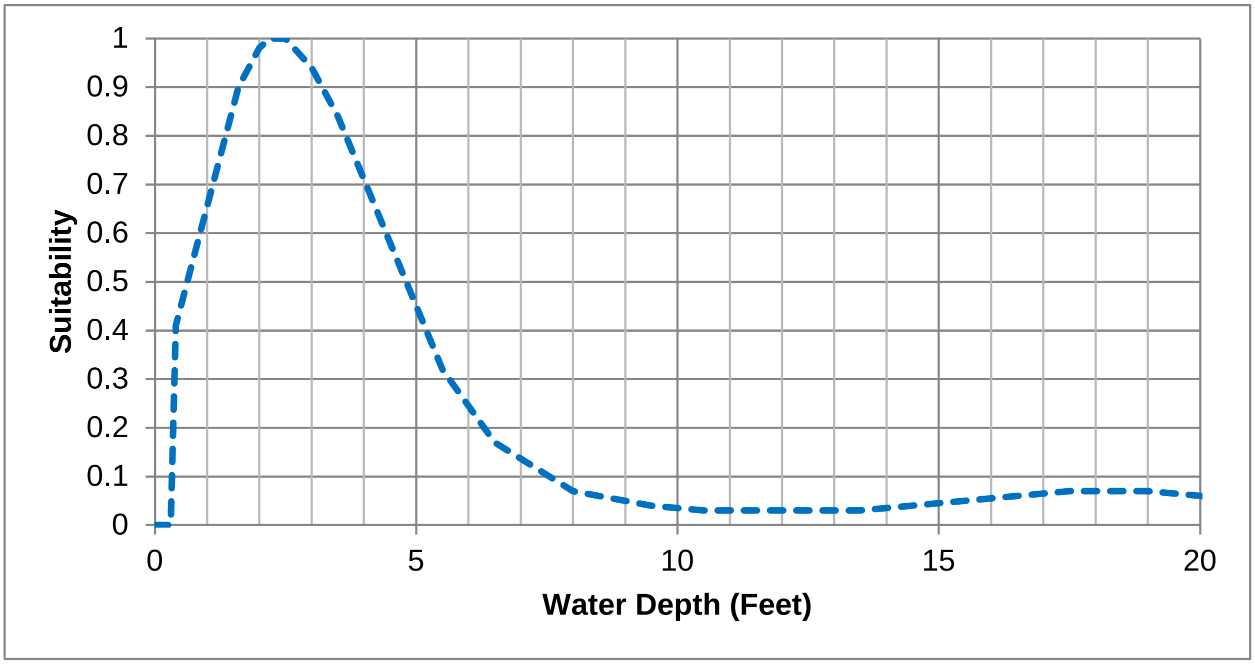
Bench Type	Code	Location	Water body	Length (ft)	Min. Elevation (ft NAVD)	Max. Elevation (ft NAVD)	DSM2-HYDRO Node
	R33	Cache Slough	Cache Slough	2,455	4.6	6.6	SLCCH016
	R34	Sutter/Steamboat Sloughs	Steamboat Slough	708	2.1	5.0	SLSBT011
	R35	Sutter/Steamboat Sloughs	Steamboat Slough	740	2.1	8.0	SLSBT011
	R36	Sutter/Steamboat Sloughs	Steamboat Slough	439	5.1	7.0	SLSBT011
	R37	Sutter/Steamboat Sloughs	Steamboat Slough	430	4.3	6.3	SLSBT011
	R38	Sutter/Steamboat Sloughs	Steamboat Slough	353	5.1	5.8	STMBT_SL
	R39	Sutter/Steamboat Sloughs	Sutter Slough	1,415	4.2	7.2	SUT_US_MIN
	R40	Sutter/Steamboat Sloughs	Sutter Slough	1,150	4.2	7.2	SUT_US_MIN
Wetland	W1	Cache Slough	Cache Slough	495	2.3	4.3	CACHE_RYER
	W8	Sacramento River above NDD	Sacramento River	1,320	2.9	4.1	NDD_US
	W19	Sacramento River from Sutter/Steamboat Sl. to Rio Vista	Sacramento River	210	0.9	2.1	RSAC123
	W20	Sacramento River from Sutter/Steamboat Sl. to Rio Vista	Sacramento River	745	-0.5	3.4	RSAC123
	W21	Sacramento River from Sutter/Steamboat Sl. to Rio Vista	Sacramento River	660	2.6	4.6	RSAC123
	W22	Sacramento River from Sutter/Steamboat Sl. to Rio Vista	Sacramento River	815	2.9	4.9	RSAC123
	W23	Sacramento River below NDD to Sutter/Steamboat Sl.	Sacramento River	790	-0.5	3.4	RSAC142
	W24	Sacramento River above NDD	Sacramento River	1,322	-0.8	4.2	RSAC155
	W26	Sacramento River above NDD	Sacramento River	1,124	1.8	2.8	RSAC155
	W31	Sacramento River below NDD to Sutter/Steamboat Sl.	Sacramento River	2,325	3.2	5.2	SAC_DS_SUT SL
	W32	Cache Slough	Cache Slough	1,042	0.9	2.1	SLCCH016
	W33	Cache Slough	Cache Slough	2,455	2.6	4.6	SLCCH016
	W34	Sutter/Steamboat Sloughs	Steamboat Slough	708	0.9	2.1	SLSBT011
	W35	Sutter/Steamboat Sloughs	Steamboat Slough	740	0.9	2.1	SLSBT011
	W36	Sutter/Steamboat Sloughs	Steamboat Slough	439	0.9	2.1	SLSBT011
	W37	Sutter/Steamboat Sloughs	Steamboat Slough	430	2.3	4.3	SLSBT011
	W38	Sutter/Steamboat Sloughs	Steamboat Slough	353	0.9	2.1	STMBT_SL

Source: US Army Corps of Engineers and California Department of Water Resources Databases.



Source: US Army Corps of Engineers and California Department of Water Resources Databases.

Figure 5.D-84. Benches Analyzed for Inundation Effects of the PA.



Source: USFWS (2005).

Figure 5.D-85. Habitat Suitability Curve for Juvenile Chinook Salmon.

5.D.2 Upstream Effects

5.D.2.1 Water Temperature Methods

5.D.2.1.1 Introduction

Water temperatures can have adverse lethal and sublethal effects to listed salmonids and green sturgeon. To determine whether there would be water temperature-related effects, this analysis used daily modeled water temperatures from HEC-5Q models for the Sacramento and American Rivers.

Water temperature results for key locations in the Sacramento and American Rivers are reported in Appendix 5.C, *Upstream Water Temperature Methods and Results*. Results in Appendix 5.C are presented as: (1) mean monthly exceedance plots; (2) box and whiskers plots, with mean, median, quartiles, and 25th and 75th percentile values indicated; and (3) a table of summary statistics and differences between NAA and PA for each statistic.

There were several methods used in this effects analysis to determine whether there would be effects of the proposed action on listed salmonids and green sturgeon and their critical habitat. The methods vary by river, race/species, and life stage (Table 5.D-48). The first analysis characterized the results of physical model outputs to identify whether there are any locations, months, or water year types that require a more detailed analysis. The second analysis determined the frequency and magnitude of exceedance above one or more water temperature thresholds for each life stage, race/species, and location. The third and fourth methods involved an evaluation of water temperature-related mortality in the Sacramento River for winter- and spring-run Chinook salmon using the Reclamation Egg Mortality Model and SALMOD.

No water temperature analyses were conducted for the Trinity, Stanislaus, and San Joaquin Rivers and Clear Creek because preliminary visual review of the data presented as monthly means by water year type, exceedance plots, and box-and-whisker plots indicated that there were no differences in water temperature between NAA and PA in these rivers (Appendix 5.C, *Upstream Water Temperature Methods and Results*, Section 5.C.7, *Upstream Water Temperature Modeling Results*).

Table 5.D-48. Water Temperature Analysis Methods Used in Each River, Species, and Life Stage

Life stage(s)	Method Used			
	Physical Model Output Characterization	**Water Temperature Thresholds Analysis**	**Egg Mortality Model**	**SALMOD – Temperature-Related Mortality**
Sacramento River				
Winter-run Chinook Salmon				
Spawning, egg incubation, and alevins	X	X	X	X
Fry and juvenile rearing	X	X		X
Juvenile emigration	X	X		
Adult immigration	X	X		
Adult holding	X	X		
Spring-run Chinook Salmon				
Spawning, egg incubation, and alevins	X	X	X	X
Fry and juvenile rearing	X	X		X
Juvenile emigration	X	X		
Adult immigration	X	X		
Adult holding	X	X		
Steelhead				
Spawning, egg incubation, and alevins	X	X		
Kelt emigration	X	X		
Juvenile rearing	X	X		
Smolt emigration (not migrant parr)	X	X		
Adult immigration	X	X		
Adult holding	X	X		
Green Sturgeon				
Spawning, egg incubation	X	X		
Pre- and post-spawn adult holding	X	X		
Post-spawn emigration	X	X		
Larval to Juvenile rearing and emigration	X	X		
Adult immigration	X	X		
American River				
Steelhead				
Spawning, egg incubation, and alevins	X	X		
Kelt emigration	X	X		
Juvenile rearing	X	X		
Smolt emigration	X	X		
Adult immigration	X	X		
Adult holding	X	X		

5.D.2.1.2 Detailed Methods

5.D.2.1.2.1 Physical Model Output Characterization

Patterns in water temperatures at key locations within the Sacramento and American Rivers were evaluated for each month that a life stage of each race/species was present and were summarized at the beginning of the section for each species and life stage. The purpose of this characterization was to identify whether there were any locations, months, or water year types in which differences in water temperatures between the PA and NAA could potentially cause a biologically meaningful effect. It included an evaluation of exceedance plots of mean monthly water temperature by month, box and whisker plots, and differences in mean monthly water temperatures by month and water year type, all of which can be found in Appendix 5.C, *Upstream Water Temperature Methods and Results*, Section 5.C.7, *Upstream Water Temperature Modeling Results*. No strict criteria were used to determine a biologically meaningful effect from these physical modeling results for this characterization step. However, if a specific result appeared concerning based on best professional judgment, the month, water year type, and location with the concerning result was flagged as requiring close examination in the results of the remaining water temperature evaluation. In addition, specifics of the month, water year type, and location with the concerning result were closely reviewed to determine the cause of the result and to determine whether the modeled effect could be avoided during real time operations.

5.D.2.1.2.2 Water Temperature Threshold Analysis

This analysis determined the frequency and magnitude of exceedance above one or more water temperature thresholds obtained from the scientific literature and USEPA guidance for each race/species and life stage at multiple locations within Sacramento River (Table 5.D-49) and American River (Table 5.D-50). Because USEPA criteria are provided as seven-day average daily maximum (7DADM) and water temperature model outputs are monthly means, an additional conversion step was performed to convert 7DADM values into monthly means, which involved first calculating daily mean and maximum values from historical stream gage data for multiple locations in the Sacramento and American Rivers obtained from the California Data Exchange Center web site (cdec.ca.gov). The 7DADM was calculated for each day using the mean of that day and the preceding 6 days. Next, the difference between 7DADM and mean daily values was calculated for each day. Finally, for each location, the mean monthly difference between 7DADM and mean daily values was calculated. This difference was used as a conversion value to adjust water temperature threshold values. These conversion values are presented by month in Table 5.D-51 for the Sacramento River and Table 5.D-52 for the American River.

The threshold analysis consisted of three steps. First, the total number of days across the 82-year modeling period on which the modeled temperature exceeded a given threshold in Table 5.D-49 was divided by the total number of days for each month and water year type to provide the frequency of exceedance above the threshold for each scenario. The difference in frequency of exceedance between NAA and PA was then calculated for each month and water year type.

Second, for all days on which the modeled temperature exceeded a given temperature threshold as shown in Table 5.D-49, the cumulative degrees exceeded were summed as a degree-day total by month and water year type across the 82-year modeling period and divided by the total number of days on which the threshold was exceeded, to provide the average daily exceedance for those days that exceeded the threshold temperature. The difference in average daily exceedance between NAA and PA for a given month and water year type was then calculated. Combined, these calculations provided a magnitude and frequency of exceedance above a given temperature threshold.

The final step identified in which months and water year types there would be a biologically meaningful effect by looking at both frequency and magnitude combined. The step defined a *biologically meaningful* effect as the months and water year types in which water temperature results met two criteria: (1) the difference in frequency of exceedance between NAA and PA was greater than 5%, and (2) the difference in average daily exceedance was greater than 0.5°F. The 5% criterion was based on best professional judgment of fisheries biologists from NMFS, CDFW, DWR, and Reclamation. The 0.5°F criterion was based on: (1) a review of the water temperature-related mortality rates for steelhead eggs and juveniles (D. Swank, pers. comm.), and (2) a reasonable water temperature differential that could be resolved through real-time reservoir operations. The 0.5°F value was applied to all species/races and life stages although it was based on data for steelhead eggs and juveniles. For those months and water year types that met these two conditions, a thorough review was conducted to determine whether these patterns were persistent across multiple years and whether the differences could be alleviated during real time operations (i.e., the results are due to a model artifact when in reality, the system would not be operated in this way). Further, when threshold results from a month and/or water year type met these two criteria, exceedance plots were reviewed to determine whether the results may be due to one or two outliers. If this was found to be the case, it was concluded that the effect was not persistent enough to be biologically relevant.

Table 5.D-49. Water Temperature Thresholds Used for Water Temperature Threshold Analyses, Sacramento River

Species	Life Stage	Period	Location	Threshold (F)		Sources/Notes
				Mean Monthly	7DADM[1]	
Winter-run	Spawning, egg incubation, and alevins	Apr-Oct	Keswick		55.4	USEPA 2003
			Clear Creek		55.4	USEPA 2003
			Balls Ferry		55.4	USEPA 2003
			Bend Bridge		55.4	USEPA 2003
			Red Bluff		55.4	USEPA 2003
	Fry and juvenile rearing and emigration	Jul-Mar	Keswick		61	USEPA 2003; core juvenile rearing[2]
			Clear Creek		61	USEPA 2003; core juvenile rearing
			Balls Ferry		61	USEPA 2003; core juvenile rearing
			Bend Bridge		61	USEPA 2003; core juvenile rearing
			Red Bluff		61	USEPA 2003; core juvenile rearing
			Knights Landing		64	USEPA 2003; non-core juvenile rearing[3]
	Adult Immigration	Dec-Aug	Keswick		68	USEPA 2003
			Bend Bridge		68	USEPA 2003
			Red Bluff		68	USEPA 2003
	Adult Holding	Jan-Aug	Keswick		61	USEPA 2003
			Balls Ferry		61	USEPA 2003
			Red Bluff		61	USEPA 2003
Spring-run	Spawning, egg incubation, and alevins	Aug-Dec	Keswick		55.4	USEPA 2003
			Clear Creek		55.4	USEPA 2003
			Balls Ferry		55.4	USEPA 2003
			Bend Bridge		55.4	USEPA 2003
			Red Bluff		55.4	USEPA 2003
	Fry and juvenile rearing and emigration	Year-round	Keswick		61	USEPA 2003; core juvenile rearing
			Clear Creek		61	USEPA 2003; core juvenile rearing
			Balls Ferry		61	USEPA 2003; core juvenile rearing
			Bend Bridge		61	USEPA 2003; core juvenile rearing
			Red Bluff		61	USEPA 2003; core juvenile rearing
			Knights Landing		64	USEPA 2003; non-core juvenile rearing

Species	Life Stage	Period	Location	Threshold (F)		Sources/Notes
				Mean Monthly	7DADM[1]	
Spring-run (Cont)	Adult Immigration	Mar-Sep	Keswick		68	USEPA 2003
			Bend Bridge		68	USEPA 2003
			Red Bluff		68	USEPA 2003
	Adult Holding	Apr-Sep	Keswick		61	USEPA 2003
			Balls Ferry		61	USEPA 2003
			Red Bluff		61	USEPA 2003
Steelhead	Spawning, egg incubation, and alevins	Nov-Apr	Keswick	53		McCullough 2001
				56		NMFS 2009
			Clear Creek	53		McCullough 2001
				56		NMFS 2009
			Balls Ferry	53		McCullough 2001
				56		NMFS 2009
			Bend Bridge	53		McCullough 2001
				56		NMFS 2009
			Red Bluff	53		McCullough 2001
				56		NMFS 2009
	Kelt Emigration	Feb-May	Keswick		68	USEPA 2003
				70		Average of studies cited in Richter and Kolmes 2005 (for upper end of suboptimal range)
			Bend Bridge		68	USEPA 2003
				70		Average of studies cited in Richter and Kolmes 2005 (for upper end of suboptimal range)
			Red Bluff		68	USEPA 2003
				70		Average of studies cited in Richter and Kolmes 2005 (for upper end of suboptimal range)

Species	Life Stage	Period	Location	Threshold (F)		Sources/Notes
				Mean Monthly	7DADM[1]	
Steelhead (Cont)	Juvenile Rearing	Year-round	Keswick	63		intermediate value of ranges of optimal growth from Grabowski 1973; Hokanson et al. 1977; Wurtsbaugh and Davis 1977; Myrick and Cech 2005; and Beakes et al. 2014
					69	Sullivan 2000
			Clear Creek	63		intermediate value of ranges of optimal growth from Grabowski 1973; Hokanson et al. 1977; Wurtsbaugh and Davis 1977; Myrick and Cech 2005; and Beakes et al. 2014
					69	Sullivan 2000
			Balls Ferry	63		intermediate value of ranges of optimal growth from Grabowski 1973; Hokanson et al. 1977; Wurtsbaugh and Davis 1977; Myrick and Cech 2005; and Beakes et al. 2014
					69	Sullivan 2000
			Bend Bridge	63		intermediate value of ranges of optimal growth from Grabowski 1973; Hokanson et al. 1977; Wurtsbaugh and Davis 1977; Myrick and Cech 2005; and Beakes et al. 2014
					69	Sullivan 2000
			Red Bluff	63		intermediate value of ranges of optimal growth from Grabowski 1973; Hokanson et al. 1977; Wurtsbaugh and Davis 1977; Myrick and Cech 2005; and Beakes et al. 2014
					69	Sullivan 2000
Steelhead (Cont)	Smoltification	Jan-Mar	Keswick	54		Zaugg and Wagner 1973; Adams et al. 1975; Zaugg 1981; Hoar 1988
			Clear Creek	54		Zaugg and Wagner 1973; Adams et al. 1975; Zaugg 1981; Hoar 1988
			Balls Ferry	54		Zaugg and Wagner 1973; Adams et al. 1975; Zaugg 1981; Hoar 1988
			Bend Bridge	54		Zaugg and Wagner 1973; Adams et al. 1975; Zaugg 1981; Hoar 1988

Species	Life Stage	Period	Location	Threshold (F)		Sources/Notes
				Mean Monthly	7DADM[1]	
			Red Bluff	54		Zaugg and Wagner 1973; Adams et al. 1975; Zaugg 1981; Hoar 1988
	Smolt Emigration (excludes migrant parr)	Nov-Jun	Keswick		61	USEPA 2003; core location
					64	USEPA 2003; non-core location
			Clear Creek		61	USEPA 2003; core location
					64	USEPA 2003; non-core location
			Balls Ferry		61	USEPA 2003; core location
					64	USEPA 2003; non-core location
			Bend Bridge		61	USEPA 2003; core location
					64	USEPA 2003; non-core location
			Red Bluff		61	USEPA 2003; core location
					64	USEPA 2003; non-core location
	Adult Immigration	Aug-Mar	Keswick		68	USEPA 2003
				70		Average of studies cited in Richter and Kolmes 2005 (for upper end of suboptimal range)
			Bend Bridge		68	USEPA 2003
				70		Average of studies cited in Richter and Kolmes 2005 (for upper end of suboptimal range)
			Red Bluff		68	USEPA 2003
				70		Average of studies cited in Richter and Kolmes 2005 (for upper end of suboptimal range)

Species	Life Stage	Period	Location	Threshold (F) Mean Monthly	Threshold (F) 7DADM[1]	Sources/Notes
Steelhead (Cont)	Adult Holding	Sep-Nov	Keswick		61	USEPA 2003
			Balls Ferry		61	USEPA 2003
			Red Bluff		61	USEPA 2003
Green Sturgeon	Spawning and Embryo Incubation	Mar-Jul	Bend Bridge	63		Upper end of optimal range for embryonic development (Van Eenennaam 2005)
			Red Bluff	63		
			Hamilton City	63		
	Non-Spawning Adult Presence (Immigration, Pre and Post-Spawn Holding)	Aug-Feb	Bend Bridge	66		Assumes that adults are at least as tolerant to temperatures as larvae and juveniles
				73		Houston 1988; Erickson et al. 2002
			Red Bluff	66		Assumes that adults are at least as tolerant to temperatures as larvae and juveniles
				73		Houston 1988; Erickson et al. 2002
			Hamilton City	66		Assumes that adults are at least as tolerant to temperatures as larvae and juveniles
				73		Houston 1988; Erickson et al. 2002
		Year-round	Knights Landing	66		Assumes that adults are at least as tolerant to temperatures as larvae and juveniles
				73		Houston 1988; Erickson et al. 2002
	Larval to Juvenile Rearing and Emigration	Year-round	Bend Bridge	66		Upper end of optimal range for bioenergetics performance of Age 0/1 sturgeon with full or reduced food supply (Mayfield and Cech 2004)
			Red Bluff	66		
			Hamilton City	66		
			Knights Landing	66		

[1] 7DADM = Seven Day Average Daily Maximum
[2] Core = “moderate to high density” (USEPA 2003)
[3] Non-core = “low to moderate density” (USEPA 2003)

Table 5.D-50. Water Temperature Thresholds Used for Water Temperature Threshold Analyses, American River

Species	Life Stage	Period	Location	Threshold (°F) Mean Monthly	Threshold (°F) 7DADM[1]	Source/Note
Steelhead	Spawning, egg incubation, and alevins	Dec-May	Hazel Avenue	53		from McCullough 2001
			Watt Avenue	53		from McCullough 2001
	Kelt emigration	Feb-May	Hazel Avenue		68	USEPA 2003
			Watt Avenue	70		Average of studies cited in Richter and Kolmes 2005 (for upper end of suboptimal range)
			Hazel Avenue		68	USEPA 2003
			Watt Avenue	70		Average of studies cited in Richter and Kolmes 2005 (for upper end of suboptimal range)
	Juvenile rearing	Year-round	Hazel Avenue	63		intermediate value of ranges of optimal growth from Grabowski 1973; Hokanson et al. 1977; Wurtsbaugh and Davis 1977; Myrick and Cech 2005, and Beakes et al. 2014
					69	Sullivan 2000
			Hazel Avenue	63		intermediate value of ranges of optimal growth from Grabowski 1973; Hokanson et al. 1977; Wurtsbaugh and Davis 1977; Myrick and Cech 2005, and Beakes et al. 2014
					69	Sullivan 2000
	Smoltification	Jan-Mar	Hazel Avenue	54		Zaugg and Wagner 1973; Adams et al. 1975; Zaugg 1981; Hoar 1988
			Watt Avenue	54		Zaugg and Wagner 1973; Adams et al. 1975; Zaugg 1981; Hoar 1988
	Smolt Emigration	Dec-Jun	Hazel Avenue		61	USEPA 2003; core location[2]
			Watt Avenue		64	USEPA 2003; non-core location[3]
	Adult Immigration	Oct-Apr	Hazel Avenue		68	USEPA 2003
				70		Average of studies cited in Richter and Kolmes 2005 (for upper end of suboptimal range)
			Hazel Avenue		68	USEPA 2003
				70		Average of studies cited in Richter and Kolmes 2005 (for upper end of suboptimal range)
	Adult Holding	Oct-Nov	Hazel Avenue		61	USEPA 2003
			Watt Avenue		61	USEPA 2003

[1] 7DADM = Seven Day Average Daily Maximum
[2] Core = "moderate to high density" (USEPA 2003)
[3] Non-core = "low to moderate density" (USEPA 2003)

Table 5.D-51. Conversion Factors (°F) for EPA Seven-Day Average Daily Maximum Water Temperature Thresholds to monthly mean, Sacramento River[1].

Month	Keswick	Clear Creek	Balls Ferry	Bend Bridge	Red Bluff	Wilkins Slough[2]
January	-0.36	-1.01	-0.75	-0.67	-0.86	0.0
February	-0.28	-1.11	-0.86	-0.62	-0.97	-0.3
March	-0.17	-1.29	-0.94	-0.66	-1.23	-0.3
April	-0.25	-1.66	-1.47	-0.95	-1.55	-0.6
May	-0.36	-1.73	-2.18	-1.59	-1.47	-1.4
June	-0.32	-1.55	-2.25	-1.87	-0.96	-1.2
July	-0.36	-1.41	-2.18	-2.01	-0.90	-1.3
August	-0.43	-1.74	-2.06	-1.61	-0.94	-1.3
September	-0.30	-2.00	-1.76	-1.16	-1.70	-2.0
October	-0.25	-1.73	-1.25	-0.91	-1.83	-1.4
November	-0.38	-1.37	-1.10	-0.99	-1.53	-1.3
December	-0.82	-1.42	-1.30	-1.24	-1.48	-1.0

[1] Based on historical data from 2003-2014 for all sites except Wilkins Slough, which is based on historical data from November 2012 through June 2015. For a given location and month, values in this table were added to 7DADM thresholds in Table 5.D-49 such that actual thresholds used in the evaluation for each month were lower than those listed in Table 5.D-49.

[2] Because there is no flow gage at Knights Landing, Wilkins Slough data were used to calculate the conversion factor for Knights Landing

Table 5.D-52. Conversion Factors (°F) for EPA Seven-Day Average Daily Maximum Water Temperature Thresholds to monthly mean, American River[1].

Month	Folsom Dam	Hazel Ave	William P Pond Park	Watt Ave
January	-0.74	-0.44	-1.16	-1.01
February	-0.44	-0.15	-1.28	-1.05
March	-0.55	-0.25	-1.71	-1.29
April	-0.80	-0.40	-2.09	-1.72
May	-0.89	-0.60	-2.32	-2.05
June	-0.55	-0.44	-2.32	-2.55
July	-1.09	-0.50	-2.61	-3.17
August	-2.07	-0.70	-3.01	-3.11
September	-1.54	-0.59	-3.02	-2.52
October	-1.46	-0.60	-2.53	-2.01
November	-1.82	-0.80	-2.01	-1.65
December	-1.10	-0.77	-1.51	-1.26

[1] Based on historical data from 2003-2014. For a given location and month, values in this table were added to 7DADM thresholds in Table 5.D-50 such that actual thresholds used in the evaluation were lower than those listed in Table 5.D-50.

5.D.2.1.2.3 Reclamation Egg Mortality Model

The Reclamation Egg Mortality Model was used to evaluate water temperature-related mortality to pre-spawned eggs, fertilized eggs, and pre-emergent fry of winter-run and spring-run Chinook salmon in the Sacramento River. Attachment 5.D-1, *Reclamation Egg Mortality Model*, describes the details of the model. NMFS believes this model underestimates temperature related mortality and likely not sensitive enough to capture small differences in scenarios or temperature-related mortality experienced by recent winter-run brood years. As a result, results should be viewed with caution until a more accurate model is developed

Results of this model are presented for each race as exceedance plots by water year type, mean annual mortality by water year type and for all water year types combined, and differences in mean annual mortality between NAA and PA by water year type and for all water year types combined. It was concluded that there would be a biologically meaningful effect of the PA if egg mortality was at least 2% higher on a raw scale compared to the NAA. This more conservative 2% value was used instead of the 5% value used elsewhere in this effects analysis because the egg life stage has the highest potential effect on the propagation of population size in a life cycle context.

5.D.2.1.2.4 SALMOD

The SALMOD model was used to evaluate flow- and temperature-related mortality of early life stages and overall production of spring- and winter-run Chinook salmon in the Sacramento River. Attachment 5.D-2, *SALMOD* Model, describes the details of the model and the results of the analysis described here.

There are two primary sources of mortality evaluated in SALMOD, water temperature-related and flow-related, both of which could affect multiple life stages. Water temperature-related mortality for the *Spawning, Egg incubation, and Alevins* section of the results included *pre-spawn* (in vivo, or in the mother before spawning) and *egg* (in the gravel) life stages (see Attachment 5.D-2, *SALMOD Model*, for full description). Water temperature-related mortality included in Chapter 5, Section 5.4.2.1.3.1.2, *Fry and Juvenile Rearing*, for winter-run Chinook salmon and Section 5.4.2.1.3.2.2, *Fry and Juvenile Rearing,* for spring-run Chinook salmon includes the fry, pre-smolt, and immature smolt life stages. For each source of mortality by life stage for the NAA and PA, results are presented as exceedance plots and mean annual values, as well as differences between NAA and PA. These results are presented by water year type and for all water year types combined. A 5% difference between NAA and PA in mean value of an output parameter was considered biologically meaningful. Each source of mortality was also combined to assess all flow- or water temperature-related mortality by life stage, as well as combined for all life stages to assess overall mortality under the PA compared to the NAA.

SALMOD calculates juvenile production each year as the cumulative survival of a predetermined set of eggs through the smolt life stage. There are several sources of mortality during these early life stages that varies based on flow and water temperature. SALMOD is not a true life cycle model because it treats production results of each year independently such that outcomes do not accumulate year over year.

For this effects analysis, overall juvenile production was assessed by water year type and for all water years combined and presented as exceedance plots and mean annual values. Production values were given a higher importance in this effects analysis because they integrate all early life stages and provide an overall assessment of effects to production as a whole.

In addition, the potential effect of the PA on the frequency of “worst case” juvenile production years was evaluated. The “worst case” was defined as years with juvenile production values that were <5% and <10% of potential egg values, which are based on the number of spawners defined by the SALMOD user (Table 5.D-53). These percentages were used because they can be considered catastrophic to an individual brood year, as was seen for the 2014 winter-run Chinook salmon brood year, in which there was an estimated 95% mortality (5% survival) associated with water temperature-related effects of the drought in the Sacramento River (Murillo 2015). The 5% survival was also doubled in an additional analysis of 10% survival to provide a more conservative worst-case scenario. For each race, the number of years during which juvenile production was lower than these worst-case scenarios was compared between NAA and PA.

Table 5.D-53. Juvenile Production Values Used to Define Worst Case Scenarios for SALMOD.

Race	Potential Eggs[1]	5% of Eggs	10% of Eggs
Winter-run Chinook Salmon	5,913,000	295,650	591,300
Spring-run Chinook Salmon	1,210,000	60,500	121,000
[1] These values are pre-defined in SALMOD			

5.D.2.2 Spawning Flows Methods

5.D.2.2.1 Introduction

This section describes procedures used in the effects analysis to evaluate flow-related effects resulting from the No Action Alternative (NAA) and Proposed Action (PA) on spawning and adult holding habitat of winter-run and spring-run Chinook salmon, California Central Valley (CCV) steelhead, and green sturgeon in the Sacramento and American Rivers. The specific potential effects evaluated are (1) flow reductions during the months of adult holding, (2) changes in flow affecting conditions during the months of spawning, egg incubation and alevin development, (3) reductions in the availability of suitable physical habitat for spawning, egg incubation, and alevin development, (4) reductions in flow resulting in dewatering of the redds, and (5) high flows resulting in redd scour or entombment.

Modeled flow results for key locations in the Sacramento and American Rivers are reported in Appendix 5A, *CALSIM Methods and Results*. Results in Appendix 5A are presented as (1) mean monthly exceedance plots, (2) box and whiskers plots, with mean, median, quartiles, and 25th and 75th percentile values indicated; and (3) a table of summary statistics and differences between NAA and PA for each statistic.

The availability of spawning habitat was estimated using weighted usable area (WUA) curves obtained from the literature (U.S. Fish and Wildlife Service 2003a, 2003b, 2006). WUA is an index of the surface area of physical habitat available, weighted by the suitability of that habitat. WUA curves are normally developed as part of instream flow incremental methodology (IFIM) studies.

Dewatering of redds occurs when the water level drops below the depth of the redds or drops low enough to produce depth and flow velocity conditions that are inadequate to sustain incubating eggs or alevins in the redds. The percentage of redds lost to dewatering in the Sacramento River was estimated using relationships developed by the USFWS (2006) between spawning habitat weighted usable area and changes in flow. Dewatering field data were not available for the

American River, so percentage reduction in flow was used as a proxy for percentage of redds dewatered.

Loss of redds to scouring or entombment occurs when flows are high enough to mobilize sediments, destroying redds and their incubating eggs and alevins, or entombing the redds when sediments are redeposited. Estimates of redd losses resulting from scouring flows in the Sacramento and American Rivers were based on estimates from various sources of the minimum flows required to mobilize sediments and the frequency of occurrence of those flows.

Details particular to each of the flow analysis methods implemented are provided below.

5.D.2.2.2 Characterization of Flow

Flow at key locations within the Sacramento and American Rivers, as simulated by CALSIM II modeling, was evaluated for each period that each life stage of winter-run or spring-run Chinook salmon, CCV steelhead, or green sturgeon is normally present. General flow patterns for each such period were identified and are summarized at the beginning of each race/species and life stage section in Chapter 5, Section 5.4.2, *Upstream Hydrologic Changes*. The purpose of this characterization of flow patterns was to identify whether there were any locations, months, or water year types in which differences in flow between the PA and NAA could have potentially meaningful biological effects. The characterizations include an evaluation of exceedance plots of mean monthly flows by month, box and whisker plots, and differences in mean monthly flows by month and water year type, all of which can be found in Appendix 5.A, *CALSIM Modeling and Results*. No strict criteria were used to directly determine a biologically meaningful effect from these physical modeling results. However, if, based on best professional judgment, a specific result was considered to have a potential to produce a biologically meaningful effect, the month, water year type, and location in which the result occurred was flagged as requiring closer examination in the results of the remaining flow evaluation. In addition, specifics of the month, water year type, and location with the potentially meaningful result were closely reviewed to determine the cause of the result.

5.D.2.2.3 Adult Holding Habitat

Changes in Sacramento and American River flow may affect holding habitat for Chinook salmon, CCV steelhead, and green sturgeon adults, but the actual relationship between flow and the amount and quality of adult holding habitat is uncertain. In general, higher flows provide greater depths in pools and may result in improved water quality. Therefore, reduced flow resulting from the PA is treated as a potential adverse effect and increased flow is treated as a beneficial effect. Mean monthly flow rates were examined for the PA and NAA at the locations where, and during the months when, most salmon, CCV steelhead, or green sturgeon holding occurs. Differences in the mean flows of greater than 5% between the PA and NAA were flagged as potentially having a biologically meaningful effect on Chinook salmon and CCV steelhead holding habitat and warranting further investigation.

5.D.2.2.4 Weighted Usable Area (WUA) Analysis Methods

5.D.2.2.4.1 Sacramento River

The WUA curves used for Chinook salmon and CCV steelhead spawning habitat in the Sacramento River were obtained from two U.S. Fish and Wildlife Service (USFWS) reports (U.S. Fish and Wildlife Service 2003a, 2006). As noted above, WUA is computed as the surface area of physical habitat available weighted by its suitability. Modeling assumptions used to derive WUA curves include that the suitability of physical habitat for salmon and steelhead spawning is largely a function of substrate particle size, water depth, and flow velocity. The race- or species-specific suitability of the habitat with respect to these variables is determined by observing the fish and is used to develop habitat suitability criteria (HSC) for each race or species of fish. Hydraulic modeling is then used to estimate the amount of habitat available for different HSC levels at different river flows, and the results are used to develop spawning habitat WUA curves (Bovee et al. 1998). The WUA curves and tables are used to look up the amount of WUA available at different flows.

USFWS 2003a provides WUA curves and tables for spawning winter-run, fall-run, and late fall–run Chinook salmon and CCV steelhead for three segments of the Sacramento River encompassing the reach from Keswick Dam to Battle Creek (Figure 5.D-86). The WUA tables were updated in USFWS 2006. No WUA curves were developed for spring-run Chinook salmon, but, as discussed later, the fall-run curves were used to quantify spring-run spawning habitat. Figure 5.D-87 through Figure 5.D-89 show the flow versus spawning WUA results for winter- and fall-run Chinook salmon and CCV steelhead in the three river segments (Segment 6 = Keswick to Anderson-Cottonwood Irrigation District [ACID] Dam, Segment 5 = ACID Dam to Cow Creek, and Segment 4 = Cow Creek to Battle Creek) as provided in USFWS 2006 (Figure 5.D-86). Note that for Segment 6, separate WUA curves were developed for periods when the ACID Dam boards were installed and for when the boards were out because installation of the boards affected water levels and velocities for some of the sampling transects used to develop the curves.

Because a number of tributaries enter the Sacramento River between Keswick Dam and Battle Creek, flows are generally different among the segments. For the USFWS studies, flows were measured directly at the sampling transects and were estimated as the sum of Keswick flow releases and tributary gage readings upstream of the transects. To estimate WUA for the effects analysis, the segment flows were estimated with CALSIM II, using the midpoint location of each segment. For Segment 6, the WUA curves for the months when the ACID Dam boards are installed (April through October) were used with the flows for those months and the WUA curves for the months when the ACID Dam boards are out were used with the flows for the rest of the year.

Although fall-run spawning WUA curves were used as surrogates for spring-run spawning, CALSIM II flows for the months of spring-run spawning, not those of fall-run spawning, were used to compute the spring-run WUA results.

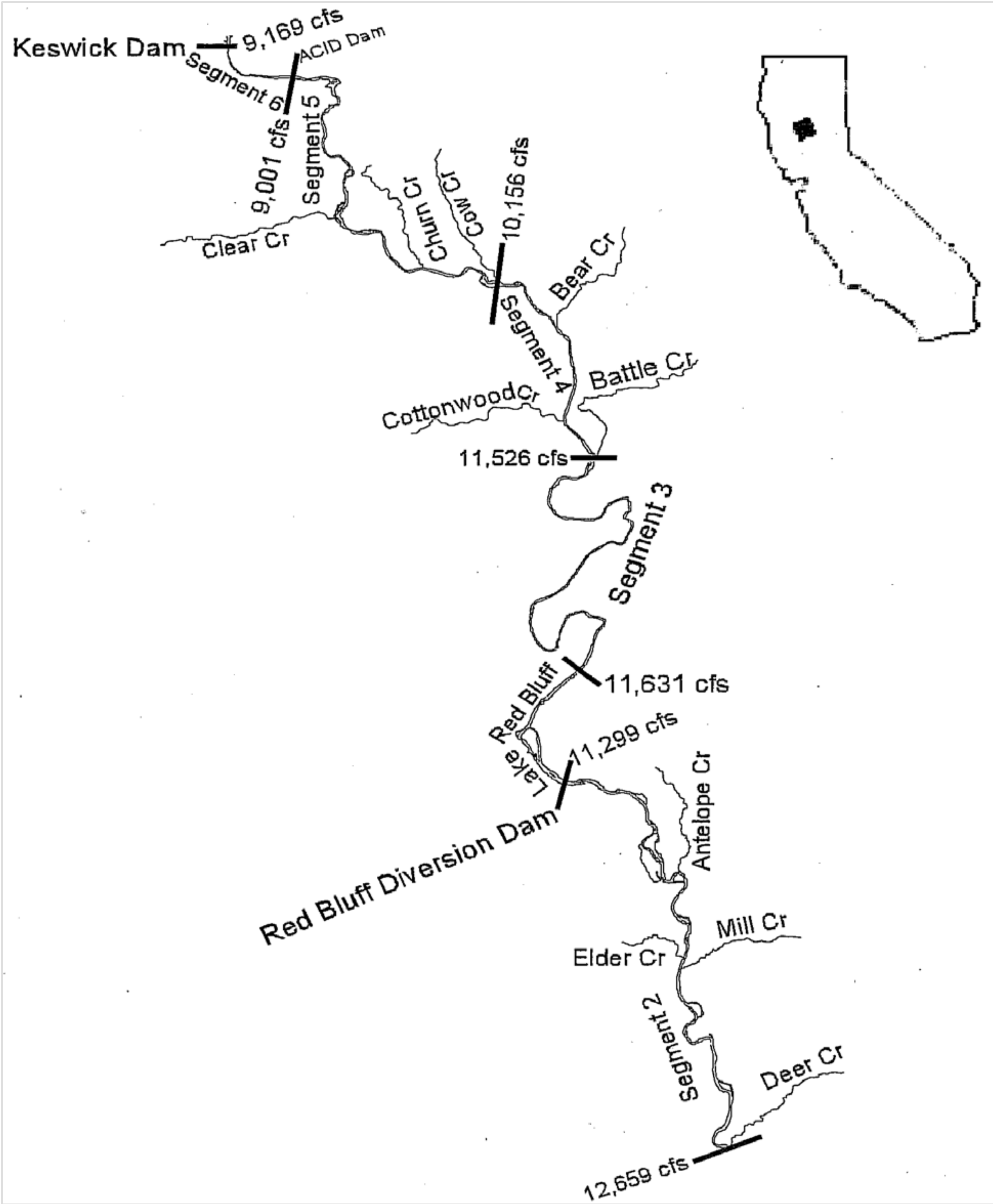


Figure 5.D-86. Segments 2–6 of the Sacramento River Used in USFWS Studies to Determine Spawning Weighted Usable Area (WUA) (flows in the figure are the average flows at the upstream boundary of each segment for October 1974 to September 1993). Source: USFWS 2003a.

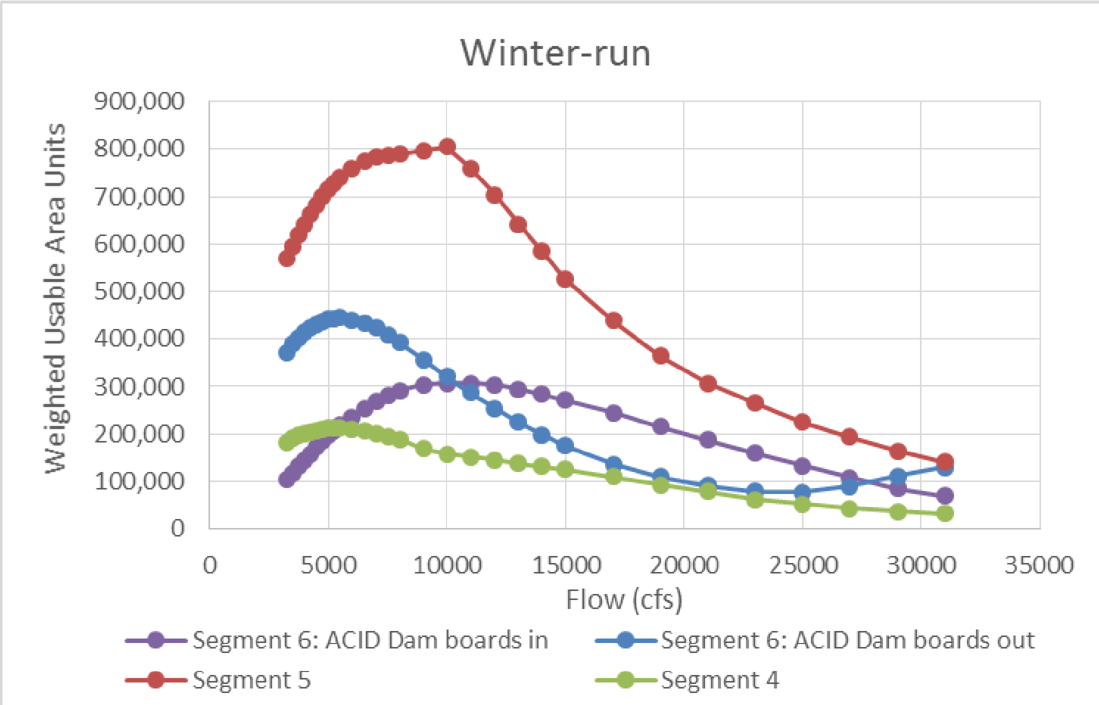


Figure 5.D-87. Spawning WUA curves for Winter-Run Chinook Salmon in the Sacramento River, Segments 4 to 6. ACID = Anderson-Cottonwood Irrigation District

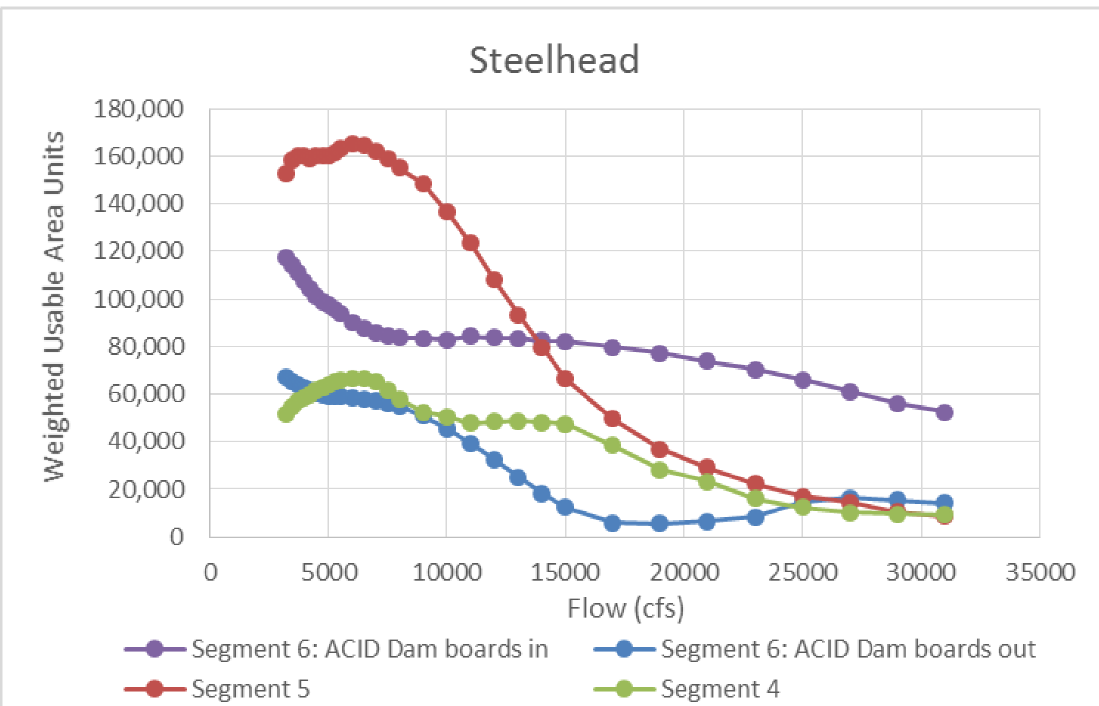


Figure 5.D-88. Spawning WUA curves for California Central Valley Steelhead in the Sacramento River, Segments 4 to 6. ACID = Anderson-Cottonwood Irrigation District

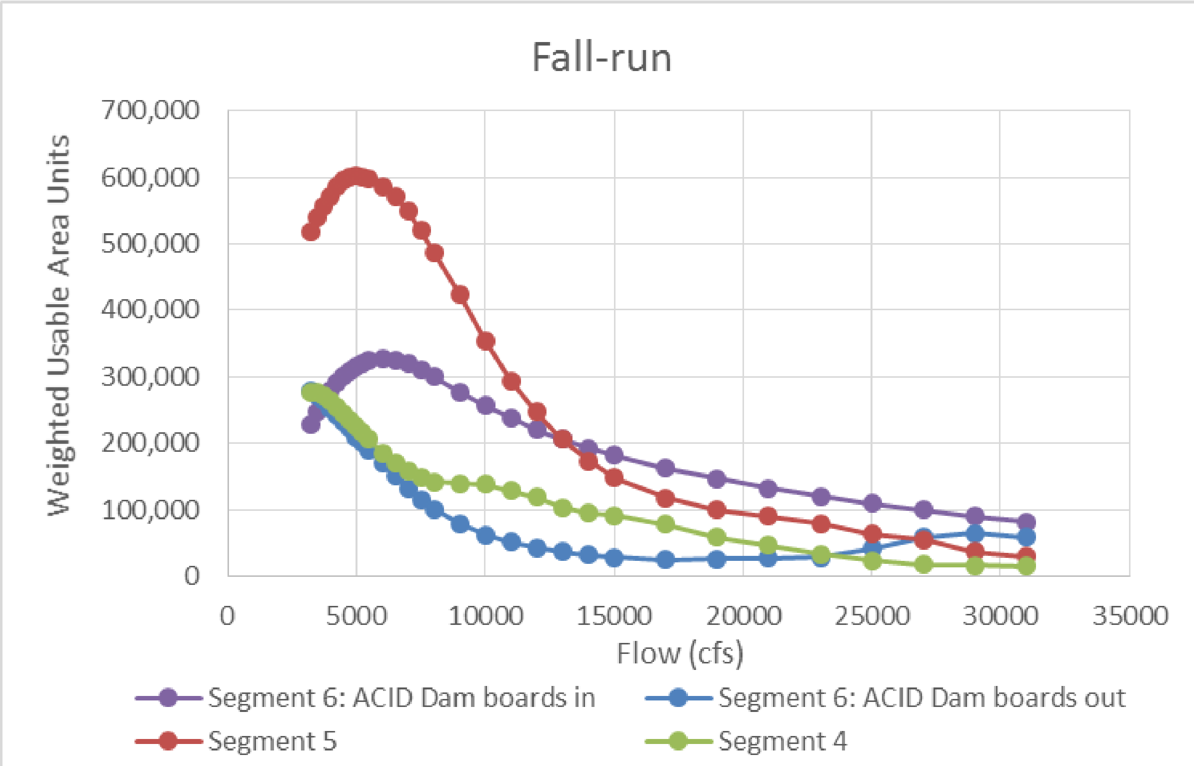


Figure 5.D-89. Spawning WUA Curves for Fall-Run Chinook Salmon in the Sacramento River, Segments 4 to 6. The fall-run curves were used to quantify spring-run Chinook salmon WUA, as discussed in the text. ACID = Anderson-Cottonwood Irrigation District

Because there are no spring-run Chinook salmon WUA curves in the USFWS documentation, previous practice, as described below, has been to use fall-run Chinook salmon WUA curves to model spring-run habitat. Two models that currently produce spawning WUA outputs for spring-run Chinook salmon, SALMOD and SacEFT, derive the spring-run WUA results using the fall-run Chinook salmon spawning WUA curves as surrogates (Bartholow 2004; ESSA 2011). Mark Gard, who led the USFWS studies that produced the Sacramento River WUA curves, has endorsed this practice (Gard pers. comm.). However, this practice introduces uncertainty to the spring-run Chinook salmon results.

A potential limitation of the WUA curves presented above, as of all IFIM studies, is that they assume the channel characteristics of the river during the time of field data collection by USFWS (1995–1999), such as proportions of mesohabitat types, have remained in dynamic equilibrium to the present time and will continue to do so through the end of the PA (at least 15 years into the future). If the channel characteristics substantially change, the shape of the curve may no longer be applicable.

A further limitation of the WUA curves for CCV steelhead is that the HSC used in developing the curves had been previously obtained from studies of steelhead in the American River (USFWS 2003b). HSC data were not collected by USFWS for steelhead in the Sacramento River because very few steelhead redds were observed and because the steelhead redds could not be distinguished from those of resident rainbow trout. The validity of this substitution could not be tested and is uncertain (USFWS 2003a).

Differences in spawning WUA under the PA and NAA for a given species or race were examined using exceedance plots of monthly mean WUA for the spawning period (Chapter 5, Section 5.4.2, *Upstream Hydrologic Changes*, Table 5.D-63, Table 5.D-65, Table 5.D-67, Table 5.D-68, and A-1) in each of the river segments for each water year type and all water year types combined. Further, differences in spawning WUA in each segment under the PAA and NAA were examined using the grand mean spawning WUA for each month of the spawning period under each water year type and all water year types combined. Differences in mean spawning WUA of greater than 5% between the PA and NAA were flagged as potentially having a biologically meaningful effect on Chinook salmon and CCV steelhead spawning habitat and warranting further investigation.

The USFWS WUA studies did not include sturgeon, and no other study providing WUA curves for green or white sturgeon in the Sacramento River has been located. Therefore, effects of the PA on spawning habitat for green sturgeon in the Sacramento River were evaluated by comparing flows under the PA and the NAA in the Sacramento River at the principal locations that green sturgeon spawn (Keswick Dam to Red Bluff) and during the months of their spawning and egg incubation period (March through July). Changes in flow can affect the instream area available for spawning and egg incubation, the quality of the spawning and egg incubation habitat, and the downstream dispersal of larvae to rearing habitat in the bay and Delta. There is some evidence that green sturgeon year class strength is positively correlated with Delta outflow, perhaps, in part, as a result of improved downstream dispersal that benefits from increased flow. In general, therefore, reduced flow resulting from the PA is treated in the effects analysis as a potential adverse effect and increased flow is treated as a beneficial effect, although the certainty of this relationship is unknown.

5.D.2.2.4.2 American River

The WUA curves used for CCV steelhead spawning habitat in the American River were obtained from USFWS 2003b, which provides spawning WUA curves for steelhead and fall-run Chinook salmon in five segments of the American River. The five segments lie within the approximately 6-mile river reach from Nimbus Dam downstream to Rossmoor Bar, where most salmon and steelhead spawning occurs. Figure 5.D-90 shows the flow versus spawning WUA results for CCV steelhead in the five river segments.

The five river segments were not contiguous and, as indicated by the results of 5 prior years of redd studies, over half of the redds of both species occurred outside of the surveyed segments. However, because the WUA curves provide relative, not absolute, estimates of habitat availability, the segments can be treated as representative samples of the entire 6-mile reach and exhaustive sampling is not necessary.

Because the five surveyed segments were all within 6 miles downstream of Nimbus Dam and there are no significant tributaries in this reach of the river, the five steelhead WUA curves were combined by summing the WUAs for each flow level. In the effects analysis, CALSIM II flows at Nimbus Dam were used to compute steelhead WUAs from the combined WUA curve.

Differences in steelhead spawning WUA under the PA and NAA were examined using exceedance plots of monthly mean WUA during the steelhead spawning period for each water year type and all water year types combined. Also, differences in the mean spawning WUA under the PA and NAA were examined for the months of the spawning period under each water year type and all water year types combined. Differences in mean spawning WUA of greater than 5% between the PA and NAA were flagged as potentially having a biologically meaningful effect on CCV steelhead spawning habitat and warranting further investigation.

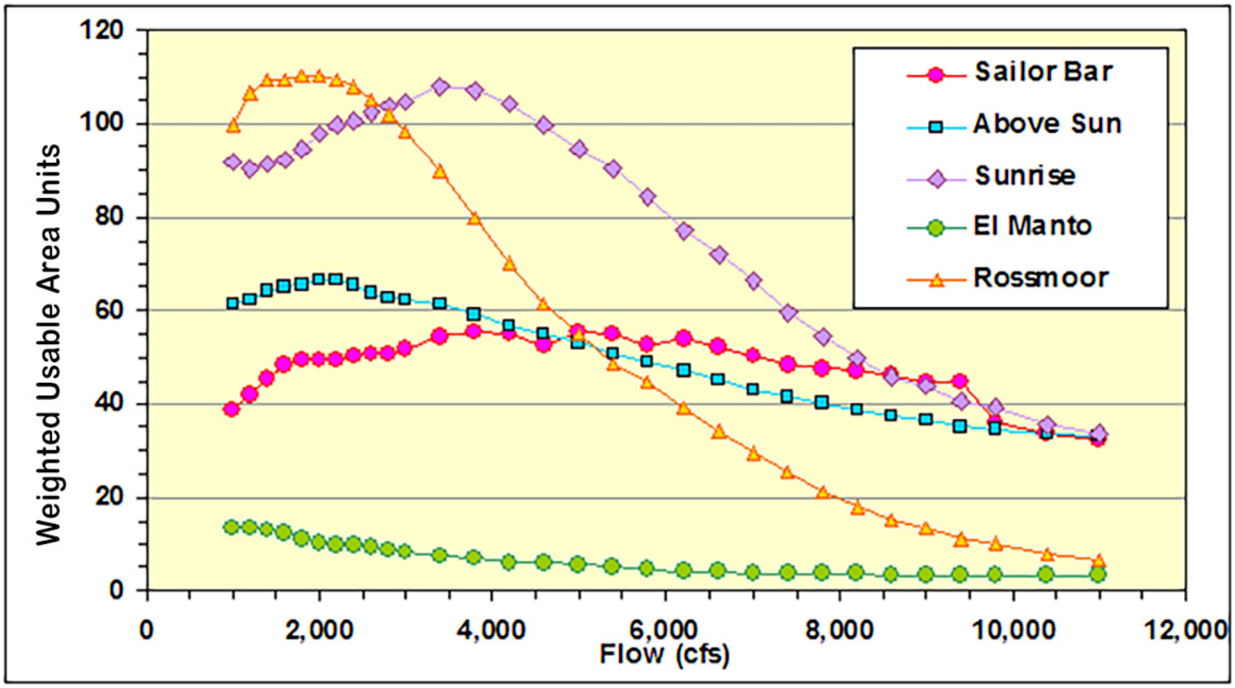


Figure 5.D-90. Spawning WUA Curves for Steelhead in the American River.

5.D.2.2.5 Redd Dewatering

The redd dewatering analyses for both the Sacramento and American Rivers are based on the maximum reduction in flow from the initial flow, or *spawning flow*, that occurs over the duration of an egg cohort. The duration of a cohort in a redd includes egg incubation and alevin development to emergence from the gravel. The analysis assumes that a new egg cohort begins each month of the spawning period. Based on technical assistance from NMFS, cohort duration was estimated as three months for both winter-run and spring-run Chinook salmon races and CCV steelhead. Therefore, the difference between the spawning flow and the minimum flow of the three months subsequent to spawning was used for the redd dewatering analyses. This minimum flow of the egg cohort period is referred to herein as the *dewatering flow*. If flows during the three subsequent months were all greater than the spawning flow, dewatering was assumed not to occur. It should be noted that the use of monthly time-step flow estimates likely underestimates redd dewatering rates. This potential bias is expected to affect both project scenarios equally.

5.D.2.2.5.1 Sacramento River

The percentage of redds lost to dewatering in the Sacramento River was estimated using tables in USFWS (2006) that relate spawning and dewatering flows to percent reductions in species-specific spawning habitat WUA. These tables are reproduced in Table 5.D-55 through Table 5.D-60.

USFWS (2006) developed dewatering tables for the same species as those for which USFWS (2003a) produced spawning habitat WUA curves—winter-run, fall-run, late fall-run Chinook salmon and CCV steelhead—but not for spring-run Chinook salmon. Therefore, as was done for the WUA curves, the fall-run salmon tables were used to estimate spring-run redd dewatering. The validity of substituting the fall-run tables for spring-run is discussed in Section 5.D.2.2.4, *Weighted Usable Area (WUA) Analysis Methods*.

The redd dewatering analysis for winter-run and spring-run Chinook salmon and CCV steelhead was conducted using the months of the spawning periods (Table 5.D-54). These spawning periods are shorter than the full spawning and incubation periods given in Section 5.4.2, *Upstream Hydrologic Changes,* Table 5.D-63, Table 5.D-65, Table 5.D-67, Table 5.D-68, and A-1 because they include only the months when spawning is expected to occur, but not the months after spawning has ceased but the eggs and larvae continue to incubate. As described above, redd dewatering was estimated from the difference between the CALSIM II flow for the month of spawning and the lowest flow of the three months following. For spring-run, although the fall-run redd dewatering tables were used for the analysis, flows from the spring-run spawning period (August through October) were used to look up the percent of spring-run redds dewatered.

Table 5.D-54. Spawning Periods for Dewatering Analyses (include months of spawning only)

Race/Species	Spawning Period
Winter-run Chinook salmon	Apr–Aug
Spring-run Chinook salmon	Aug–Oct
California Central Valley Steelhead	Sacramento: Nov–Feb
	American: Dec–Feb

The spawning and dewatering flows for each location and month of spawning under the PA and NAA, as estimated by CALSIM II, were used to look up the percent of redds dewatered for each of the salmon races and CCV steelhead. Absolute differences between the PA and NAA percentages of greater than 5% were flagged as potentially having a biologically meaningful effect on the race or species and warranting further investigation.

Table 5.D-55. Percent Redd Dewatered Look-up Table for Winter-Run Chinook Salmon with ACID Dam Boards Out (the percent of redds dewatered are looked up at the intersection of the "Spawning Flow" columns and "Dewatering Flow" rows).

	Spawning Flow																
Dewatering Flow	3,500	3,750	4,000	4,250	4,500	4,750	5,000	5,250	5,500	6,000	6,500	7,000	7,500	8,000	9,000	10,000	11,000
3,250	0.8	1.5	2.2	3	3.9	4.9	5.8	7	8.2	11	13.8	16.7	19.7	22.6	28.8	34.8	39.4
3,500		0.6	1	1.4	2	2.7	3.4	4.2	5.1	7.2	9.5	12.1	14.7	17.4	23.4	29.5	34.3
3,750			0.2	0.5	0.8	1.2	1.6	2.1	2.8	4.3	6.1	8.3	10.6	13.1	18.9	25.1	30
4,000				0.2	0.4	0.7	1	1.4	2	3.2	4.7	7.6	8.9	11.3	16.9	23.1	27.9
4,250					0.1	0.3	0.5	0.8	1.2	2.2	3.4	5.9	7	9.1	14.3	20.3	25
4,500						0.2	0.3	0.6	0.8	1.7	2.6	3.9	5.5	7.6	12.2	17.8	22.3
4,750							0.1	0.3	0.5	1.2	1.9	2.9	4.3	5.8	10.2	15.5	19.8
5,000								0.2	0.4	0.9	1.5	2.4	3.5	4.8	8.7	13.8	17.9
5,250									0.2	0.6	1.1	1.8	2.7	3.8	7	11.8	15.7
5,500										0.3	0.8	1.4	2.1	3	5.8	10.3	14.1
6,000											0.2	0.6	1.1	1.7	3.7	7.7	10.9
6,500												0.1	0.4	0.8	2.2	5.5	8.4
7,000													0.2	0.4	1.2	3.5	5.6
7,500														0.2	0.7	2.6	4.3
8,000															0.3	1.9	3.2
9,000																1.2	1.8
10,000																	0.4
11,000																	
12,000																	
13,000																	
14,000																	
15,000																	
17,000																	
19,000																	
21,000																	
23,000																	
25,000																	
27,000																	
29,000																	

Table 5.D-55 (cont.)

		Spawning Flow											
Dewatering Flow		12,000	13,000	14,000	15,000	17,000	19,000	21,000	23,000	25,000	27,000	29,000	31,000
	3,250	43.2	46.2	49.1	51.4	55	57.6	59.9	62.6	64.7	68.9	73.3	77.3
	3,500	38.3	41.5	44.6	47.1	51	53.6	56.1	58.8	61.1	65.4	70.2	74.5
	3,750	34.1	37.5	40.6	43.2	47.2	50	52.5	55.4	57.7	62.3	67.4	72
	4,000	32.1	35.5	38.6	41.2	45.4	48.2	50.7	53.6	56.1	60.8	66.1	70.8
	4,250	29.1	32.5	35.5	38.2	42.4	45.3	47.8	50.8	53.4	58.3	63.8	68.8
	4,500	26.3	29.6	32.6	35.3	39.6	42.5	45.1	48.2	51	56	61.7	66.9
	4,750	23.7	26.9	29.9	32.7	37	40	42.7	45.9	48.8	54	59.9	65.4
	5,000	21.6	24.7	27.7	30.4	34.8	37.9	40.6	43.8	44.1	52.3	58.4	64.1
	5,250	19.4	22.4	25.4	28.2	32.7	35.8	38.6	41.9	45.2	50.7	57	62.8
	5,500	17.6	20.6	23.5	26.2	30.7	33.9	36.8	40.1	43.5	49	55.5	61.5
	6,000	14	16.7	19.4	22	26.4	29.6	32.6	35.9	39.6	45.4	52.2	58.5
	6,500	11.2	13.6	16.2	18.8	23.1	26.2	29.3	32.7	36.5	42.6	49.7	56.4
	7,000	7.9	10.1	12.4	14.8	19	22.3	25.6	29.2	33.3	39.7	47.2	54.1
	7,500	6.3	8.1	10.2	12.4	16.3	19.7	23	26.7	31	37.6	45.3	52.5
	8,000	4.9	6.6	8.6	10.5	14.3	17.7	21.1	25	29.3	36.1	44.1	51.4
	9,000	3	4.4	6	7.8	11.4	14.7	18.3	22.1	26.6	33.6	41.9	49.5
	10,000	1.3	2.3	3.7	5.3	8.6	11.8	15.4	19.3	23.8	30.6	39.7	47.5
	11,000	0.6	1.2	2.2	3.5	6.4	9.5	13.2	17.1	21.7	28.5	37.6	45.6
	12,000		0.2	0.9	1.8	4.1	7	10.5	14.7	19.3	26.3	35.7	43.8
	13,000			0.4	1	2.8	5.3	8.7	13	17.5	24.5	34	42.3
	14,000				0.4	1.6	4.2	7.5	11.8	16.2	23	32.6	41
	15,000					0.9	2.8	5.9	10.6	14.9	21.8	31.5	40.1
	17,000						1.3	3.9	7.8	11.8	18.3	28.1	36.9
	19,000							1.4	4	7.1	13	22.5	31.7
	21,000								1.3	3.6	9.2	18.7	28
	23,000									1.4	6.2	15.4	24.6
	25,000										0	8.3	15.2
	27,000											1.6	3.6
	29,000												0.6

Table 5.D-56. Percent Redd Dewatered Look-up Table for Winter-Run Chinook Salmon with ACID Dam Boards In (the percent of reds dewatered are looked up at the intersection of the "Spawning Flow" columns and "Dewatering Flow" rows).

		Spawning Flow																
Dewatering Flow		3,500	3,750	4,000	4,250	4,500	4,750	5,000	5,250	5,500	6,000	6,500	7,000	7,500	8,000	9,000	10,000	11,000
	3,250	1.2	2.2	3.1	4.1	5.2	6.4	7.5	8.8	10.2	13	16	18.9	21.9	24.7	30.5	35.9	40.1
	3,500		0.9	1.4	2	2.7	3.6	4.4	5.3	6.3	8.5	11	13.6	16.2	18.9	24.7	30.4	34.8
	3,750			0.4	0.8	0.2	1.7	2.2	2.8	3.5	5.1	7	9.3	11.7	14.2	19.9	25.9	30.5
	4,000				0.4	0.7	1.1	1.4	1.9	2.5	3.8	5.4	7.5	9.8	12.2	17.7	23.7	28.3
	4,250					0.3	0.5	0.8	1.1	1.5	2.6	3.9	5.6	7.6	9.7	15	20.7	25.2
	4,500						0.3	0.5	0.8	1.1	1.9	2.9	4.3	5.9	7.9	12.6	18.1	22.4
	4,750							0.2	0.4	0.7	1.3	2.1	3.1	4.5	6.1	10.5	15.7	20
	5,000								0.3	0.5	1	1.6	2.5	3.7	5	9	14	18.1
	5,250									0.3	0.7	1.2	1.9	2.9	3.9	7.3	11.9	15.9
	5,500										0.4	0.9	1.5	2.3	3.2	6.1	10.5	14.3
	6,000											0.3	0.7	1.3	1.9	4	8	11.3
	6,500												0.2	0.5	1	2.4	5.8	8.8
	7,000													0.3	0.5	1.4	3.8	6.1
	7,500														0.3	0.9	2.9	4.8
	8,000															0.4	2.1	3.7
	9,000																1.3	2.4
	10,000																	0.9
	11,000																	
	12,000																	
	13,000																	
	14,000																	
	15,000																	
	17,000																	
	19,000																	
	21,000																	
	23,000																	
	25,000																	
	27,000																	
	29,000																	

Table 5.D-56 (cont.)

	Spawning Flow											
Dewatering Flow	12,000	13,000	14,000	15,000	17,000	19,000	21,000	23,000	25,000	27,000	29,000	31,000
3,250	43.4	46	48.4	50.3	53.5	56	58.9	62.4	65.4	69.5	73.7	77.2
3,500	38.5	41.1	43.9	46.1	49.6	52.3	55.3	58.8	61.9	65.9	69.9	73.5
3,750	34.4	37.3	40	42.4	46.1	49	52.1	55.7	58.8	62.8	66.7	70.2
4,000	32.2	35.3	38	40.4	44.2	47.2	50.3	53.9	57	61.1	65	68.5
4,250	29.2	32.2	34.9	37.4	41.4	44.4	47.5	51.2	54.4	58.5	62.3	65.7
4,500	26.3	29.3	32	34.6	38.6	41.7	45	48.7	52	56	59.8	63.2
4,750	23.7	26.7	29.5	32.1	36.3	39.5	42.8	46.6	49.9	53.9	57.6	61.1
5,000	21.7	24.6	27.4	29.9	34.2	37.4	40.8	44.6	48	51.9	55.7	59.1
5,250	19.5	22.5	25.2	27.9	32.2	35.6	39	42.8	46.4	50.3	54.1	57.5
5,500	17.9	20.7	23.5	26.1	30.5	33.9	37.4	41.2	44.8	48.7	52.4	55.8
6,000	14.5	17.1	19.8	22.3	26.8	30.2	33.7	37.5	41.3	45.1	48.8	52.2
6,500	11.8	14.3	16.8	19.3	23.7	27.2	30.7	34.7	38.4	42.3	45.9	49.3
7,000	8.7	10.9	13.3	15.7	20.1	23.7	27.5	31.5	35.4	39.4	42.9	46.2
7,500	7	9	11.2	13.5	17.7	21.4	25.2	29.3	33.2	37.2	40.7	44
8,000	5.7	7.6	9.7	11.8	15.9	19.6	23.5	27.7	31.6	35.7	39.1	42.4
9,000	4	5.6	7.4	9.4	13.3	16.9	20.8	24.9	28.7	32.8	36.3	39.6
10,000	2.2	3.6	5.2	7	10.5	14	17.7	18.6	25.4	28.9	32.6	35.8
11,000	1.1	2	3.1	4.6	7.6	10.5	13.8	17.4	20.6	23.5	26.7	29.4
12,000		0.5	1.2	2.2	4.2	6.4	9.1	12.1	14.6	16.8	19.1	21.1
13,000			0.5	1.1	2.6	4.4	6.7	9.2	11.7	13.5	15.3	17
14,000				0.5	1.7	3.5	5.5	8.2	10.1	11.7	13.4	14.9
15,000					0.7	2.1	3.9	6.8	8.6	10.1	11.6	13
17,000						0.9	2.5	4.9	6.5	7.7	9.1	10.4
19,000							1	2.5	3.6	4.4	5.5	6.6
21,000								0.9	1.6	2.1	3	4
23,000									0.4	0.6	1.1	1.9
25,000										0.3	0.9	1.6
27,000											0.3	0.7
29,000												0.3

Table 5.D-57. Percent Redd Dewatered Look-up Table for Fall-Run Chinook Salmon (Used for the Spring-Run Chinook Salmon Analysis) with ACID Dam Boards Out (the percent of redds dewatered are looked up at the intersection of the "Spawning Flow" columns and "Dewatering Flow" rows).

		Spawning Flow																
Dewatering Flow		3,500	3,750	4,000	4,250	4,500	4,750	5,000	5,250	5,500	6,000	6,500	7,000	7,500	8,000	9,000	10,000	11,000
	3,250	1	2	3.4	4.8	6.6	8.4	10.6	12.9	15.3	20.6	26.2	31.7	37	41.5	50.2	56.3	60.4
	3,500		1	2.1	3.2	4.6	6.2	8.1	10.1	12.2	17	22.2	27.4	29.2	37	45.9	52.8	57.3
	3,750			0.9	1.6	2.6	3.9	5.5	7.3	9.2	13.6	18.4	23.1	28	32.4	41.5	48.7	53.6
	4,000				0.9	1.7	2.8	4.1	5.7	7.3	11.4	15.8	20.3	24.8	29	38	45.7	50.7
	4,250					0.8	1.6	2.7	4	5.4	8.9	13	17.2	21.6	25.8	34.9	42.8	48
	4,500						0.8	1.7	2.8	4	6.9	10.4	14.2	18.2	22.1	30.9	38.8	44.2
	4,750							0.8	1.6	2.5	4.8	7.6	10.8	14.2	17.6	25.8	33.2	38.8
	5,000								0.7	1.3	3.2	5.6	8.6	11.6	14.7	22.6	30.2	36
	5,250									0.7	2.1	4.2	6.8	9.4	12.3	19.8	27.2	33.1
	5,500										1.4	3.2	5.4	7.7	10.3	17.6	24.9	31
	6,000											1.2	2.8	4.6	6.4	12.9	19.7	25.8
	6,500												1.3	2.6	4.2	9.8	15.6	21.1
	7,000													0.9	2	6.6	11.8	17.3
	7,500														0.8	4.4	9.1	14.1
	8,000															2.6	6.6	11.5
	9,000																2.2	5.5
	10,000																	0.9
	11,000																	
	12,000																	
	13,000																	
	14,000																	
	15,000																	
	17,000																	
	19,000																	
	21,000																	
	23,000																	
	25,000																	
	27,000																	
	29,000																	

Table 5.D-57 (cont.)

		Spawning Flow											
		12,000	13,000	14,000	15,000	17,000	19,000	21,000	23,000	25,000	27,000	29,000	31,000
Dewatering Flow	3,250	62.9	63.7	65.3	66.4	66.8	65.7	67.8	71.3	74.5	80.4	87.3	92
	3,500	60.1	61.1	63	64.2	64.9	63.8	66	69.5	73	79.1	86.2	91
	3,750	56.9	58.3	60.3	61.8	62.7	61.7	64	67.7	71.4	77.7	84.9	89.6
	4,000	54.3	55.9	58.2	59.9	61.2	60.2	62.7	66.5	70.4	77.1	84.1	88.8
	4,250	51.8	53.6	56	58.1	59.6	58.8	61.3	65	68.5	75.7	83.1	87.8
	4,500	48.3	50.2	52.8	55.1	57.1	56.4	59	62.7	66.2	73.3	81.8	86.5
	4,750	43.3	45.6	48.6	51.4	54	53.7	56.6	60.4	64.5	71.7	80.3	85
	5,000	40.6	43	46.1	49.1	52.2	52.2	55.2	59.1	63.3	70.6	79.4	84.1
	5,250	37.7	40.2	43.5	46.5	50	50.2	53.5	57.4	60.7	68	78.2	83
	5,500	35.8	38.4	41.7	44.8	48.3	48.8	52.3	56.1	60.1	67.5	77.3	82
	6,000	30.9	33.8	37.3	40.6	45	45.8	49.5	53.2	57.2	65	75.4	80
	6,500	26.5	29.2	32.7	36.1	41	42.4	46.5	50.4	54.8	63	73.3	77.7
	7,000	22.8	25.8	29.3	32.9	38.3	40	44.4	48.3	52.9	61.3	71.8	76.1
	7,500	20	23.2	26.9	30.7	36.4	38.2	42.8	46.8	51.9	60.5	70.9	75.3
	8,000	17.2	20.9	24.9	28.9	34.9	36.6	41.3	45.4	50.5	59.3	70.2	74.7
	9,000	10.6	14.4	18.4	22.5	29.2	31.9	37.4	41.8	47.7	57	68.2	72.6
	10,000	4.5	7.7	12	16.4	23.5	26.9	33	38.5	44.5	54.1	65.9	70.5
	11,000	2.7	5.3	9	13.6	21.4	24.8	30.2	35.3	41.8	51.6	63.7	68.4
	12,000		1.6	4.7	9	16.8	20.6	27	32.9	39.8	50	62.3	67.2
	13,000			1.6	4.8	12.2	16.9	24.4	31.3	38.1	48.4	60.8	65.9
	14,000				2.6	9.5	14.8	22.1	28.9	36.2	46.8	59.5	64.7
	15,000					5.3	11.1	18.5	26.2	33.5	44.6	57.6	63.1
	17,000						4.1	11.3	18.5	26.1	37.8	51.5	57.9
	19,000							4.6	10.8	18.8	30.4	44.2	51.1
	21,000								4.2	11.7	23.9	38.4	46.3
	23,000									6.7	17.8	31.2	38.9
	25,000										2.3	6.4	10.7
	27,000											1.8	5.3
	29,000												2.2

Table 5.D-58. Percent Redd Dewatered Look-up Table for Fall-Run Chinook Salmon (Used for the Spring-Run Chinook Salmon Analysis) with ACID Dam Boards In (the percent of redds dewatered are looked up at the intersection of the “Spawning Flow” columns and “Dewatering Flow” rows).

		Spawning Flow																
Dewatering Flow		3,500	3,750	4,000	4,250	4,500	4,750	5,000	5,250	5,500	6,000	6,500	7,000	7,500	8,000	9,000	10,000	11,000
	3,250	1.0	2.0	3.3	4.7	6.2	7.8	9.7	11.7	13.6	17.8	22.2	26.3	30.2	33.4	39.5	43.5	46.0
	3,500		1.0	2.0	3.1	4.4	5.7	7.4	9.2	10.9	14.8	18.8	22.8	23.9	29.8	36.2	40.8	43.6
	3,750			0.9	1.6	2.5	3.6	5.1	6.7	8.3	11.9	15.6	19.3	23.0	26.2	32.8	37.7	40.9
	4,000				0.9	1.7	2.6	3.8	5.3	6.6	10.0	13.5	16.9	20.4	23.5	30.1	35.4	38.7
	4,250					0.8	1.5	2.5	3.7	5.0	7.8	11.1	14.4	17.8	20.9	27.5	33.1	36.6
	4,500						0.8	1.6	2.6	3.7	6.0	8.9	11.9	15.0	17.8	24.4	29.9	33.6
	4,750							0.8	1.6	2.4	4.3	6.6	9.1	11.8	14.3	20.3	25.7	29.5
	5,000								0.7	1.3	2.9	4.9	7.2	9.6	11.9	17.7	23.1	26.9
	5,250									0.6	1.9	3.5	5.6	7.7	9.7	15.3	20.4	24.1
	5,500										1.2	2.7	4.4	6.2	8.1	13.5	18.5	22.3
	6,000											1.0	2.3	3.7	5.1	9.8	14.5	18.3
	6,500												1.1	2.1	3.3	7.4	11.5	15.0
	7,000													0.7	1.6	5.0	8.6	12.1
	7,500														0.6	3.4	6.7	9.9
	8,000															2.0	4.9	8.1
	9,000																1.6	3.8
	10,000																	1.2
	11,000																	
	12,000																	
	13,000																	
	14,000																	
	15,000																	
	17,000																	
	19,000																	
	21,000																	
	23,000																	
	25,000																	
	27,000																	
	29,000																	

Table 5.D-58 (cont.)

		Spawning Flow											
Dewatering Flow		12,000	13,000	14,000	15,000	17,000	19,000	21,000	23,000	25,000	27,000	29,000	31,000
	3,250	47.6	48.0	49.3	50.5	52.0	52.5	55.1	57.6	57.4	59.0	61.1	63.3
	3,500	45.5	46.0	47.4	48.8	50.4	50.8	53.4	55.9	55.7	57.2	59.3	61.6
	3,750	43.1	43.9	45.5	47.0	48.7	49.1	51.8	54.3	54.1	55.6	57.6	59.8
	4,000	41.2	42.2	43.8	45.5	47.5	47.9	50.5	53.1	52.9	54.5	56.3	58.5
	4,250	39.2	4.0	42.1	43.9	46.0	46.4	49.0	51.3	50.8	52.5	54.4	56.5
	4,500	36.4	37.6	39.4	41.4	43.6	43.9	46.4	48.7	47.8	49.1	51.6	53.7
	4,750	32.6	34.0	36.1	38.3	40.8	41.1	43.6	45.7	44.9	46.0	48.3	50.3
	5,000	30.0	31.2	33.2	35.3	37.6	37.6	39.8	41.7	40.5	41.3	43.2	45.1
	5,250	27.1	28.2	29.9	31.8	33.9	33.5	35.4	36.8	34.6	35.0	37.4	39.0
	5,500	25.3	26.4	28.0	29.7	31.5	31.0	32.7	33.8	31.7	31.9	33.6	35.1
	6,000	21.5	22.7	24.4	26.2	28.2	27.5	29.0	29.8	27.1	27.1	28.7	29.8
	6,500	18.3	19.5	21.1	23.0	25.2	24.7	26.4	27.1	24.4	24.2	25.3	26.3
	7,000	15.6	17.0	18.7	20.7	23.2	22.8	24.5	25.1	22.4	22.1	23.2	24.0
	7,500	13.7	15.3	17.1	19.3	21.9	21.5	23.3	23.9	21.3	21.0	21.9	22.7
	8,000	11.8	13.7	15.7	17.9	20.7	20.2	21.9	22.4	19.8	19.4	20.5	21.4
	9,000	7.2	9.2	11.3	13.6	16.8	16.8	18.9	19.6	17.2	16.8	17.9	18.5
	10,000	3.0	4.9	7.2	9.8	13.3	13.8	16.2	17.4	14.9	14.5	15.9	16.7
	11,000	1.9	3.4	5.4	8.2	12.1	12.2	14.5	15.6	13.3	12.8	14.1	15.0
	12,000		1.0	2.8	5.4	9.4	10.0	12.5	14.0	11.9	11.5	12.9	13.9
	13,000			1.0	3.0	6.9	8.1	11.1	13.1	11.0	10.7	12.1	13.1
	14,000				1.8	5.4	7.0	9.8	11.8	10.0	9.9	11.4	12.4
	15,000					2.8	4.8	7.7	10.2	8.6	8.7	10.4	11.5
	17,000						1.8	5.0	7.5	6.5	6.8	8.5	10.0
	19,000							2.3	4.8	4.6	5.0	6.9	8.4
	21,000								1.9	2.0	2.6	4.7	6.6
	23,000									0.7	1.6	3.6	5.7
	25,000										1.2	3.0	5.0
	27,000											1.2	3.3
	29,000												1.5

Table 5.D-59. Percent Redd Dewatered Look-up Table for California Central Valley Steelhead with ACID Dam Boards In (the percent of redds dewatered are looked up at the intersection of the "Spawning Flow" columns and "Dewatering Flow" rows).

	Spawning Flow																
Dewatering Flow	3,500	3,750	4,000	4,250	4,500	4,750	5,000	5,250	5,500	6,000	6,500	7,000	7,500	8,000	9,000	10,000	11,000
3,250	1.1	2.3	3.3	4.7	6.5	8.7	11	13.6	16	20.3	23.9	26.9	29.3	31.8	37.6	42.3	46.7
3,500		1.4	2.2	3.2	4.6	6.4	8.4	10.8	13	17.1	20.6	23.7	26.1	28.6	34.5	39.2	43.5
3,750			0.6	1.3	2.6	4.1	5.9	8.1	10	13.6	17	20	22.5	25.1	31.2	35.9	40.3
4,000				0.9	2.1	3.3	4.7	6.7	8.3	11.6	14.6	17.4	19.7	22.2	28.3	33.3	37.8
4,250					1.3	2.6	4	5.8	7.2	10.3	13.2	15.9	18.1	20.5	26.5	31.3	35.7
4,500						1.4	2.7	4.2	5.5	8.2	10.8	13.3	15.4	17.6	23.6	28.4	32.7
4,750							1.5	2.9	3.8	6.2	8.5	11	12.9	15.1	20.9	25.7	30
5,000								1.7	2.4	4.4	6.5	8.8	10.6	12.6	18.3	23.1	27.5
5,250									1.1	2.6	4.6	6.5	8	9.6	15	19.7	24
5,500										1.5	3.2	4.8	6.2	7.7	12.8	17.5	21.6
6,000											1.3	2.7	3.8	5.1	9.9	14.3	18.3
6,500												2.7	1.4	2.5	6.9	10.8	14.8
7,000													0.5	1.3	4.9	8.4	12.2
7,500														0.7	4	7.3	10.8
8,000															3	5.9	9.2
9,000																2.2	4.4
10,000																	1.6
11,000																	
12,000																	
13,000																	
14,000																	
15,000																	
17,000																	
19,000																	
21,000																	
23,000																	
25,000																	
27,000																	
29,000																	

Table 5.D-59 (cont.)

	Spawning Flow											
Dewatering Flow	12,000	13,000	14,000	15,000	17,000	19,000	21,000	23,000	25,000	27,000	29,000	31,000
3,250	50.5	53.5	55.6	56.3	54.1	49.5	46.8	42.3	39.1	38.3	37.7	39.2
3,500	47.4	50.6	52.9	54.1	52.3	48.1	45.6	41.3	38.2	37.6	37	38.5
3,750	44.2	47.4	49.9	51.4	50.6	46.3	44.4	40.4	37.6	37	36.5	38.1
4,000	41.7	45.1	47.7	49.4	48.3	44.8	43.2	39.4	37	36.5	36.2	37.8
4,250	36.5	42.8	45.5	47.3	46.6	43.2	41.7	38.2	36	35.6	35.4	37.1
4,500	36.6	39.8	42.6	44.6	44.5	41.5	40.1	36.5	34.2	34	34	35.8
4,750	33.7	37	39.7	41.8	42.1	39.4	38.2	34.8	32.9	32.8	33	34.8
5,000	31.2	34.4	37.2	39.4	39.8	37.2	36.2	32.8	31.1	31.1	31.1	32.8
5,250	27.9	31.1	33.8	36.2	36.9	34.8	33.8	30.3	28.2	28.4	28.9	30.4
5,500	25.3	28.4	31.1	33.5	34.5	32.8	32.3	28.9	26.8	27	27.3	28.8
6,000	21.9	25.1	27.8	30.2	31.3	29.7	29.4	26.3	24.3	24.5	24.8	26
6,500	18.7	22.1	27.8	27.1	28.1	26.2	25.9	22.9	21.2	21.5	21.7	22.8
7,000	16.2	19.6	22.5	24.9	26.4	24.7	24.5	21.7	19.9	20.2	20.4	21.4
7,500	14.8	18.3	21.2	23.7	25.2	23.5	23.5	20.7	19.1	19.3	19.4	20.4
8,000	13.1	16.6	19.5	21.9	23.7	22.2	22.5	19.7	18	18.1	18.5	19.5
9,000	7.6	10.8	13.6	16.6	19.4	18.7	19.3	16.8	15.2	15.4	15.9	17
10,000	3.6	6.6	9.2	12.1	15.1	15.3	16.4	14.5	12.9	13.4	14.3	15.5
11,000	2.3	5	7.5	10.1	13.1	13.1	14.5	12.8	11.5	11.9	12.8	14.1
12,000		2.2	4.3	6.7	10.1	10.9	12.9	11.4	10.4	10.9	11.9	13.2
13,000			3.7	3.6	6.8	8.3	10.7	10.5	9.6	10.3	11.3	12.7
14,000				2.1	5.1	6.6	9.1	9	8.3	9.2	10.3	11.9
15,000					2.6	4.2	7.2	7.9	7.4	8.3	9.4	10.9
17,000						1.9	5.1	5.8	5.6	6.8	8.3	10
19,000							3	3.7	3.8	5.1	6.7	8.4
21,000								1.4	1.8	2.9	4.4	6.3
23,000									0.9	2.2	3.8	5.7
25,000										1.7	3.4	5.4
27,000											1.8	3.8
29,000												2.2

Table 5.D-60. Percent Redd Dewatered Look-up Table for California Central Valley Steelhead with ACID Dam Boards In (the percent of redds dewatered are looked up at the intersection of the “Spawning Flow” columns and “Dewatering Flow” rows).

	Spawning Flow																
Dewatering Flow	3,500	3,750	4,000	4,250	4,500	4,750	5,000	5,250	5,500	6,000	6,500	7,000	7,500	8,000	9,000	10,000	11,000
3,250	1.1	2.3	3.3	4.7	6.5	8.7	11	13.6	16	20.3	23.9	26.9	29.3	31.8	37.6	42.3	46.7
3,500		1.4	2.2	3.2	4.6	6.4	8.4	10.8	13	17.1	20.6	23.7	26.1	28.6	34.5	39.2	43.5
3,750			0.6	1.3	2.6	4.1	5.9	8.1	10	13.6	17	20	22.5	25.1	31.2	35.9	40.3
4,000				0.9	2.1	3.3	4.7	6.7	8.3	11.6	14.6	17.4	19.7	22.2	28.3	33.3	37.8
4,250					1.3	2.6	4	5.8	7.2	10.3	13.2	15.9	18.1	20.5	26.5	31.3	35.7
4,500						1.4	2.7	4.2	5.5	8.2	10.8	13.3	15.4	17.6	23.6	28.4	32.7
4,750							1.5	2.9	3.8	6.2	8.5	11	12.9	15.1	20.9	25.7	30
5,000								1.7	2.4	4.4	6.5	8.8	10.6	12.6	18.3	23.1	27.5
5,250									1.1	2.6	4.6	6.5	8	9.6	15	19.7	24
5,500										1.5	3.2	4.8	6.2	7.7	12.8	17.5	21.6
6,000											1.3	2.7	3.8	5.1	9.9	14.3	18.3
6,500												2.7	1.4	2.5	6.9	10.8	14.8
7,000													0.5	1.3	4.9	8.4	12.2
7,500														0.7	4	7.3	10.8
8,000															3	5.9	9.2
9,000																2.2	4.4
10,000																	1.6
11,000																	
12,000																	
13,000																	
14,000																	
15,000																	
17,000																	
19,000																	
21,000																	
23,000																	
25,000																	
27,000																	
29,000																	

Table 5.D-60 (cont.)

		Spawning Flow											
		12,000	13,000	14,000	15,000	17,000	19,000	21,000	23,000	25,000	27,000	29,000	31,000
Dewatering Flow	3,250	50.5	53.5	55.6	56.3	54.1	49.5	46.8	42.3	39.1	38.3	37.7	39.2
	3,500	47.4	50.6	52.9	54.1	52.3	48.1	45.6	41.3	38.2	37.6	37	38.5
	3,750	44.2	47.4	49.9	51.4	50.6	46.3	44.4	40.4	37.6	37	36.5	38.1
	4,000	41.7	45.1	47.7	49.4	48.3	44.8	43.2	39.4	37	36.5	36.2	37.8
	4,250	36.5	42.8	45.5	47.3	46.6	43.2	41.7	38.2	36	35.6	35.4	37.1
	4,500	36.6	39.8	42.6	44.6	44.5	41.5	40.1	36.5	34.2	34	34	35.8
	4,750	33.7	37	39.7	41.8	42.1	39.4	38.2	34.8	32.9	32.8	33	34.8
	5,000	31.2	34.4	37.2	39.4	39.8	37.2	36.2	32.8	31.1	31.1	31.1	32.8
	5,250	27.9	31.1	33.8	36.2	36.9	34.8	33.8	30.3	28.2	28.4	28.9	30.4
	5,500	25.3	28.4	31.1	33.5	34.5	32.8	32.3	28.9	26.8	27	27.3	28.8
	6,000	21.9	25.1	27.8	30.2	31.3	29.7	29.4	26.3	24.3	24.5	24.8	26
	6,500	18.7	22.1	27.8	27.1	28.1	26.2	25.9	22.9	21.2	21.5	21.7	22.8
	7,000	16.2	19.6	22.5	24.9	26.4	24.7	24.5	21.7	19.9	20.2	20.4	21.4
	7,500	14.8	18.3	21.2	23.7	25.2	23.5	23.5	20.7	19.1	19.3	19.4	20.4
	8,000	13.1	16.6	19.5	21.9	23.7	22.2	22.5	19.7	18	18.1	18.5	19.5
	9,000	7.6	10.8	13.6	16.6	19.4	18.7	19.3	16.8	15.2	15.4	15.9	17
	10,000	3.6	6.6	9.2	12.1	15.1	15.3	16.4	14.5	12.9	13.4	14.3	15.5
	11,000	2.3	5	7.5	10.1	13.1	13.1	14.5	12.8	11.5	11.9	12.8	14.1
	12,000		2.2	4.3	6.7	10.1	10.9	12.9	11.4	10.4	10.9	11.9	13.2
	13,000			3.7	3.6	6.8	8.3	10.7	10.5	9.6	10.3	11.3	12.7
	14,000				2.1	5.1	6.6	9.1	9	8.3	9.2	10.3	11.9
	15,000					2.6	4.2	7.2	7.9	7.4	8.3	9.4	10.9
	17,000						1.9	5.1	5.8	5.6	6.8	8.3	10
	19,000							3	3.7	3.8	5.1	6.7	8.4
	21,000								1.4	1.8	2.9	4.4	6.3
	23,000									0.9	2.2	3.8	5.7
	25,000										1.7	3.4	5.4
	27,000											1.8	3.8
	29,000												2.2

5.D.2.2.5.2 American River

No redd dewatering field data similar to USFWS (2006) were available for CCV steelhead in the American River; therefore, the flow reduction from the spawning to the dewatering flow was used directly. The spawning and dewatering flows for each location and month of CCV steelhead spawning under the PA and the NAA, as estimated by CALSIM II, were used to compute the reduction, expressed as a percentage of the spawning flow, under the two scenarios. Absolute differences in percentages of greater than 5% between the PA and NAA were flagged as potentially having a biologically meaningful effect on CCV steelhead and warranting further investigation.

5.D.2.2.6 Redd Scour

The probability of flows occurring that would be high enough to mobilize sediments and scour or entomb Chinook salmon and CCV steelhead redds was estimated for the PA and the NAA using monthly modeled flows from CALSIM. The amount of flow needed to mobilize sediments in the Sacramento and American Rivers has been little studied (Kondolf 2000; Ayers 2001), but the information available suggests that a minimum of roughly 40,000 cubic feet per second (cfs) of flow is required in both rivers for significant bed movement (scour flow threshold) (Table 5.D-61). It should be noted that 40,000 cfs is likely to be a conservative estimate for redd scour because, due to the areas of a streambed that salmonids typically select for redd construction, the flows needed to scour redds may be significantly greater than those that initiate bed mobility (May et al. 2009).

Table 5.D-61. Estimated Bed Mobility Flows for Potentially Affected Rivers.

River	Approximate flow ranges to initiate mobility (cfs)	References
Sacramento River	24,000–50,000	Kondolf 2000; Cain and Monohan 2008
American River	26,500–50,000	Ayres Associates 2001; Fairman 2007

Redd scour could occur at a very small temporal scale (minutes to hours), whereas CALSIM provides mean monthly flow estimates, and daily flows used to model daily water temperatures in HEC-5Q were uniform within a month and, therefore, not useful for this analysis. In an attempt to overcome this discrepancy in temporal scales, historical monthly and daily flow data during December through April (when scour is most likely to occur) were plotted to determine whether the probability of occurrence of daily flows above the scour flow threshold could be predicted with monthly flow data (Figure 5.D-91, Figure 5.D-92, Figure 5.D-93). The purpose was to find the minimum monthly flow value at which the maximum daily flow in that month would always be greater than the 40,000-cfs scour flow threshold. These minimum monthly flows were found to be 27,300 cfs at Keswick Dam, 21,800 cfs at Bend Bridge, and 19,350 cfs at Hazel Avenue. Therefore, the redd scour/entombment risks for the PA and the NAA were evaluated by comparing frequencies of CALSIM II flows greater than these minimum monthly flows during the spawning and incubation periods of the winter-run and spring-run Chinook salmon and CCV steelhead. CALSIM II flows for Keswick Dam were used to estimate the Keswick Dam flows, CALSIM II flows for Red Bluff were used to estimate the Bend Bridge flows, and CALSIM II flows for Nimbus Dam were used to estimate the Hazel Avenue flows. The Red Bluff location is about 14 miles downstream of Bend Bridge and the Nimbus Dam location is immediately upstream of the Hazel Avenue gage location.

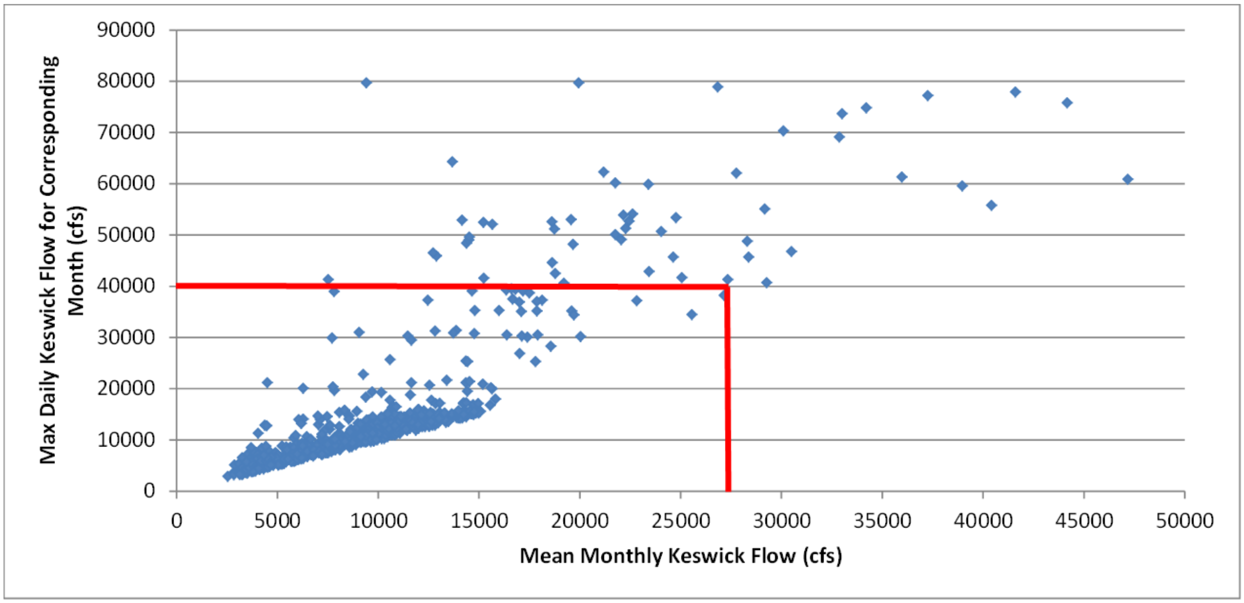


Figure 5.D-91. Relationship between Mean Monthly Flows and Maximum Daily Flows during December through April, Sacramento River at Keswick 1938–2015. Minimum monthly flow is identified in red.

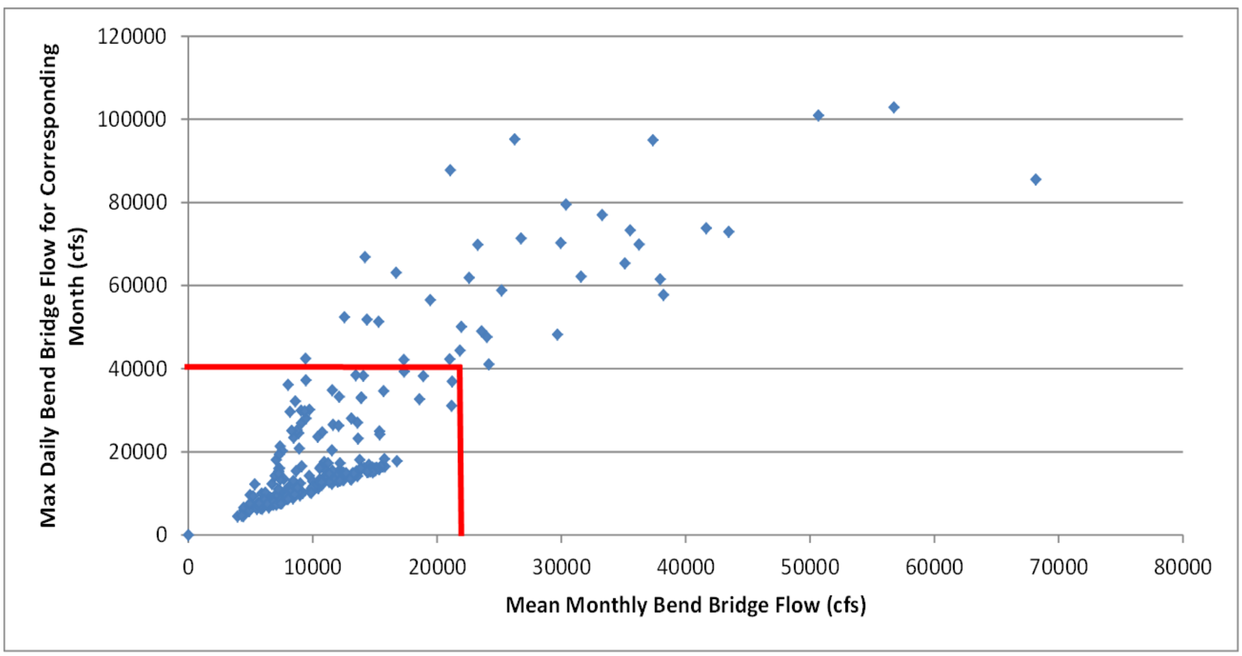


Figure 5.D-92. Relationship between Mean Monthly Flows and Maximum Daily Flows during December through April, Sacramento River at Bend Bridge, 1993–2015. Minimum monthly flow is identified in red.

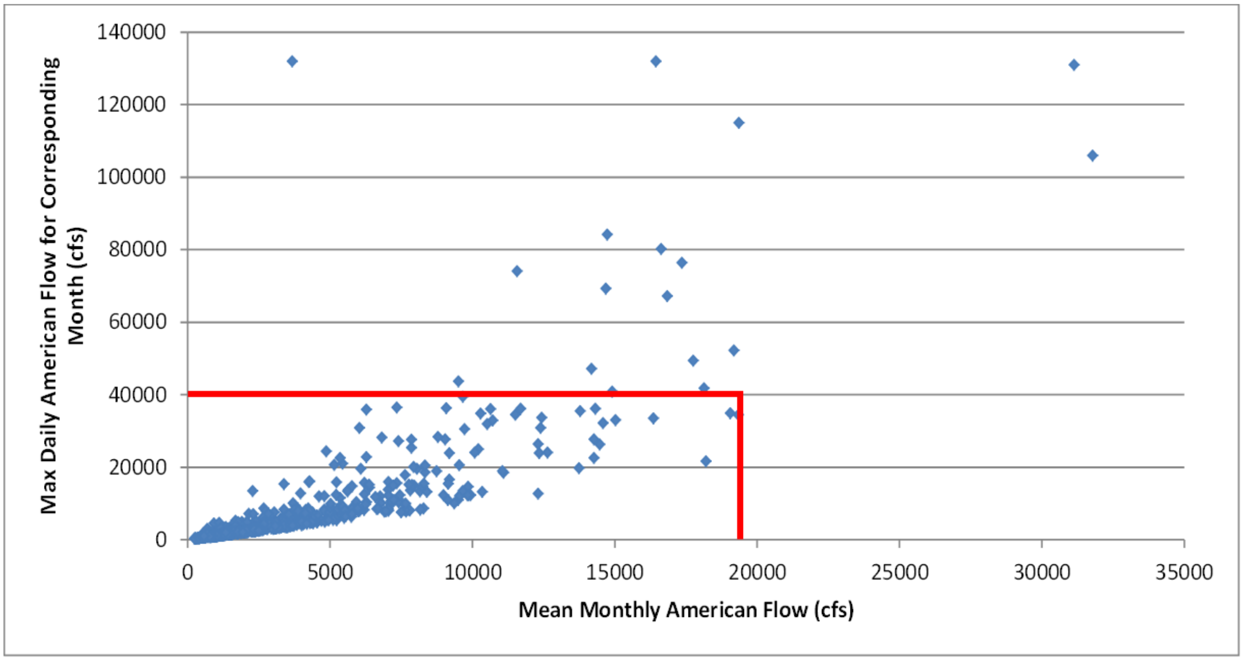


Figure 5.D-93. Relationship between Mean Monthly Flows and Maximum Daily Flows during December through April, American River Downstream of Hazel Avenue, 1950–2015. Minimum monthly flow is identified in red.

5.D.2.2.7 SALMOD

As described in Section 5.D.2.1.2.4, *SALMOD*, the SALMOD model was used to evaluate flow- and temperature-related mortality of early life stages and overall production of winter- and spring-run Chinook salmon in the Sacramento River. Attachment 5.D.2, *SALMOD Model*, describes the details of the model.

There are two primary sources of mortality evaluated in SALMOD, water temperature-related and flow-related, both of which could affect multiple life stages. Flow-related mortality for the *Spawning, Egg incubation, and Alevins* section of the results includes *incubation* mortality (which refers to redd dewatering and scour) and *superimposition* (of redds) mortality (see Attachment 5.D.2, *SALMOD Model*, for full description). Redd superimposition for each race of salmon is predicted without consideration of redd densities of the other races. Flow-related mortality results of the NAA and PA are presented as exceedance plots and mean annual values, as well as differences between NAA and PA. The mean values are presented by water year type and for all water year types combined. A 5% difference between NAA and PA in mean number of a life stage lost was considered biologically meaningful.

5.D.2.3 Rearing Flows Methods

5.D.2.3.1 Introduction

This section describes procedures used in the effects analysis to evaluate potential flow-related effects - resulting from the No Action Alternative (NAA) and Proposed Action (PA) on rearing habitat of winter-run and spring-run Chinook salmon, California Central Valley (CCV) steelhead, and Southern Distinct Population Segment (DPS) green sturgeon in the Sacramento and American Rivers. The specific potential effects evaluated are (1) changes in flow conditions during the months of fry and juvenile rearing and (2) the availability of suitable physical habitat for fry and juvenile rearing.

Modeled flow results for key locations in the Sacramento and American Rivers are reported in Appendix 5A, *CALSIM Methods and Results*. Results in Appendix 5A are presented as (1) mean monthly exceedance plots; (2) box and whiskers plots, with mean, median, quartiles, and 25th and 75th percentile values indicated; and (3) a table of summary statistics and differences between the NAA and PA for each statistic.

The availability of rearing habitat was estimated using weighted usable area (WUA) curves obtained from the literature (U.S. Fish and Wildlife Service 2005b). WUA is an index of the surface area of physical habitat available, weighted by the suitability of that habitat. WUA curves are normally developed as part of instream flow incremental methodology (IFIM) studies.

A potential effect that is not evaluated in the effects analysis is juvenile stranding. Juvenile stranding generally results from reductions in flow that occur over short periods of time, and the CALSIM modeling used to evaluate flow in this effects analysis has a monthly time step, which is too long for any meaningful analysis of juvenile stranding. Juvenile salmon typically rest in shallow slow-moving water between feeding forays into swifter water. This tendency makes them particularly susceptible to stranding during rapid reductions in flow that dewater and isolate the shallow river margin areas (Jarrett and Killam 2015). Juveniles are most vulnerable to stranding during periods of high and fluctuating flow, when they typically move into side channel habitats that may be extensively inundated. Stranding can lead to direct mortality when these areas drain or dry up, or to indirect mortality from predators or rising water temperatures and deteriorating water quality. High, rapidly changing flows may result from flow release pulses to meet Delta water quality standards and from flood control releases, as well as from tributary freshets following rain events (Jarrett and Killam 2015, USBR 2008). Stranding may also occur during periods of controlled flow reductions, such as when irrigation demand declines in the fall (NMFS 2009) or following gate removal at the ACID dam in November and the RBDD dam in September (NMFS 2009).

The effect of juvenile stranding on production of Chinook salmon and steelhead populations is not well understood, but stranding is frequently identified as a potentially important mortality factor for the populations in the Sacramento River and its tributaries (Snider et al. 2001, USFWS 2001, Water Forum 2005, Reclmation 2008, NMFS 2009, Cramer Fish Sciences 2014, Jarret and Killam 2014, 2015). To determine the impact of juvenile stranding on salmonid populations, the number of juveniles lost to stranding is compared the number of juveniles produced. Numbers of stranded juveniles observed in CDFW juvenile stranding surveys are typically very low relative to estimates of total juvenile production. For instance, in the most recent CDFW stranding surveys, 76 surveys conducted from Keswick Dam 73 miles downstream to Tehama Bridge between August 11, 2014 and April 10, 2015, survey teams counted 798 stranded juvenile winter-run Chinook salmon. Of these, 105 were judged not likely to survive based on stranding site conditions and weather forecasts. This number is very small in comparison to the USFWS Juvenile Production Index (JPI), the estimated number of fry equivalents at RBDD, which was 502,506 fish for 2014 (up to December 3) (Kratville 2014, enclosure 2 of NMFS 2015). However, the numbers of stranded juveniles reported in the CDFW survey reports are estimates of observed stranded juveniles and "do not represent the exact total number of stranded fish or fish mortality in this reach or throughout the whole Upper Sacramento River Basin" (Jarrett and Killam 2015). They cannot, therefore, be meaningfully compared to the juvenile production estimate. If the CDFW juvenile stranding surveys continue and improve in the future, meaningful comparisons may be possible, allowing direct estimates of percent mortality resulting from juvenile stranding.

The NMFS 2009 includes ramping rate restrictions on flow releases from both Keswick Dam and Nimbus Dam to reduce the risk of juvenile stranding and redd dewatering. The restrictions for Keswick Dam are given as follows (NMFS 2009, Appendix 1):

> Reclamation proposes a minimum flow of 3,250 cfs from October 1 through March 31 and ramping constraints for Keswick release reductions from July 1 through March 31 as follows:
>
> - Releases must be reduced between sunset and sunrise.
> - When Keswick releases are 6,000 cfs or greater, decreases may not exceed 15 percent per night. Decreases also may not exceed 2.5 percent in one hour.
> - For Keswick releases between 4,000 and 5,999 cfs, decreases may not exceed 200 cfs per night. Decreases also may not exceed 100 cfs per hour.
> - For Keswick releases between 3,250 and 3,999 cfs, decreases may not exceed 100 cfs per night.
> - Variances to these release requirements are allowed under flood control operations.

The ramping restrictions for Nimbus Dam, Action II.4 of the RPA, together with their objective and rationale are given as follows:

<u>Action II.4. Minimize Flow Fluctuation Effects</u>

Objective: Reduce stranding and isolation of juvenile steelhead through ramping protocols.

Action: The following flow fluctuation objectives shall be followed:

1) From January 1 through May 30, at flow levels <5,000 cfs, flow reductions shall not exceed more than 500 cfs/day and not more than 100 cfs per hour.

2) From January 1 through May 30, Reclamation shall coordinate with NMFS, CDFG, and USFWS to fund and implement monitoring in order to estimate the incidental take of salmonids associated with reductions in Nimbus Dam releases.

3) Minimize the occurrence of flows exceeding 4,000 cfs throughout the year, except as may be necessary for flood control or in response to natural high precipitation events.

Rationale: Flow fluctuations in the lower American River have been documented to result in steelhead redd dewatering and isolation (Hannon *et al.*, 2003, Hannon and Deason 2008 as cited in National Marine Fisheries Service 2009), fry stranding, and fry and juvenile isolation (Water Forum 2005a). By limiting the rate of flow reductions, the risk of stranding and isolating steelhead is reduced. Two lower American River habitat evaluations indicate that releases above 4,000 cfs inundate several pools along the river that are isolated at flows below this threshold (CDFG 2001, Hall and Healey 2006 as cited in National Marine

Fisheries Service 2009). Thus, by maintaining releases below 4,000 cfs the risk of isolating juvenile steelhead is reduced.

All ramping restrictions for dams on the Sacramento River and its tributaries would be kept in place for the PA, and, therefore, it is expected that the juvenile stranding risk would be similar for the PA and the NAA. No further analyses regarding juvenile stranding were conducted

Details particular to each of the flow analysis methods implemented are provided below.

5.D.2.3.2 Characterization of Flow

The approach taken to characterize expected flows in the Sacramento and American Rivers for the PA and the NAA, and assessing the potential biological significance of changes in flow resulting from the PA, are based on CALSIM modeling.

5.D.2.3.3 Weighted Usable Area Analysis Methods

5.D.2.3.3.1 Sacramento River

The WUA curves used for Chinook salmon rearing habitat in the Sacramento River were obtained from a U.S. Fish and Wildlife Service (USFWS) report (U.S. Fish and Wildlife Service 2005b). As noted above, WUA is computed as the surface area of physical habitat available weighted by its suitability. Modeling assumptions used to derive WUA curves include that the suitability of physical habitat for salmon and steelhead rearing is largely a function of water depth, flow velocity, and the availability and type of cover. The race- or species-specific suitability of the habitat with respect to these variables is determined by observing the fish and is used to develop habitat suitability criteria (HSC) for each race or species. Hydraulic modeling is then used to estimate the amount of habitat available for different HSC levels at different river flows, and the results are used to develop rearing habitat WUA curves and tables (Leclerc et al. 1995; Bovee et al. 1998). These curves and tables are used to look up the amount of WUA available at different flows.

USFWS (2005b) provides WUA curves and tables for rearing winter-run, fall-run, and late fall–run Chinook salmon for three segments of the Sacramento River encompassing the reach from Keswick Dam to Battle Creek (Section 5.D.2.2, *Spawning Flows Methods*, Figure 5.D-86). Separate curves were developed for fry and juveniles, with fry defined as fish less than 60 millimeters and juveniles defined as greater than 60 millimeters. No WUA curves were developed for spring-run Chinook salmon or CCV steelhead, but, as discussed later, the fall-run curves were used to quantify spring-run rearing habitat and the late fall-run curves were used for steelhead. Figure 5.D-94 through RFM-6 show the flow versus rearing WUA results for fry and juvenile winter-run, fall-run, and late fall-run Chinook salmon in the three river segments (Segment 6 = Keswick to Anderson-Cottonwood Irrigation District [ACID] Dam, Segment 5 = ACID Dam to Cow Creek, and Segment 4 = Cow Creek to Battle Creek) as provided in USFWS 2006 (Section 5.D.2.2, *Spawning Flows Methods*, Figure 5.D-86). Note that for Segment 6, separate WUA curves were developed for periods when the ACID Dam boards were installed and for when the boards were out because installation of the boards affected water depths and velocities for some of the sampling transects used to develop the curves. All rearing WUA analyses were limited to juveniles less than a year old.

Because a number of tributaries enter the Sacramento River between Keswick Dam and Battle Creek, flows are generally different among the segments. For the USFWS studies, flows were measured directly at the sampling transects and were also estimated as the sum of Keswick Dam flow releases and tributary gage readings upstream of the transects. To estimate WUA for the effects analysis, the segment flows were estimated with CALSIM, using the midpoint location of each segment. For Segment 6, the WUA curves for the months when the ACID Dam boards are installed (April through October) were used with the flows for those months and the WUA curves for the months when the ACID Dam boards are out were used with the flows for the rest of the year.

Although fall-run rearing WUA curves were used as surrogates for spring-run rearing, CALSIM flows for the months of spring-run rearing, not those of fall-run rearing, were used to compute the spring-run WUA results. This caveat applies as well to the use of the late fall-run rearing WUA curves to compute CCV steelhead WUA results.

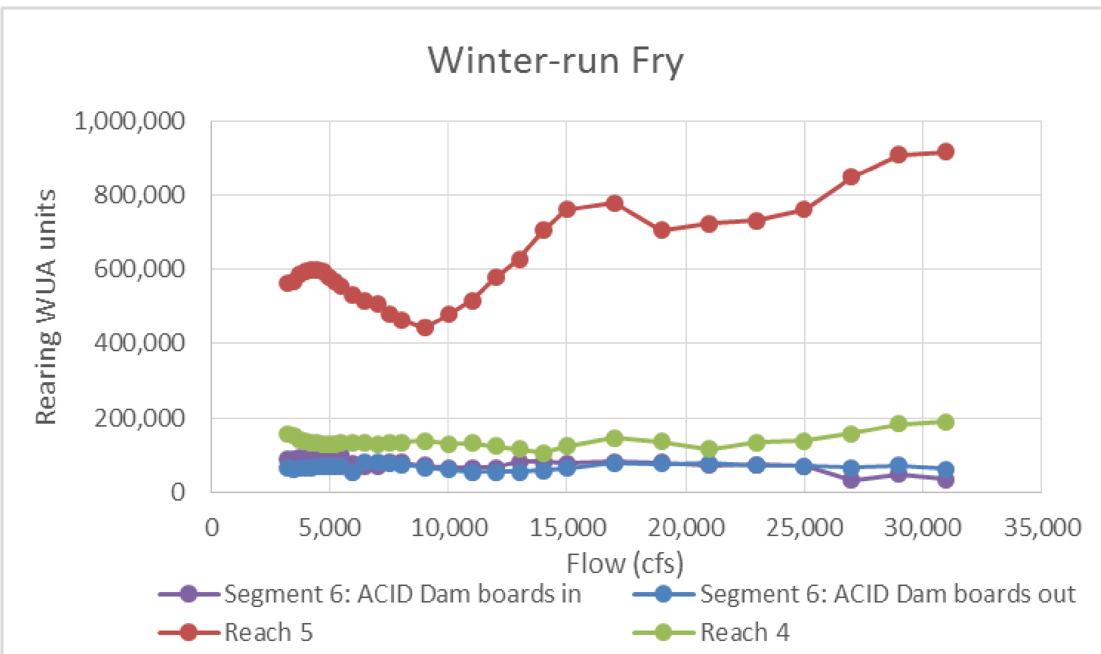


Figure 5.D-94. Rearing WUA curves for Winter-Run Chinook Salmon Fry in the Sacramento River, Segments 4 to 6. ACID = Anderson-Cottonwood Irrigation District.

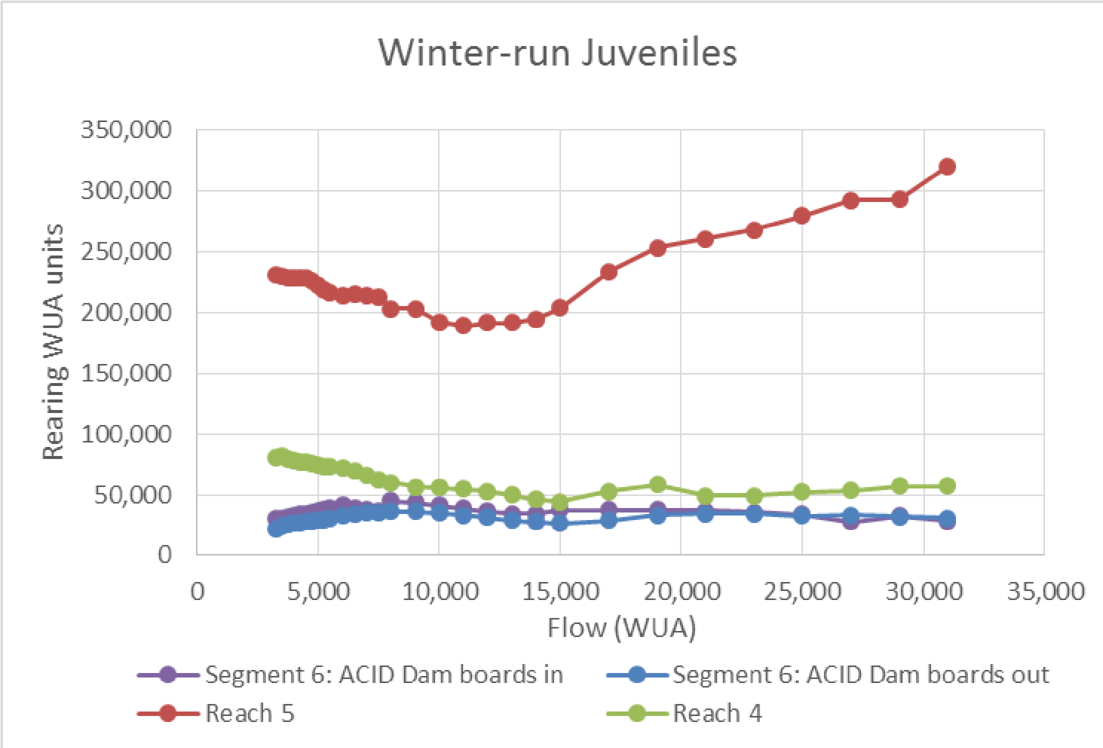


Figure 5.D-95. Rearing WUA curves for Winter-Run Chinook Salmon Juveniles in the Sacramento River, Segments 4 to 6. ACID = Anderson-Cottonwood Irrigation District.

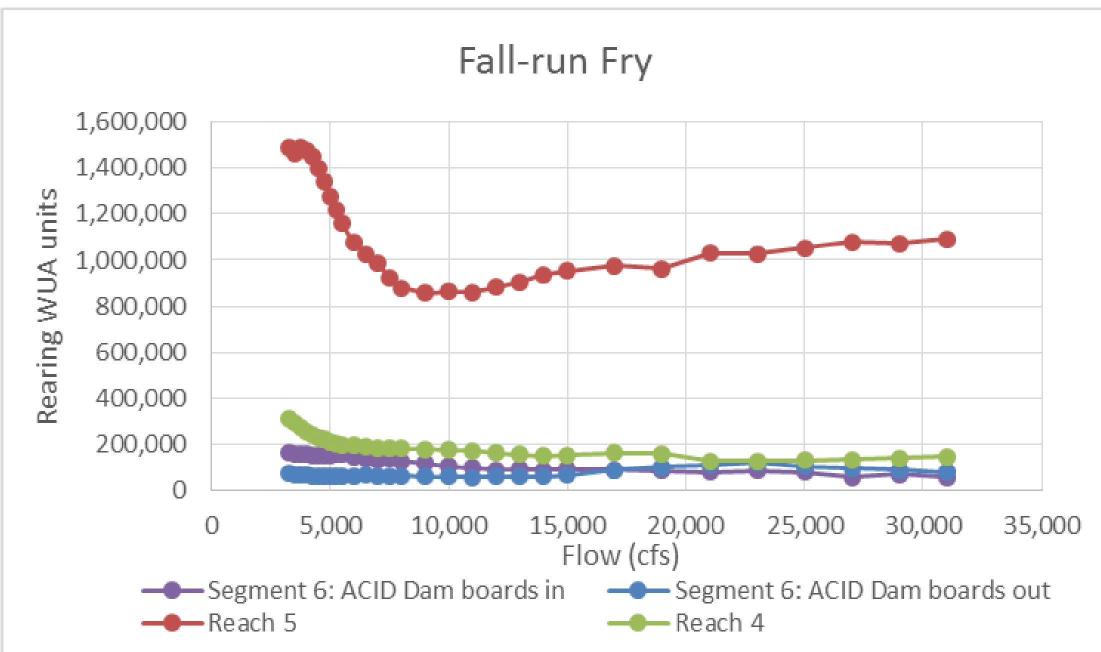


Figure 5.D-96. Rearing WUA Curves for Fall-Run Chinook Salmon Fry in the Sacramento River, Segments 4 to 6. (The fall-run curves were used to quantify spring-run Chinook salmon WUA, as discussed in the text.) ACID = Anderson-Cottonwood Irrigation District.

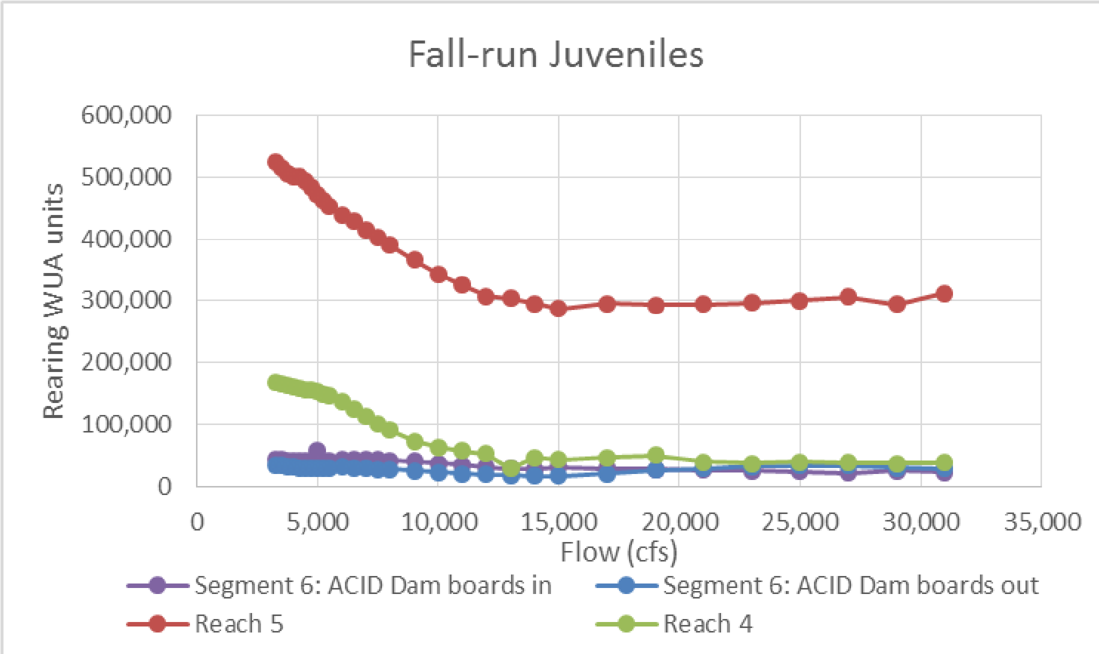


Figure 5.D-97. Rearing WUA Curves for Fall-Run Chinook Salmon Juveniles in the Sacramento River, Segments 4 to 6. (The fall-run curves were used to quantify spring-run Chinook salmon WUA, as discussed in the text.) ACID = Anderson-Cottonwood Irrigation District.

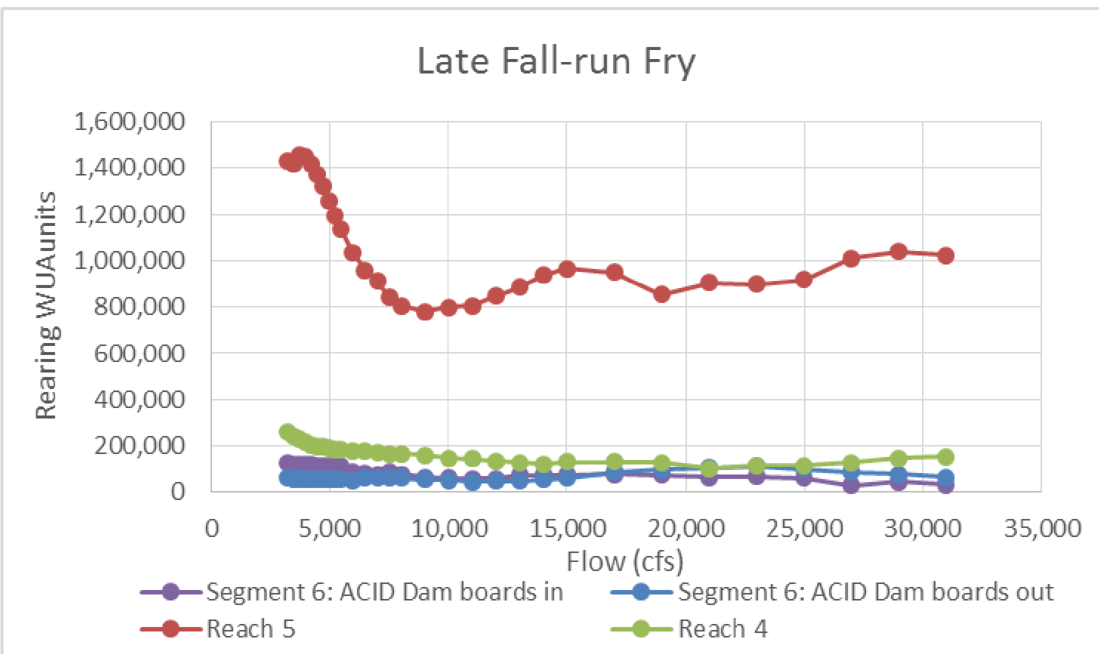


Figure 5.D-98. Rearing WUA Curves for Late Fall-Run Chinook Salmon Fry in the Sacramento River, Segments 4 to 6. (The late fall-run curves were used to quantify CCV steelhead rearing WUA, as discussed in the text.) ACID = Anderson-Cottonwood Irrigation District.

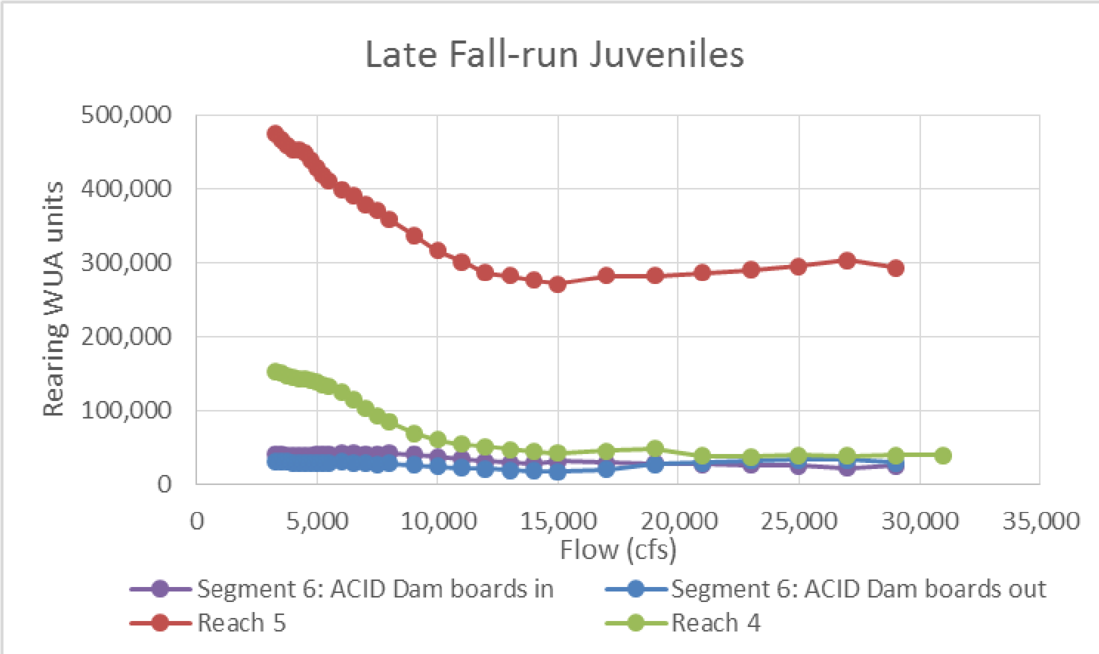


Figure 5.D-99. Rearing WUA Curves for Late Fall-Run Chinook Salmon Juveniles in the Sacramento River, Segments 4 to 6. (The late fall-run curves were used to quantify CCV steelhead rearing WUA, as discussed in the text.) ACID = Anderson-Cottonwood Irrigation District.

As previously noted, there are no spring-run Chinook salmon– or CCV steelhead–rearing WUA curves in the USFWS documentation, so the fall-run and late fall-run Chinook salmon–rearing WUA curves were used as surrogates to model rearing habitat for spring-run and steelhead, respectively. These substitutions follow previous practice. For instance, the SacEFT model, which produces spawning and rearing WUA outputs for spring-run Chinook salmon and CCV steelhead, derives the spring-run WUA results using the fall-run Chinook salmon WUA curves as surrogates and the CCV steelhead WUA results using the late fall-run Chinook salmon WUA curves as surrogates (ESSA 2011; Robinson pers. comm.). Mark Gard, who led the USFWS studies that produced the Sacramento River WUA curves, has endorsed this practice for both spring-run Chinook salmon and CCV steelhead (Gard pers. comm.). It should be noted that this practice introduces additional uncertainty to the spring-run Chinook salmon and CCV steelhead results.

A potential limitation of the WUA curves presented above, as of all IFIM studies, is that they assume the channel characteristics of the river during the time of field data collection by USFWS (1995–1999), such as proportions of mesohabitat types, have remained in dynamic equilibrium to the present time and will continue to do so through the end of the PA (at least 15 years into the future). If the channel characteristics substantially change, the shape of the curves may no longer be applicable. A further limitation is that the curves were developed for the Sacramento River upstream of Battle Creek, but all races of Chinook salmon and CCV steelhead spend time rearing downstream of this part of the river.

Differences in rearing WUA under the PA and NAA for a given species or race were examined using exceedance plots of monthly mean WUA in each of the river segments for each water year type and all water year types combined for the fry and juvenile rearing periods (Table 5.D-62). Further, differences in rearing WUA in each segment under the PAA and NAA were examined using the grand mean rearing WUA for each month of the rearing periods under each water year type and all water year types combined. Differences in mean rearing WUA of greater than 5% between the PA and NAA were flagged as potentially having a biologically meaningful effect on Chinook salmon and CCV steelhead rearing habitat and warranting further investigation.

Table 5.D-62. Fry and Juvenile Rearing Periods for Weighted Usable Area Analysis.

Race/Species	Fry (<60 mm)	Juvenile (>60 mm)
Winter-run Chinook salmon	July–October	September–November
Spring-run Chinook salmon	November–February	Year round
California Central Valley steelhead	February–May	Year round
Note: fry periods assume fry emerge three months after egg deposition and grow for two months before reaching juvenile size. Abbreviations: mm = millimeters.		

The USFWS WUA studies did not include sturgeon, and no other study providing WUA curves for green or white sturgeon (as a potential surrogate) in the Sacramento River has been located. Therefore, effects of the PA on rearing habitat for green sturgeon in the Sacramento River were evaluated by comparing flows under the PA and the NAA in the Sacramento River at Red Bluff and Wilkins Slough during the year-round larval and juvenile rearing period. Changes in flow can affect the instream area available for rearing, the quality of the habitat, and downstream dispersal to rearing habitat in the bay and Delta. There is some evidence that green sturgeon year class strength is positively correlated with Delta outflow, perhaps, in part, as a result of improved downstream dispersal that benefits from higher flows. In general, therefore, it is assumed in the effects analysis that reduced flow resulting from the PA would reduce the availability and quality of green sturgeon habitat and increased flow would increase the availability and quality of green sturgeon habitat, although the certainty of this relationship is unknown. Differences in mean flow of greater than 5% between the PA and NAA were flagged as potentially having a biologically meaningful effect on green sturgeon habitat and warranting further investigation.

5.D.2.3.3.2 American River

The USFWS (2003b) study of CCV steelhead spawning habitat WUA in the American River discussed in Section 5.D.2.2.4.2, *American River*, included no rearing habitat investigations, and no rearing habitat WUA curves have been located for CCV steelhead or any other salmonid in the American River. Therefore, effects of flow on rearing habitat for CCV steelhead in the American River were evaluated using flow simulations from CALSIM modeling for the year-round steelhead rearing period. Although, as evidenced by the rearing habitat WUA curves for Sacramento River winter-run, fall-run, and late fall-run Chinook salmon (Figure 5.D-94 through Figure 5.D-99), effects of river flow on rearing habitat are generally complex, it is assumed for the purposes of this effects analysis that increased flow would increase the availability and quality of rearing habitat and thereby benefit steelhead. Differences in mean flow of greater than 5% between the PA and NAA were flagged as potentially having a biologically meaningful effect on CCV steelhead rearing habitat and warranting further investigation. As noted for green sturgeon, the certainty of this relationship is unknown.

5.D.2.3.4 SALMOD

As described in Section 5.D.2.1.2.4, *SALMOD*, the SALMOD model was used to evaluate flow- and temperature-related mortality of early life stages and overall production of spring- and winter-run Chinook salmon in the Sacramento River. Attachment 5.D.2, *SALMOD Model*, describes the details of the model.

Flow-related mortality of *Fry and Juvenile Rearing* section of the results includes the fry, pre-smolt, and immature smolt life stages. For each of these life stages, mortality results of the NAA and PA are presented as exceedance plots and mean annual values, as well as differences between NAA and PA. The mean values are presented by water year type and for all water year types combined. A 5% difference between NAA and PA in mean number of a life stage lost was considered biologically meaningful.

5.D.2.4 Migration Flows Methods

This section describes procedures used in the effects analysis to evaluate potential flow-related effects of flow resulting from the No Action Alternative (NAA) and Proposed Action (PA) on migration of winter-run and spring-run Chinook salmon, California Central Valley (CCV) steelhead, and green sturgeon in the Sacramento and American Rivers. The specific life stage migrations included in the analysis include immigration of adult winter-run and spring-run Chinook salmon, CCV steelhead, and green sturgeon; emigration of juvenile winter-run and spring-run Chinook salmon and CCV steelhead; emigration of CCV steelhead kelts; emigration of juvenile and larval green sturgeon; and emigration of post-spawn green sturgeon adults. The specific potential effects evaluated are (1) flow conditions during the months of juvenile and adult migration periods that may adversely affect emigration or immigration of salmonids and green sturgeon and (2) the frequency of flows lower than specified adult migration thresholds that may adversely affect the immigration of the adult salmonids and green sturgeon.

Modeled flow results for key locations in the Sacramento and American Rivers are reported in Appendix 5A, *CALSIM Methods and Results*. Results in Appendix 5A are presented as (1) mean monthly exceedance plots; (2) box and whiskers plots, with mean, median, quartiles, and 25th- and 75th-percentile values indicated; and (3) a table of summary statistics and differences between NAA and PA for each statistic.

Flow potentially affects a number of conditions for migrating fish. For immigrating adult salmonids, flow potentially affects cues for locating natal streams, energy expenditure, water quality, crowding, and passage conditions (Quinn 2005; Milner et al. 2012). For emigrating juveniles and kelts, flow potentially affects the timing and rate of emigration, feeding, protective cover, resting habitat, temperature, turbidity, and other habitat factors. Crowding and stranding, especially in side-channel habitats, can also be affected (Quinn 2005; Williams 2006; del Rosario et al. 2013). For green sturgeon, potential effects of flow include energy expenditure, water quality, crowding, passage conditions, feeding, timing and rate of migration, and downstream dispersal of larvae to rearing habitat in the bay and Delta. However, although many of the effects of flow on salmonid and sturgeon migration are understood qualitatively, quantitative relationships between flow and migration are generally highly variable and poorly understood (Quinn 2005; Williams 2006; Milner et al. 2012). It is known that migration cues for anadromous fish species are often the result of natural pulse flows, which will not be affected by the PA (Milner et al. 2012; del Rosario et al. 2013). Increasing flow can have both benefits and costs to migrating salmonids and sturgeon, but on balance, except under very high flows, the benefits generally outweigh the costs. For the purposes of this effects analysis, it is assumed that higher flows would improve both immigration and emigration conditions for all species.

The potential effects of the PA on migration flows were evaluated by comparing CALSIM modeled mean monthly flows by water year type under the PA with those under the NAA for each month of the migration period for a given species and life stage and at a given location. The locations for which migration flows were evaluated in the Sacramento and American Rivers were the CALSIM nodes on the migration corridors of the target species. On the Sacramento River, for winter-run and spring-run Chinook salmon and CCV steelhead, these locations were Keswick Dam, Red Bluff Diversion Dam, Wilkins Slough, and Verona; for green sturgeon, the locations were Red Bluff Diversion Dam, Wilkins Slough, and Verona. On the American River, the locations were Nimbus Dam and the confluence of the American with the Sacramento River for both CCV steelhead and green sturgeon. Differences in mean flow of greater than 5% between the PA and NAA at any of these locations were flagged as potentially having a biologically meaningful effect on migration habitat and warranting further investigation.

An additional analysis was conducted that evaluated the frequency of very low flows under the PA compared to the NAA. Very low flows can interfere with passage (e.g., block due to exposure of an impediment at low flows) of adult salmon, steelhead, and sturgeon and otherwise adversely affect adult migrations. The specific flow level at which passage and related problems for migrating adults first appear is not known for either the Sacramento or American Rivers. Therefore, threshold flows were selected based on the expert judgment of biologists who have long experience from observing fish in these two rivers at many different flows. A 3,250 cfs threshold for the Sacramento River was selected for this analysis because the river rarely drops below this level, and adults have not been observed experiencing any migration difficulties at flows approaching this level (Killam pers. comm.). As such, it represents a conservative minimum flow above which fish do not experience migration difficulties. However, there have not been opportunities to observe whether fish experience migration difficulties below this level. A 1,000 cfs flow threshold for the American River was selected for this analysis because this is the approximate flow at which adult fall-run Chinook salmon have been first observed to delay upstream movement to spawning grounds (Kundargi pers. comm.).

Three locations in the Sacramento River (Keswick Dam, Red Bluff Diversion Dam, and Wilkins Slough) and two locations in the American River (below Nimbus Dam and the confluence with the Sacramento River) were selected for this analysis of very low flows. For each species and location, the number of months and percent of total months during the adult immigration period over the 82 year CALSIM period during which modeled flows would be lower than the minimum flow thresholds were calculated for each scenario. The difference between NAA and PA in number of months in which flows were lower than the threshold was then calculated. A difference of >5% was deemed as potentially having a biologically meaningful effects to a given species and migratory life stage and warranting further investigation.

5.D.2.5 Detailed Water Temperature Threshold Analysis Results

5.D.2.5.1 Sacramento River

5.D.2.5.1.1 Winter-run Chinook Salmon

Table 5.D-63. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Spawning, Egg Incubation, and Alevins, Sacramento River at Keswick, 55.4°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.6	0.6	0.0	2	2	0	0.40	0.40	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	4.7	4.7	0	12	12	NA	0.75	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	2.4	2.4	0.0	7	5	-2	0.78	0.56	-0.22
	All	0.6	1.2	0.6	9	19	10	0.64	0.63	-0.01
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	1.7	1.1	1	2	1	0.50	0.33	-0.17
	All	0.1	0.2	0.2	1	2	1	0.50	0.33	-0.17
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	23.4	24.5	1.1	124	132	8	1.43	1.45	0.03
	All	3.4	3.6	0.2	124	132	8	1.43	1.45	0.03
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	5.5	3.2	-2.3	13	3	-10	0.38	0.15	-0.23
	C	55.1	53.5	-1.6	1,136	1,116	-20	5.54	5.61	0.07
	All	9.4	8.6	-0.8	1,149	1,119	-30	4.81	5.11	0.30
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	9.7	13.6	3.9	17	21	4	0.53	0.47	-0.06
	D	19.7	15.8	-3.8	58	33	-25	0.49	0.35	-0.14
	C	86.7	83.3	-3.3	2,350	2,273	-77	7.53	7.58	0.04
	All	18.8	17.9	-0.9	2,425	2,327	-98	5.25	5.29	0.04
Oct	W	10.7	10.2	-0.5	45	29	-16	0.52	0.35	-0.17
	AN	5.4	3.8	-1.6	5	2	-3	0.25	0.14	-0.11
	BN	27.9	24.0	-3.8	42	20	-22	0.44	0.24	-0.20
	D	40.8	41.5	0.6	139	112	-27	0.55	0.44	-0.11
	C	99.5	100.0	0.5	2,175	2,019	-156	5.88	5.43	-0.45
	All	32.8	32.1	-0.7	2,406	2,182	-224	2.92	2.70	-0.22

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-64. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Spawning, Egg Incubation, and Alevins, Sacramento River at Clear Creek, 55.4°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Apr	W	1.5	1.4	-0.1	8	8	0	0.67	0.73	0.06
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	2.1	2.1	0	5	5	NA	0.71	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.5	0.7	0.2	8	13	5	0.67	0.72	0.06
May	W	4.0	4.0	0.0	55	55	0	1.72	1.72	0
	AN	1.0	1.0	0.0	2	2	0	0.50	0.50	0
	BN	2.3	8.5	6.2	6	60	54	0.75	2.07	1.32
	D	0.6	0.8	0.2	1	2	1	0.25	0.40	0.15
	C	11.0	11.0	0.0	66	58	-8	1.61	1.41	-0.20
	All	3.5	4.4	0.9	130	177	47	1.46	1.59	0.13
Jun	W	1.3	1.3	0.0	6	6	0	0.60	0.60	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	2.1	0.3	-1.8	4	0	-4	0.57	0.00	-0.57
	D	0.8	0.5	-0.3	1	0	-1	0.20	0.00	-0.20
	C	47.8	44.2	-3.6	166	161	-5	0.97	1.01	0.05
	All	7.9	7.0	-0.9	177	167	-10	0.91	0.97	0.05
Jul	W	3.8	3.8	0.0	15	15	0	0.48	0.48	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	12.3	11.4	-0.9	39	25	-14	0.93	0.64	-0.29
	D	9.5	10.5	1.0	24	23	-1	0.41	0.35	-0.05
	C	86.0	84.7	-1.3	576	597	21	1.80	1.90	0.10
	All	17.8	17.7	-0.1	654	660	6	1.45	1.47	0.02
Aug	W	12.9	12.4	-0.5	60	59	-1	0.58	0.59	0.01
	AN	5.5	1.7	-3.7	3	2	-1	0.14	0.29	0.15
	BN	37.5	45.2	7.6	78	134	56	0.61	0.87	0.26
	D	69.2	71.3	2.1	555	463	-92	1.29	1.05	-0.25
	C	100.0	99.7	-0.3	1,854	1,788	-66	4.98	4.82	-0.16
	All	41.5	42.3	0.7	2,550	2,446	-104	2.42	2.28	-0.14
Sep	W	10.0	10.3	0.3	55	51	-4	0.71	0.64	-0.07
	AN	13.1	15.1	2.1	24	27	3	0.47	0.46	-0.01
	BN	79.7	86.1	6.4	397	497	100	1.51	1.75	0.24
	D	94.5	99.0	4.5	1,123	1,211	88	1.98	2.04	0.06
	C	100.0	100.0	0.0	3,239	3,189	-50	9.00	8.86	-0.14
	All	53.6	56.0	2.4	4,838	4,975	137	3.67	3.61	-0.06
Oct	W	91.9	91.8	-0.1	813	873	60	1.10	1.18	0.08
	AN	85.5	81.7	-3.8	325	302	-23	1.02	0.99	-0.03
	BN	90.3	93.3	2.9	450	395	-55	1.46	1.24	-0.22
	D	89.8	97.1	7.3	1,044	1,022	-22	1.87	1.70	-0.18
	C	100.0	100.0	0.0	2,843	2,700	-143	7.64	7.26	-0.38
	All	91.4	93.0	1.6	5,475	5,292	-183	2.38	2.27	-0.12

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-65. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Spawning, Egg Incubation, and Alevins, Sacramento River at Balls Ferry, 55.4°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Apr	W	5.8	5.8	0.0	51	52	1	1.13	1.16	0.02
	AN	4.1	4.4	0.3	9	11	2	0.56	0.65	0.08
	BN	3.3	5.5	2.1	7	18	11	0.64	1.00	0.36
	D	13.7	13.5	-0.2	68	72	4	0.83	0.89	0.06
	C	7.5	6.4	-1.1	22	22	0	0.81	0.96	0.14
	All	7.4	7.5	0.1	157	175	18	0.87	0.95	0.08
May	W	32.0	32.6	0.6	443	447	4	1.72	1.70	-0.02
	AN	34.5	35.2	0.7	161	158	-3	1.16	1.11	-0.05
	BN	29.0	35.2	6.2	91	176	85	0.92	1.47	0.55
	D	37.6	34.4	-3.2	359	313	-46	1.54	1.47	-0.07
	C	69.1	67.5	-1.6	464	441	-23	1.81	1.76	-0.05
	All	38.8	38.9	0.1	1,518	1,535	17	1.54	1.55	0.01
Jun	W	51.0	50.5	-0.5	451	454	3	1.13	1.15	0.02
	AN	24.4	24.1	-0.3	110	101	-9	1.16	1.07	-0.08
	BN	41.2	40.3	-0.9	146	124	-22	1.07	0.93	-0.14
	D	39.5	30.3	-9.2	182	141	-41	0.77	0.77	0.01
	C	91.1	89.7	-1.4	862	816	-46	2.63	2.53	-0.10
	All	48.5	45.8	-2.8	1,751	1,636	-115	1.47	1.45	-0.01
Jul	W	55.1	55.3	0.2	470	464	-6	1.06	1.04	-0.02
	AN	20.6	26.1	5.5	44	53	9	0.53	0.50	-0.03
	BN	45.2	49.6	4.4	246	249	3	1.60	1.47	-0.12
	D	76.5	79.7	3.2	658	681	23	1.39	1.38	-0.01
	C	100.0	100.0	0.0	1,434	1,475	41	3.85	3.97	0.11
	All	60.1	62.4	2.3	2,852	2,922	70	1.87	1.84	-0.03
Aug	W	89.6	90.0	0.4	974	960	-14	1.35	1.32	-0.02
	AN	76.7	84.1	7.4	315	333	18	1.02	0.98	-0.04
	BN	93.8	97.9	4.1	505	610	105	1.58	1.83	0.25
	D	100.0	100.0	0.0	1,708	1,616	-92	2.75	2.61	-0.15
	C	100.0	100.0	0.0	2,519	2,452	-67	6.77	6.59	-0.18
	All	92.2	94.0	1.8	6,021	5,971	-50	2.57	2.50	-0.07
Sep	W	24.4	26.5	2.2	188	184	-4	0.99	0.89	-0.10
	AN	46.2	62.8	16.7	159	247	88	0.88	1.01	0.12
	BN	98.5	99.1	0.6	881	1,030	149	2.71	3.15	0.44
	D	100.0	99.7	-0.3	2,129	2,258	129	3.55	3.78	0.23
	C	100.0	100.0	0.0	3,573	3,550	-23	9.93	9.86	-0.06
	All	67.3	70.6	3.3	6,930	7,269	339	4.19	4.18	0.00
Oct	W	86.7	89.5	2.7	837	926	89	1.20	1.28	0.09
	AN	84.7	83.6	-1.1	367	349	-18	1.17	1.12	-0.04
	BN	92.1	95.6	3.5	513	438	-75	1.63	1.34	-0.29
	D	92.6	97.6	5.0	1,171	1,135	-36	2.04	1.88	-0.16
	C	100.0	100.0	0.0	2,759	2,638	-121	7.42	7.09	-0.33
	All	90.6	93.0	2.4	5,647	5,486	-161	2.48	2.35	-0.13

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-66. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Spawning, Egg Incubation, and Alevins, Sacramento River at Bend Bridge, 55.4°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Apr	W	21.4	21.5	0.1	241	242	1	1.44	1.44	0.00
	AN	28.5	28.7	0.3	173	175	2	1.56	1.56	0.00
	BN	36.4	38.2	1.8	128	147	19	1.07	1.17	0.10
	D	42.3	42.0	-0.3	453	445	-8	1.78	1.77	-0.02
	C	28.9	27.5	-1.4	139	133	-6	1.34	1.34	0.01
	All	30.7	30.8	0.0	1,134	1,142	8	1.50	1.51	0.01
May	W	78.2	78.5	0.4	1,693	1,716	23	2.69	2.71	0.02
	AN	83.6	84.1	0.5	900	895	-5	2.67	2.64	-0.03
	BN	86.5	86.5	0.0	599	689	90	2.03	2.34	0.31
	D	87.6	83.9	-3.7	1,480	1,345	-135	2.73	2.59	-0.14
	C	96.0	95.4	-0.5	1,160	1,124	-36	3.25	3.17	-0.08
	All	85.1	84.3	-0.8	5,832	5,769	-63	2.70	2.69	0.00
Jun	W	95.8	93.8	-1.9	2,349	2,316	-33	3.14	3.16	0.02
	AN	87.7	80.0	-7.7	768	683	-85	2.25	2.19	-0.06
	BN	86.1	82.7	-3.3	691	624	-67	2.43	2.29	-0.15
	D	97.2	93.5	-3.7	1,349	1,148	-201	2.31	2.05	-0.27
	C	98.6	98.6	0.0	1,646	1,558	-88	4.64	4.39	-0.25
	All	93.9	90.8	-3.2	6,803	6,329	-474	2.94	2.83	-0.11
Jul	W	98.0	98.0	0.0	2,332	2,315	-17	2.95	2.93	-0.02
	AN	93.8	94.5	0.7	634	677	43	1.68	1.78	0.10
	BN	98.2	99.7	1.5	818	831	13	2.44	2.44	0.00
	D	99.4	99.7	0.3	1,994	2,053	59	3.24	3.32	0.08
	C	100.0	100.0	0.0	2,254	2,325	71	6.06	6.25	0.19
	All	98.0	98.4	0.4	8,032	8,201	169	3.22	3.28	0.05
Aug	W	99.9	99.9	0.0	2,791	2,764	-27	3.47	3.43	-0.03
	AN	99.8	99.5	-0.2	1,165	1,190	25	2.90	2.97	0.07
	BN	100.0	100.0	0.0	1,158	1,317	159	3.40	3.86	0.47
	D	100.0	100.0	0.0	3,063	2,932	-131	4.94	4.73	-0.21
	C	100.0	100.0	0.0	3,107	3,036	-71	8.35	8.16	-0.19
	All	99.9	99.9	0.0	11,284	11,239	-45	4.44	4.43	-0.02
Sep	W	55.8	57.1	1.3	619	639	20	1.42	1.44	0.01
	AN	88.2	96.4	8.2	596	799	203	1.73	2.13	0.39
	BN	100.0	100.0	0.0	1,539	1,730	191	4.66	5.24	0.58
	D	100.0	100.0	0.0	3,392	3,560	168	5.65	5.93	0.28
	C	100.0	100.0	0.0	3,874	3,870	-4	10.76	10.75	-0.01
	All	84.1	85.8	1.7	10,020	10,598	578	4.84	5.02	0.18
Oct	W	89.1	90.7	1.6	1,141	1,268	127	1.59	1.73	0.15
	AN	89.0	86.6	-2.4	544	533	-11	1.64	1.66	0.01
	BN	93.5	96.8	3.2	664	576	-88	2.08	1.75	-0.34
	D	94.4	96.0	1.6	1,476	1,428	-48	2.52	2.40	-0.12
	C	100.0	100.0	0.0	2,674	2,574	-100	7.19	6.92	-0.27
	All	92.6	93.6	1.0	6,499	6,379	-120	2.80	2.71	-0.08

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-67. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Spawning, Egg Incubation, and Alevins, Sacramento River at Red Bluff, 55.4°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Apr	W	36.4	36.2	-0.3	555	558	3	1.95	1.98	0.02
	AN	46.9	46.7	-0.3	380	382	2	2.08	2.10	0.02
	BN	68.5	70.9	2.4	408	437	29	1.81	1.87	0.06
	D	65.8	64.3	-1.5	981	952	-29	2.48	2.47	-0.02
	C	61.7	60.6	-1.1	415	397	-18	1.87	1.82	-0.05
	All	53.3	52.9	-0.3	2,739	2,726	-13	2.09	2.09	0.00
May	W	87.7	87.8	0.1	2,370	2,396	26	3.35	3.38	0.03
	AN	95.0	94.5	-0.5	1,316	1,310	-6	3.44	3.44	0.00
	BN	98.2	98.2	0.0	956	1,040	84	2.85	3.10	0.25
	D	97.1	94.8	-2.3	2,154	1,987	-167	3.58	3.38	-0.20
	C	99.2	98.7	-0.5	1,579	1,538	-41	4.28	4.19	-0.09
	All	94.3	93.6	-0.7	8,375	8,271	-104	3.50	3.48	-0.02
Jun	W	97.8	96.4	-1.4	2,876	2,823	-53	3.77	3.75	-0.02
	AN	93.8	89.7	-4.1	1,057	942	-115	2.89	2.69	-0.20
	BN	95.2	90.6	-4.5	910	823	-87	2.90	2.75	-0.15
	D	98.7	96.7	-2.0	1,817	1,569	-248	3.07	2.71	-0.36
	C	98.9	98.9	0.0	1,903	1,796	-107	5.35	5.04	-0.30
	All	97.2	95.0	-2.2	8,563	7,953	-610	3.58	3.40	-0.18
Jul	W	99.0	98.9	-0.1	2,818	2,787	-31	3.53	3.50	-0.03
	AN	98.3	98.3	0.0	835	876	41	2.11	2.21	0.10
	BN	100.0	100.0	0.0	985	990	5	2.89	2.90	0.01
	D	99.7	100.0	0.3	2,328	2,388	60	3.77	3.85	0.08
	C	100.0	100.0	0.0	2,453	2,539	86	6.59	6.83	0.23
	All	99.3	99.4	0.0	9,419	9,580	161	3.73	3.79	0.06
Aug	W	100.0	100.0	0.0	3,651	3,614	-37	4.53	4.48	-0.05
	AN	100.0	100.0	0.0	1,575	1,598	23	3.91	3.97	0.06
	BN	100.0	100.0	0.0	1,467	1,656	189	4.30	4.86	0.55
	D	100.0	100.0	0.0	3,704	3,557	-147	5.97	5.74	-0.24
	C	100.0	100.0	0.0	3,416	3,346	-70	9.18	8.99	-0.19
	All	100.0	100.0	0.0	13,813	13,771	-42	5.43	5.42	-0.02
Sep	W	93.3	95.3	1.9	1,649	1,700	51	2.27	2.29	0.02
	AN	100.0	100.0	0.0	1,300	1,541	241	3.33	3.95	0.62
	BN	100.0	100.0	0.0	2,256	2,470	214	6.84	7.48	0.65
	D	100.0	100.0	0.0	4,755	4,929	174	7.93	8.22	0.29
	C	100.0	100.0	0.0	4,513	4,526	13	12.54	12.57	0.04
	All	97.9	98.5	0.6	14,473	15,166	693	6.01	6.26	0.25
Oct	W	98.9	99.1	0.2	2,178	2,335	157	2.73	2.92	0.19
	AN	98.9	98.4	-0.5	1,047	1,037	-10	2.85	2.83	-0.01
	BN	99.7	100.0	0.3	1,152	1,057	-95	3.39	3.10	-0.29
	D	98.7	99.8	1.1	2,377	2,331	-46	3.88	3.77	-0.12
	C	100.0	100.0	0.0	3,157	3,070	-87	8.49	8.25	-0.23
	All	99.1	99.4	0.3	9,911	9,830	-81	3.98	3.94	-0.05

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-68. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Keswick, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.3	0.0	-0.3	0	0	0	0.00	NA	NA
	All	0.0	0.0	0.0	0	0	0	0.00	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	32.8	32.5	-0.3	245	269	24	2.01	2.22	0.21
	All	4.8	4.8	0.0	245	269	24	2.01	2.22	0.21
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	64.4	60.0	-4.4	857	909	52	3.69	4.21	0.51
	All	9.4	8.8	-0.7	857	909	52	3.69	4.21	0.51
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	52.7	49.5	-3.2	450	407	-43	2.30	2.21	-0.08
	All	7.8	7.3	-0.5	450	407	-43	2.30	2.21	-0.08
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.0	-0.6	1	0	-1	0.50	NA	NA
	All	0.1	0.0	-0.1	1	0	-1	0.50	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

1 7DADM = Seven day average daily maximum
2 Only includes days on which temperature exceeded threshold

Table 5.D-69. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Clear Creek, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	3.0	3.2	0.3	10	9	-1	0.91	0.75	-0.16
	All	0.4	0.5	0.0	10	9	-1	0.91	0.75	-0.16
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	41.1	39.2	-1.9	543	565	22	3.55	3.87	0.32
	All	6.0	5.7	-0.3	543	565	22	3.55	3.87	0.32
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	73.1	66.4	-6.7	1,458	1,484	26	5.54	6.21	0.67
	All	10.7	9.7	-1.0	1,458	1,484	26	5.54	6.21	0.67
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	79.8	68.0	-11.8	903	801	-102	3.04	3.17	0.13
	All	11.8	10.1	-1.8	903	801	-102	3.04	3.17	0.13
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	5.8	4.2	-1.7	13	9	-4	0.62	0.60	-0.02
	All	0.9	0.6	-0.2	13	9	-4	0.62	0.60	-0.02
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-70. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Balls Ferry, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	9.7	12.1	2.4	54	65	11	1.50	1.44	-0.06
	All	1.4	1.8	0.4	54	65	11	1.50	1.44	-0.06
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	2.3	0.2	-2.1	4	0	-4	0.29	0	-0.29
	C	46.0	42.5	-3.5	799	802	3	4.67	5.08	0.40
	All	7.3	6.3	-1.0	803	802	-1	4.34	5.04	0.70
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	3.9	6.1	2.1	6	13	7	0.46	0.65	0.19
	D	12.2	11.0	-1.2	52	37	-15	0.71	0.56	-0.15
	C	83.9	73.9	-10.0	1,667	1,658	-9	5.52	6.23	0.71
	All	15.8	14.3	-1.5	1,725	1,708	-17	4.45	4.85	0.41
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.2	0.2	0	0	0	NA	0	NA
	C	76.6	62.6	-14.0	827	742	-85	2.90	3.18	0.28
	All	11.4	9.3	-2.0	827	742	-85	2.90	3.17	0.27
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	4.4	4.2	-0.3	8	7	-1	0.50	0.47	-0.03
	All	0.7	0.6	0.0	8	7	-1	0.50	0.47	-0.03
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-71. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Bend Bridge, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jul	W	3.3	3.7	0.4	7	7	0	0.26	0.23	-0.03
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	1.2	0.6	-0.6	1	0	-1	0.25	0	-0.25
	D	1.3	1.1	-0.2	1	1	0	0.13	0.14	0.02
	C	56.2	64.0	7.8	332	384	52	1.59	1.61	0.02
	All	9.8	10.9	1.1	341	392	51	1.38	1.42	0.04
Aug	W	4.1	3.8	-0.2	21	22	1	0.64	0.71	0.07
	AN	2.7	0.5	-2.2	6	0	-6	0.55	0	-0.55
	BN	0.6	6.5	5.9	1	8	7	0.50	0.36	-0.14
	D	33.1	24.7	-8.4	206	118	-88	1.00	0.77	-0.23
	C	77.2	65.6	-11.6	1,107	1,090	-17	3.86	4.47	0.61
	All	21.2	17.8	-3.4	1,341	1,238	-103	2.49	2.74	0.25
Sep	W	0.8	0.5	-0.3	4	1	-3	0.67	0.25	-0.42
	AN	0.8	0.0	-0.8	1	0	-1	0.33	NA	NA
	BN	26.1	41.8	15.8	85	159	74	0.99	1.15	0.16
	D	46.8	54.8	8.0	469	517	48	1.67	1.57	-0.10
	C	93.9	92.2	-1.7	1,897	1,882	-15	5.61	5.67	0.06
	All	29.0	32.6	3.6	2,456	2,559	103	3.44	3.19	-0.25
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	1.8	1.3	-0.5	5	4	-1	0.45	0.50	0.05
	C	69.6	58.6	-11.0	757	685	-72	2.92	3.14	0.22
	All	10.8	9.0	-1.8	762	689	-73	2.82	3.05	0.23
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	1.7	1.9	0.3	2	2	0	0.33	0.29	-0.05
	All	0.2	0.3	0.0	2	2	0	0.33	0.29	-0.05
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-72. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Red Bluff, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jul	W	8.4	8.4	0.0	46	46	0	0.68	0.68	0
	AN	0.5	0.2	-0.2	1	1	0	0.50	1.00	0.50
	BN	5.0	2.9	-2.1	7	4	-3	0.41	0.40	-0.01
	D	10.5	9.5	-1.0	28	19	-9	0.43	0.32	-0.11
	C	66.1	72.6	6.5	470	548	78	1.91	2.03	0.12
	All	15.7	16.1	0.4	552	618	66	1.39	1.51	0.13
Aug	W	18.0	15.9	-2.1	134	117	-17	0.92	0.91	-0.01
	AN	12.7	9.7	-3.0	47	20	-27	0.92	0.51	-0.41
	BN	15.2	24.6	9.4	22	53	31	0.42	0.63	0.21
	D	57.7	51.6	-6.1	519	391	-128	1.45	1.22	-0.23
	C	85.5	79.0	-6.5	1,363	1,311	-52	4.29	4.46	0.17
	All	36.3	34.0	-2.3	2,085	1,892	-193	2.26	2.19	-0.07
Sep	W	3.5	2.7	-0.8	32	22	-10	1.19	1.05	-0.14
	AN	9.0	16.7	7.7	37	51	14	1.06	0.78	-0.27
	BN	74.8	85.2	10.3	503	669	166	2.04	2.38	0.34
	D	87.5	93.0	5.5	1,462	1,606	144	2.78	2.88	0.09
	C	97.5	97.8	0.3	2,504	2,513	9	7.13	7.14	0.01
	All	48.2	51.9	3.7	4,538	4,861	323	3.83	3.81	-0.02
Oct	W	0.7	2.0	1.2	2	7	5	0.33	0.44	0.10
	AN	1.6	2.2	0.5	2	4	2	0.33	0.50	0.17
	BN	4.7	3.8	-0.9	10	7	-3	0.63	0.54	-0.09
	D	12.1	10.3	-1.8	72	60	-12	0.96	0.94	-0.02
	C	80.9	81.2	0.3	1,123	1,043	-80	3.73	3.45	-0.28
	All	16.1	16.0	0.0	1,209	1,121	-88	2.99	2.78	-0.21
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	4.7	4.4	-0.3	12	11	-1	0.71	0.69	-0.02
	All	0.7	0.7	0.0	12	11	-1	0.71	0.69	-0.02
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-73. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Knights Landing, 64°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jul	W	100.0	100.0	0.0	7,366	7,265	-101	9.14	9.01	-0.13
	AN	100.0	100.0	0.0	3,022	3,025	3	7.50	7.51	0.01
	BN	100.0	100.0	0.0	2,684	2,631	-53	7.87	7.72	-0.16
	D	100.0	100.0	0.0	5,472	5,535	63	8.83	8.93	0.10
	C	100.0	100.0	0.0	4,034	4,189	155	10.84	11.26	0.42
	All	100.0	100.0	0.0	22,578	22,645	67	8.88	8.91	0.03
Aug	W	100.0	100.0	0.0	7,777	7,697	-80	9.65	9.55	-0.10
	AN	100.0	100.0	0.0	3,588	3,642	54	8.90	9.04	0.13
	BN	100.0	100.0	0.0	2,856	3,201	345	8.38	9.39	1.01
	D	100.0	100.0	0.0	6,423	6,282	-141	10.36	10.13	-0.23
	C	100.0	100.0	0.0	4,372	4,303	-69	11.75	11.57	-0.19
	All	100.0	100.0	0.0	25,016	25,125	109	9.84	9.88	0.04
Sep	W	82.6	84.1	1.5	2,229	2,272	43	3.46	3.46	0.00
	AN	99.7	100.0	0.3	1,815	2,149	334	4.67	5.51	0.84
	BN	100.0	100.0	0.0	2,886	3,144	258	8.75	9.53	0.78
	D	100.0	100.0	0.0	6,001	6,128	127	10.00	10.21	0.21
	C	100.0	100.0	0.0	4,223	4,261	38	11.73	11.84	0.11
	All	94.4	95.0	0.5	17,154	17,954	800	7.38	7.69	0.30
Oct	W	27.3	34.2	6.9	217	337	120	0.99	1.22	0.23
	AN	31.5	33.1	1.6	250	292	42	2.14	2.37	0.24
	BN	49.3	41.3	-7.9	444	406	-38	2.64	2.88	0.24
	D	57.1	52.7	-4.4	1,004	961	-43	2.84	2.94	0.10
	C	89.8	88.2	-1.6	1,545	1,558	13	4.63	4.75	0.12
	All	47.5	47.6	0.1	3,460	3,554	94	2.90	2.97	0.07
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	2.2	1.7	-0.6	6	5	-1	0.75	0.83	0.08
	All	0.3	0.2	-0.1	6	5	-1	0.75	0.83	0.08
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.5	0.5	0.0	1	1	0	0.33	0.33	0
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.1	0.1	0.0	1	1	0	0.33	0.33	0

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-74. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Adult Immigration, Sacramento River at Keswick, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-75. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Adult Immigration, Sacramento River at Bend Bridge, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	11.6	16.7	5.1	56	81	25	1.30	1.31	0
	All	1.7	2.4	0.7	56	81	25	1.30	1.31	0

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-76. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Adult Immigration, Sacramento River at Red Bluff, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	21.0	21.2	0.3	101	129	28	1.29	1.63	0.34
	All	3.1	3.1	0.0	101	129	28	1.29	1.63	0.34

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-77. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Adult Holding, Sacramento River at Keswick, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.3	0.0	-0.3	0	0	0	0.00	NA	NA
	All	0.0	0.0	0.0	0	0	0	0.00	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	32.8	32.5	-0.3	245	269	24	2.01	2.22	0.21
	All	4.8	4.8	0.0	245	269	24	2.01	2.22	0.21

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-78. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Adult Holding, Sacramento River at Balls Ferry, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.7	0.7	0.0	3	3	0	0.50	0.50	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.2	0.2	0	0	0	NA	0	NA
	C	1.1	1.1	0.0	2	1	-1	0.50	0.25	-0.25
	All	0.4	0.4	0.0	5	4	-1	0.50	0.36	-0.14
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.3	-0.3	0	0	0	0	0	0
	All	0.1	0.0	0.0	0	0	0	0	0	0
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	9.7	12.1	2.4	54	65	11	1.50	1.44	-0.06
	All	1.4	1.8	0.4	54	65	11	1.50	1.44	-0.06
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	2.3	0.2	-2.1	4	0	-4	0.29	0	-0.29
	C	46.0	42.5	-3.5	799	802	3	4.67	5.08	0.40
	All	7.3	6.3	-1.0	803	802	-1	4.34	5.04	0.70

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-79. Water Temperature Threshold Analysis Results, Winter-Run Chinook Salmon, Adult Holding, Sacramento River at Red Bluff, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.5	0.5	0.0	2	2	0	0.50	0.50	0
	AN	0.5	0.5	0.0	1	1	0	0.50	0.50	0
	BN	0.0	0.3	0.3	0	0	0	NA	0	NA
	D	2.7	2.8	0.2	11	11	0	0.69	0.65	-0.04
	C	1.7	1.7	0.0	6	6	0	1.00	1.00	0
	All	1.1	1.2	0.1	20	20	0	0.71	0.67	-0.05
May	W	15.8	15.9	0.1	162	162	0	1.28	1.27	-0.01
	AN	14.6	12.2	-2.5	81	76	-5	1.37	1.55	0.18
	BN	5.3	8.8	3.5	10	24	14	0.56	0.80	0.24
	D	19.0	14.8	-4.2	181	150	-31	1.53	1.63	0.10
	C	25.3	23.7	-1.6	127	118	-9	1.35	1.34	-0.01
	All	16.4	15.2	-1.1	561	530	-31	1.35	1.37	0.02
Jun	W	12.7	12.4	-0.3	103	103	0	1.04	1.06	0.02
	AN	10.8	9.0	-1.8	39	37	-2	0.93	1.06	0.13
	BN	7.0	6.1	-0.9	23	21	-2	1.00	1.05	0.05
	D	4.3	2.8	-1.5	20	11	-9	0.77	0.65	-0.12
	C	46.7	40.8	-5.8	238	186	-52	1.42	1.27	-0.15
	All	14.6	12.8	-1.7	423	358	-65	1.18	1.13	-0.05
Jul	W	8.4	8.4	0.0	46	46	0	0.68	0.68	0
	AN	0.5	0.2	-0.2	1	1	0	0.50	1.00	0.50
	BN	5.0	2.9	-2.1	7	4	-3	0.41	0.40	-0.01
	D	10.5	9.5	-1.0	28	19	-9	0.43	0.32	-0.11
	C	66.1	72.6	6.5	470	548	78	1.91	2.03	0.12
	All	15.7	16.1	0.4	552	618	66	1.39	1.51	0.13
Aug	W	18.0	15.9	-2.1	134	117	-17	0.92	0.91	-0.01
	AN	12.7	9.7	-3.0	47	20	-27	0.92	0.51	-0.41
	BN	15.2	24.6	9.4	22	53	31	0.42	0.63	0.21
	D	57.7	51.6	-6.1	519	391	-128	1.45	1.22	-0.23
	C	85.5	79.0	-6.5	1,363	1,311	-52	4.29	4.46	0.17
	All	36.3	34.0	-2.3	2,085	1,892	-193	2.26	2.19	-0.07

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

5.D.2.5.1.2 *Spring-Run Chinook Salmon*

Table 5.D-80. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Spawning, Egg Incubation, and Alevins, Sacramento River at Keswick, 55.4°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	5.5	3.2	-2.3	13	3	-10	0.38	0.15	-0.23
	C	55.1	53.5	-1.6	1,136	1,116	-20	5.54	5.61	0.07
	All	9.4	8.6	-0.8	1,149	1,119	-30	4.81	5.11	0.30
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	9.7	13.6	3.9	17	21	4	0.53	0.47	-0.06
	D	19.7	15.8	-3.8	58	33	-25	0.49	0.35	-0.14
	C	86.7	83.3	-3.3	2,350	2,273	-77	7.53	7.58	0.04
	All	18.8	17.9	-0.9	2,425	2,327	-98	5.25	5.29	0.04
Oct	W	10.7	10.2	-0.5	45	29	-16	0.52	0.35	-0.17
	AN	5.4	3.8	-1.6	5	2	-3	0.25	0.14	-0.11
	BN	27.9	24.0	-3.8	42	20	-22	0.44	0.24	-0.20
	D	40.8	41.5	0.6	139	112	-27	0.55	0.44	-0.11
	C	99.5	100.0	0.5	2,175	2,019	-156	5.88	5.43	-0.45
	All	32.8	32.1	-0.7	2,406	2,182	-224	2.92	2.70	-0.22
Nov	W	67.2	61.3	-5.9	404	360	-44	0.77	0.75	-0.02
	AN	50.8	37.5	-13.3	128	92	-36	0.70	0.68	-0.02
	BN	40.6	37.0	-3.6	138	101	-37	1.03	0.83	-0.20
	D	45.7	48.3	2.7	199	212	13	0.73	0.73	0
	C	86.1	86.1	0.0	625	617	-8	2.02	1.99	-0.03
	All	58.6	54.9	-3.7	1,494	1,382	-112	1.05	1.04	-0.01
Dec	W	8.3	7.8	-0.5	50	39	-11	0.75	0.62	-0.13
	AN	6.2	3.0	-3.2	15	4	-11	0.65	0.36	-0.29
	BN	11.4	7.6	-3.8	23	17	-6	0.59	0.65	0.06
	D	2.6	2.9	0.3	7	9	2	0.44	0.50	0.06
	C	14.0	14.5	0.5	31	32	1	0.60	0.59	0
	All	7.8	6.8	-1.0	126	101	-25	0.64	0.59	-0.05

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-81. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Spawning, Egg Incubation, and Alevins, Sacramento River at Clear Creek, 55.4°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	12.9	12.4	-0.5	60	59	-1	0.58	0.59	0.01
	AN	5.5	1.7	-3.7	3	2	-1	0.14	0.29	0.15
	BN	37.5	45.2	7.6	78	134	56	0.61	0.87	0.26
	D	69.2	71.3	2.1	555	463	-92	1.29	1.05	-0.25
	C	100.0	99.7	-0.3	1,854	1,788	-66	4.98	4.82	-0.16
	All	41.5	42.3	0.7	2,550	2,446	-104	2.42	2.28	-0.14
Sep	W	10.0	10.3	0.3	55	51	-4	0.71	0.64	-0.07
	AN	13.1	15.1	2.1	24	27	3	0.47	0.46	-0.01
	BN	79.7	86.1	6.4	397	497	100	1.51	1.75	0.24
	D	94.5	99.0	4.5	1,123	1,211	88	1.98	2.04	0.06
	C	100.0	100.0	0.0	3,239	3,189	-50	9.00	8.86	-0.14
	All	53.6	56.0	2.4	4,838	4,975	137	3.67	3.61	-0.06
Oct	W	91.9	91.8	-0.1	813	873	60	1.10	1.18	0.08
	AN	85.5	81.7	-3.8	325	302	-23	1.02	0.99	-0.03
	BN	90.3	93.3	2.9	450	395	-55	1.46	1.24	-0.22
	D	89.8	97.1	7.3	1,044	1,022	-22	1.87	1.70	-0.18
	C	100.0	100.0	0.0	2,843	2,700	-143	7.64	7.26	-0.38
	All	91.4	93.0	1.6	5,475	5,292	-183	2.38	2.27	-0.12
Nov	W	89.5	84.7	-4.7	1,035	953	-82	1.48	1.44	-0.04
	AN	73.6	64.7	-8.9	348	272	-76	1.31	1.17	-0.15
	BN	63.9	63.9	0.0	323	281	-42	1.53	1.33	-0.20
	D	67.5	72.8	5.3	560	583	23	1.38	1.33	-0.05
	C	93.6	93.6	0.0	944	934	-10	2.80	2.77	-0.03
	All	78.8	77.3	-1.5	3,210	3,023	-187	1.68	1.61	-0.07
Dec	W	13.6	12.2	-1.5	96	80	-16	0.87	0.82	-0.06
	AN	8.1	5.6	-2.4	27	13	-14	0.90	0.62	-0.28
	BN	15.2	11.1	-4.1	43	30	-13	0.83	0.79	-0.04
	D	5.2	4.8	-0.3	18	20	2	0.56	0.67	0.10
	C	17.5	18.3	0.8	51	53	2	0.78	0.78	-0.01
	All	11.5	10.2	-1.4	235	196	-39	0.81	0.77	-0.04

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-82. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Spawning, Egg Incubation, and Alevins, Sacramento River at Balls Ferry, 55.4°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	89.6	90.0	0.4	974	960	-14	1.35	1.32	-0.02
	AN	76.7	84.1	7.4	315	333	18	1.02	0.98	-0.04
	BN	93.8	97.9	4.1	505	610	105	1.58	1.83	0.25
	D	100.0	100.0	0.0	1,708	1,616	-92	2.75	2.61	-0.15
	C	100.0	100.0	0.0	2,519	2,452	-67	6.77	6.59	-0.18
	All	92.2	94.0	1.8	6,021	5,971	-50	2.57	2.50	-0.07
Sep	W	24.4	26.5	2.2	188	184	-4	0.99	0.89	-0.10
	AN	46.2	62.8	16.7	159	247	88	0.88	1.01	0.12
	BN	98.5	99.1	0.6	881	1,030	149	2.71	3.15	0.44
	D	100.0	99.7	-0.3	2,129	2,258	129	3.55	3.78	0.23
	C	100.0	100.0	0.0	3,573	3,550	-23	9.93	9.86	-0.06
	All	67.3	70.6	3.3	6,930	7,269	339	4.19	4.18	0.00
Oct	W	86.7	89.5	2.7	837	926	89	1.20	1.28	0.09
	AN	84.7	83.6	-1.1	367	349	-18	1.17	1.12	-0.04
	BN	92.1	95.6	3.5	513	438	-75	1.63	1.34	-0.29
	D	92.6	97.6	5.0	1,171	1,135	-36	2.04	1.88	-0.16
	C	100.0	100.0	0.0	2,759	2,638	-121	7.42	7.09	-0.33
	All	90.6	93.0	2.4	5,647	5,486	-161	2.48	2.35	-0.13
Nov	W	75.1	66.7	-8.5	633	550	-83	1.08	1.06	-0.02
	AN	54.7	40.8	-13.9	186	126	-60	0.94	0.86	-0.09
	BN	48.5	47.6	-0.9	220	182	-38	1.38	1.16	-0.22
	D	47.0	49.3	2.3	273	298	25	0.97	1.01	0.04
	C	76.7	76.9	0.3	717	717	0	2.60	2.59	-0.01
	All	61.8	57.5	-4.3	2,029	1,873	-156	1.35	1.34	-0.01
Dec	W	4.8	4.3	-0.5	24	15	-9	0.62	0.43	-0.19
	AN	3.2	1.1	-2.2	7	1	-6	0.58	0.25	-0.33
	BN	4.1	3.8	-0.3	8	6	-2	0.57	0.46	-0.11
	D	0.6	0.6	0.0	1	2	1	0.25	0.50	0.25
	C	2.2	2.4	0.3	2	2	0	0.25	0.22	-0.03
	All	3.1	2.6	-0.5	42	26	-16	0.55	0.40	-0.15

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-83. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Spawning, Egg Incubation, and Alevins, Sacramento River at Bend Bridge, 55.4°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	99.9	99.9	0.0	2,791	2,764	-27	3.47	3.43	-0.03
	AN	99.8	99.5	-0.2	1,165	1,190	25	2.90	2.97	0.07
	BN	100.0	100.0	0.0	1,158	1,317	159	3.40	3.86	0.47
	D	100.0	100.0	0.0	3,063	2,932	-131	4.94	4.73	-0.21
	C	100.0	100.0	0.0	3,107	3,036	-71	8.35	8.16	-0.19
	All	99.9	99.9	0.0	11,284	11,239	-45	4.44	4.43	-0.02
Sep	W	55.8	57.1	1.3	619	639	20	1.42	1.44	0.01
	AN	88.2	96.4	8.2	596	799	203	1.73	2.13	0.39
	BN	100.0	100.0	0.0	1,539	1,730	191	4.66	5.24	0.58
	D	100.0	100.0	0.0	3,392	3,560	168	5.65	5.93	0.28
	C	100.0	100.0	0.0	3,874	3,870	-4	10.76	10.75	-0.01
	All	84.1	85.8	1.7	10,020	10,598	578	4.84	5.02	0.18
Oct	W	89.1	90.7	1.6	1,141	1,268	127	1.59	1.73	0.15
	AN	89.0	86.6	-2.4	544	533	-11	1.64	1.66	0.01
	BN	93.5	96.8	3.2	664	576	-88	2.08	1.75	-0.34
	D	94.4	96.0	1.6	1,476	1,428	-48	2.52	2.40	-0.12
	C	100.0	100.0	0.0	2,674	2,574	-100	7.19	6.92	-0.27
	All	92.6	93.6	1.0	6,499	6,379	-120	2.80	2.71	-0.08
Nov	W	49.5	42.4	-7.1	384	319	-65	0.99	0.96	-0.03
	AN	30.3	18.1	-12.2	85	45	-40	0.78	0.69	-0.09
	BN	38.2	37.0	-1.2	163	128	-35	1.29	1.05	-0.24
	D	25.2	28.3	3.2	122	138	16	0.81	0.81	0.00
	C	56.1	56.9	0.8	464	478	14	2.30	2.33	0.03
	All	40.1	36.7	-3.3	1,218	1,108	-110	1.25	1.24	-0.01
Dec	W	0.5	0.2	-0.2	1	0	-1	0.25	0	-0.25
	AN	0.3	0.0	-0.3	0	0	0	0	NA	NA
	BN	0.3	0.6	0.3	0	0	0	0	0	0.00
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.2	0.2	-0.1	1	0	-1	0.17	0	-0.17

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-84. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Spawning, Egg Incubation, and Alevins, Sacramento River at Red Bluff, 55.4°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	100.0	100.0	0.0	3,651	3,614	-37	4.53	4.48	-0.05
	AN	100.0	100.0	0.0	1,575	1,598	23	3.91	3.97	0.06
	BN	100.0	100.0	0.0	1,467	1,656	189	4.30	4.86	0.55
	D	100.0	100.0	0.0	3,704	3,557	-147	5.97	5.74	-0.24
	C	100.0	100.0	0.0	3,416	3,346	-70	9.18	8.99	-0.19
	All	100.0	100.0	0.0	13,813	13,771	-42	5.43	5.42	-0.02
Sep	W	93.3	95.3	1.9	1,649	1,700	51	2.27	2.29	0.02
	AN	100.0	100.0	0.0	1,300	1,541	241	3.33	3.95	0.62
	BN	100.0	100.0	0.0	2,256	2,470	214	6.84	7.48	0.65
	D	100.0	100.0	0.0	4,755	4,929	174	7.93	8.22	0.29
	C	100.0	100.0	0.0	4,513	4,526	13	12.54	12.57	0.04
	All	97.9	98.5	0.6	14,473	15,166	693	6.01	6.26	0.25
Oct	W	98.9	99.1	0.2	2,178	2,335	157	2.73	2.92	0.19
	AN	98.9	98.4	-0.5	1,047	1,037	-10	2.85	2.83	-0.01
	BN	99.7	100.0	0.3	1,152	1,057	-95	3.39	3.10	-0.29
	D	98.7	99.8	1.1	2,377	2,331	-46	3.88	3.77	-0.12
	C	100.0	100.0	0.0	3,157	3,070	-87	8.49	8.25	-0.23
	All	99.1	99.4	0.3	9,911	9,830	-81	3.98	3.94	-0.05
Nov	W	66.5	56.4	-10.1	647	563	-84	1.25	1.28	0.03
	AN	45.8	34.4	-11.4	160	105	-55	0.97	0.85	-0.12
	BN	46.4	45.5	-0.9	252	218	-34	1.65	1.45	-0.19
	D	39.5	40.7	1.2	256	279	23	1.08	1.14	0.06
	C	65.8	66.1	0.3	610	622	12	2.57	2.61	0.04
	All	54.0	49.2	-4.7	1,925	1,787	-138	1.47	1.49	0.03
Dec	W	1.4	0.4	-1.0	3	1	-2	0.27	0.33	0.06
	AN	0.8	0.0	-0.8	1	0	-1	0.33	NA	NA
	BN	0.9	0.6	-0.3	1	1	0	0.33	0.50	0.17
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.7	0.2	-0.5	5	2	-3	0.29	0.40	0.11

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-85. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Keswick, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.3	0.0	-0.3	0	0	0	0.00	NA	NA
	All	0.0	0.0	0.0	0	0	0	0.00	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	32.8	32.5	-0.3	245	269	24	2.01	2.22	0.21
	All	4.8	4.8	0.0	245	269	24	2.01	2.22	0.21
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	64.4	60.0	-4.4	857	909	52	3.69	4.21	0.51
	All	9.4	8.8	-0.7	857	909	52	3.69	4.21	0.51
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	52.7	49.5	-3.2	450	407	-43	2.30	2.21	-0.08
	All	7.8	7.3	-0.5	450	407	-43	2.30	2.21	-0.08
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.0	-0.6	1	0	-1	0.50	NA	NA
	All	0.1	0.0	-0.1	1	0	-1	0.50	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-86. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Clear Creek, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	3.0	3.2	0.3	10	9	-1	0.91	0.75	-0.16
	All	0.4	0.5	0.0	10	9	-1	0.91	0.75	-0.16
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	41.1	39.2	-1.9	543	565	22	3.55	3.87	0.32
	All	6.0	5.7	-0.3	543	565	22	3.55	3.87	0.32
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	73.1	66.4	-6.7	1,458	1,484	26	5.54	6.21	0.67
	All	10.7	9.7	-1.0	1,458	1,484	26	5.54	6.21	0.67
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	79.8	68.0	-11.8	903	801	-102	3.04	3.17	0.13
	All	11.8	10.1	-1.8	903	801	-102	3.04	3.17	0.13
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	5.8	4.2	-1.7	13	9	-4	0.62	0.60	-0.02
	All	0.9	0.6	-0.2	13	9	-4	0.62	0.60	-0.02
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-87. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Balls Ferry, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.7	0.7	0.0	3	3	0	0.50	0.50	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.2	0.2	0	0	0	NA	0	NA
	C	1.1	1.1	0.0	2	1	-1	0.50	0.25	-0.25
	All	0.4	0.4	0.0	5	4	-1	0.50	0.36	-0.14
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.3	-0.3	0	0	0	0	0	0
	All	0.1	0.0	0.0	0	0	0	0	0	0
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	9.7	12.1	2.4	54	65	11	1.50	1.44	-0.06
	All	1.4	1.8	0.4	54	65	11	1.50	1.44	-0.06
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	2.3	0.2	-2.1	4	0	-4	0.29	0	-0.29
	C	46.0	42.5	-3.5	799	802	3	4.67	5.08	0.40
	All	7.3	6.3	-1.0	803	802	-1	4.34	5.04	0.70
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	3.9	6.1	2.1	6	13	7	0.46	0.65	0.19
	D	12.2	11.0	-1.2	52	37	-15	0.71	0.56	-0.15
	C	83.9	73.9	-10.0	1,667	1,658	-9	5.52	6.23	0.71
	All	15.8	14.3	-1.5	1,725	1,708	-17	4.45	4.85	0.41
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.2	0.2	0	0	0	NA	0	NA
	C	76.6	62.6	-14.0	827	742	-85	2.90	3.18	0.28
	All	11.4	9.3	-2.0	827	742	-85	2.90	3.17	0.27
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	4.4	4.2	-0.3	8	7	-1	0.50	0.47	-0.03
	All	0.7	0.6	0.0	8	7	-1	0.50	0.47	-0.03
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-88. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Bend Bridge, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.2	0.2	0.0	1	1	0	1.00	1.00	0
	C	0.3	0.3	0.0	1	0	-1	1.00	0	-1.00
	All	0.1	0.1	0.0	2	1	-1	1.00	0.50	-0.50
May	W	6.2	6.2	0.0	50	50	0	1.00	1.00	0
	AN	5.5	5.5	0.0	26	26	0	1.18	1.18	0
	BN	0.3	2.9	2.6	0	7	7	0	0.70	0.70
	D	9.4	7.7	-1.6	66	55	-11	1.14	1.15	0.01
	C	9.4	9.4	0.0	36	32	-4	1.03	0.91	-0.11
	All	6.5	6.5	0.0	178	170	-8	1.07	1.03	-0.04
Jun	W	5.3	5.5	0.3	36	37	1	0.88	0.86	-0.02
	AN	4.4	4.4	0.0	16	16	0	0.94	0.94	0
	BN	3.6	3.3	-0.3	10	10	0	0.83	0.91	0.08
	D	0.3	0.2	-0.2	1	0	-1	0.50	0	-0.50
	C	29.7	26.9	-2.8	113	79	-34	1.06	0.81	-0.24
	All	7.3	6.9	-0.4	176	142	-34	0.98	0.84	-0.14
Jul	W	3.3	3.7	0.4	7	7	0	0.26	0.23	-0.03
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	1.2	0.6	-0.6	1	0	-1	0.25	0	-0.25
	D	1.3	1.1	-0.2	1	1	0	0.13	0.14	0.02
	C	56.2	64.0	7.8	332	384	52	1.59	1.61	0.02
	All	9.8	10.9	1.1	341	392	51	1.38	1.42	0.04
Aug	W	4.1	3.8	-0.2	21	22	1	0.64	0.71	0.07

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	2.7	0.5	-2.2	6	0	-6	0.55	0	-0.55
	BN	0.6	6.5	5.9	1	8	7	0.50	0.36	-0.14
	D	33.1	24.7	-8.4	206	118	-88	1.00	0.77	-0.23
	C	77.2	65.6	-11.6	1,107	1,090	-17	3.86	4.47	0.61
	All	21.2	17.8	-3.4	1,341	1,238	-103	2.49	2.74	0.25
Sep	W	0.8	0.5	-0.3	4	1	-3	0.67	0.25	-0.42
	AN	0.8	0.0	-0.8	1	0	-1	0.33	NA	NA
	BN	26.1	41.8	15.8	85	159	74	0.99	1.15	0.16
	D	46.8	54.8	8.0	469	517	48	1.67	1.57	-0.10
	C	93.9	92.2	-1.7	1,897	1,882	-15	5.61	5.67	0.06
	All	29.0	32.6	3.6	2,456	2,559	103	3.44	3.19	-0.25
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	1.8	1.3	-0.5	5	4	-1	0.45	0.50	0.05
	C	69.6	58.6	-11.0	757	685	-72	2.92	3.14	0.22
	All	10.8	9.0	-1.8	762	689	-73	2.82	3.05	0.23
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	1.7	1.9	0.3	2	2	0	0.33	0.29	-0.05
	All	0.2	0.3	0.0	2	2	0	0.33	0.29	-0.05
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-89. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Red Bluff, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.5	0.5	0.0	2	2	0	0.50	0.50	0
	AN	0.5	0.5	0.0	1	1	0	0.50	0.50	0
	BN	0.0	0.3	0.3	0	0	0	NA	0	NA
	D	2.7	2.8	0.2	11	11	0	0.69	0.65	-0.04
	C	1.7	1.7	0.0	6	6	0	1.00	1.00	0
	All	1.1	1.2	0.1	20	20	0	0.71	0.67	-0.05
May	W	15.8	15.9	0.1	162	162	0	1.28	1.27	-0.01
	AN	14.6	12.2	-2.5	81	76	-5	1.37	1.55	0.18
	BN	5.3	8.8	3.5	10	24	14	0.56	0.80	0.24
	D	19.0	14.8	-4.2	181	150	-31	1.53	1.63	0.10
	C	25.3	23.7	-1.6	127	118	-9	1.35	1.34	-0.01
	All	16.4	15.2	-1.1	561	530	-31	1.35	1.37	0.02
Jun	W	12.7	12.4	-0.3	103	103	0	1.04	1.06	0.02
	AN	10.8	9.0	-1.8	39	37	-2	0.93	1.06	0.13
	BN	7.0	6.1	-0.9	23	21	-2	1.00	1.05	0.05
	D	4.3	2.8	-1.5	20	11	-9	0.77	0.65	-0.12
	C	46.7	40.8	-5.8	238	186	-52	1.42	1.27	-0.15
	All	14.6	12.8	-1.7	423	358	-65	1.18	1.13	-0.05
Jul	W	8.4	8.4	0.0	46	46	0	0.68	0.68	0
	AN	0.5	0.2	-0.2	1	1	0	0.50	1.00	0.50
	BN	5.0	2.9	-2.1	7	4	-3	0.41	0.40	-0.01
	D	10.5	9.5	-1.0	28	19	-9	0.43	0.32	-0.11
	C	66.1	72.6	6.5	470	548	78	1.91	2.03	0.12
	All	15.7	16.1	0.4	552	618	66	1.39	1.51	0.13
Aug	W	18.0	15.9	-2.1	134	117	-17	0.92	0.91	-0.01

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	12.7	9.7	-3.0	47	20	-27	0.92	0.51	-0.41
	BN	15.2	24.6	9.4	22	53	31	0.42	0.63	0.21
	D	57.7	51.6	-6.1	519	391	-128	1.45	1.22	-0.23
	C	85.5	79.0	-6.5	1,363	1,311	-52	4.29	4.46	0.17
	All	36.3	34.0	-2.3	2,085	1,892	-193	2.26	2.19	-0.07
Sep	W	3.5	2.7	-0.8	32	22	-10	1.19	1.05	-0.14
	AN	9.0	16.7	7.7	37	51	14	1.06	0.78	-0.27
	BN	74.8	85.2	10.3	503	669	166	2.04	2.38	0.34
	D	87.5	93.0	5.5	1,462	1,606	144	2.78	2.88	0.09
	C	97.5	97.8	0.3	2,504	2,513	9	7.13	7.14	0.01
	All	48.2	51.9	3.7	4,538	4,861	323	3.83	3.81	-0.02
Oct	W	0.7	2.0	1.2	2	7	5	0.33	0.44	0.10
	AN	1.6	2.2	0.5	2	4	2	0.33	0.50	0.17
	BN	4.7	3.8	-0.9	10	7	-3	0.63	0.54	-0.09
	D	12.1	10.3	-1.8	72	60	-12	0.96	0.94	-0.02
	C	80.9	81.2	0.3	1,123	1,043	-80	3.73	3.45	-0.28
	All	16.1	16.0	0.0	1,209	1,121	-88	2.99	2.78	-0.21
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	4.7	4.4	-0.3	12	11	-1	0.71	0.69	-0.02
	All	0.7	0.7	0.0	12	11	-1	0.71	0.69	-0.02
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-90. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Fry and Juvenile Rearing and Emigration, Sacramento River at Knights Landing, 64°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.5	0.5	0.0	1	1	0	0.33	0.33	0
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.1	0.1	0.0	1	1	0	0.33	0.33	0
Apr	W	5.1	5.1	0.0	35	35	0	0.88	0.88	0
	AN	9.2	9.0	-0.3	34	34	0	0.94	0.97	0.03
	BN	36.7	38.5	1.8	171	181	10	1.41	1.43	0.01
	D	22.2	21.2	-1.0	232	224	-8	1.74	1.76	0.02
	C	35.8	34.4	-1.4	209	203	-6	1.62	1.64	0.02
	All	18.7	18.4	-0.2	681	677	-4	1.48	1.49	0.01
May	W	72.2	72.3	0.1	2,517	2,536	19	4.32	4.35	0.03
	AN	87.8	87.8	0.0	1,768	1,759	-9	4.99	4.97	-0.03
	BN	96.5	97.1	0.6	1,538	1,561	23	4.67	4.72	0.04
	D	95.8	95.3	-0.5	3,299	3,065	-234	5.55	5.19	-0.37
	C	98.7	97.8	-0.8	2,152	2,114	-38	5.86	5.81	-0.06
	All	87.6	87.5	-0.1	11,274	11,035	-239	5.06	4.96	-0.10
Jun	W	98.7	98.7	0.0	5,886	5,747	-139	7.64	7.46	-0.18
	AN	100.0	100.0	0.0	3,022	2,769	-253	7.75	7.10	-0.65
	BN	100.0	100.0	0.0	2,354	2,143	-211	7.13	6.49	-0.64
	D	100.0	100.0	0.0	4,867	4,403	-464	8.11	7.34	-0.77
	C	100.0	100.0	0.0	3,262	3,080	-182	9.06	8.56	-0.51
	All	99.6	99.6	0.0	19,391	18,142	-1,249	7.91	7.40	-0.51
Jul	W	100.0	100.0	0.0	7,366	7,265	-101	9.14	9.01	-0.13
	AN	100.0	100.0	0.0	3,022	3,025	3	7.50	7.51	0.01
	BN	100.0	100.0	0.0	2,684	2,631	-53	7.87	7.72	-0.16
	D	100.0	100.0	0.0	5,472	5,535	63	8.83	8.93	0.10
	C	100.0	100.0	0.0	4,034	4,189	155	10.84	11.26	0.42
	All	100.0	100.0	0.0	22,578	22,645	67	8.88	8.91	0.03
Aug	W	100.0	100.0	0.0	7,777	7,697	-80	9.65	9.55	-0.10

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	100.0	100.0	0.0	3,588	3,642	54	8.90	9.04	0.13
	BN	100.0	100.0	0.0	2,856	3,201	345	8.38	9.39	1.01
	D	100.0	100.0	0.0	6,423	6,282	-141	10.36	10.13	-0.23
	C	100.0	100.0	0.0	4,372	4,303	-69	11.75	11.57	-0.19
	All	100.0	100.0	0.0	25,016	25,125	109	9.84	9.88	0.04
Sep	W	82.6	84.1	1.5	2,229	2,272	43	3.46	3.46	0.00
	AN	99.7	100.0	0.3	1,815	2,149	334	4.67	5.51	0.84
	BN	100.0	100.0	0.0	2,886	3,144	258	8.75	9.53	0.78
	D	100.0	100.0	0.0	6,001	6,128	127	10.00	10.21	0.21
	C	100.0	100.0	0.0	4,223	4,261	38	11.73	11.84	0.11
	All	94.4	95.0	0.5	17,154	17,954	800	7.38	7.69	0.30
Oct	W	27.3	34.2	6.9	217	337	120	0.99	1.22	0.23
	AN	31.5	33.1	1.6	250	292	42	2.14	2.37	0.24
	BN	49.3	41.3	-7.9	444	406	-38	2.64	2.88	0.24
	D	57.1	52.7	-4.4	1,004	961	-43	2.84	2.94	0.10
	C	89.8	88.2	-1.6	1,545	1,558	13	4.63	4.75	0.12
	All	47.5	47.6	0.1	3,460	3,554	94	2.90	2.97	0.07
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	2.2	1.7	-0.6	6	5	-1	0.75	0.83	0.08
	All	0.3	0.2	-0.1	6	5	-1	0.75	0.83	0.08
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-91. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Adult Immigration, Sacramento River at Keswick, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	2.2	2.2	0	3	3	NA	0.38	NA
	All	0.0	0.3	0.3	0	3	3	NA	0.38	NA

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-92. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Adult Immigration, Sacramento River at Bend Bridge, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	11.6	16.7	5.1	56	81	25	1.30	1.31	0.004
	All	1.7	2.4	0.7	56	81	25	1.30	1.31	0.004
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	28.1	33.3	5.3	163	203	40	1.61	1.69	0.08
	All	4.1	4.9	0.8	163	203	40	1.61	1.69	0.08

[1] 7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-93. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Adult Immigration, Sacramento River at Red Bluff, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	21.0	21.2	0.3	101	129	28	1.29	1.63	0.34
	All	3.1	3.1	0.0	101	129	28	1.29	1.63	0.34
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.6	0.6	0	1	1	NA	0.50	NA
	D	0.8	0.5	-0.3	1	1	0	0.20	0.33	0.13
	C	51.1	55.0	3.9	408	476	68	2.22	2.40	0.19
	All	7.7	8.3	0.6	409	478	69	2.16	2.35	0.19

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-94. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Adult Holding, Sacramento River at Keswick, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.3	0.0	-0.3	0	0	0	0.00	NA	NA
	All	0.0	0.0	0.0	0	0	0	0.00	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	32.8	32.5	-0.3	245	269	24	2.01	2.22	0.21
	All	4.8	4.8	0.0	245	269	24	2.01	2.22	0.21
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	64.4	60.0	-4.4	857	909	52	3.69	4.21	0.51
	All	9.4	8.8	-0.7	857	909	52	3.69	4.21	0.51

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-95. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Adult Holding, Sacramento River at Balls Ferry, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.7	0.7	0.0	3	3	0	0.50	0.50	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.2	0.2	0	0	0	NA	0	NA
	C	1.1	1.1	0.0	2	1	-1	0.50	0.25	-0.25
	All	0.4	0.4	0.0	5	4	-1	0.50	0.36	-0.14
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.3	-0.3	0	0	0	0	0	0
	All	0.1	0.0	0.0	0	0	0	0	0	0
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	9.7	12.1	2.4	54	65	11	1.50	1.44	-0.06
	All	1.4	1.8	0.4	54	65	11	1.50	1.44	-0.06
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	2.3	0.2	-2.1	4	0	-4	0.29	0	-0.29
	C	46.0	42.5	-3.5	799	802	3	4.67	5.08	0.40
	All	7.3	6.3	-1.0	803	802	-1	4.34	5.04	0.70
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	3.9	6.1	2.1	6	13	7	0.46	0.65	0.19
	D	12.2	11.0	-1.2	52	37	-15	0.71	0.56	-0.15
	C	83.9	73.9	-10.0	1,667	1,658	-9	5.52	6.23	0.71
	All	15.8	14.3	-1.5	1,725	1,708	-17	4.45	4.85	0.41

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-96. Water Temperature Threshold Analysis Results, Spring-Run Chinook Salmon, Adult Holding, Sacramento River at Red Bluff, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Apr	W	0.5	0.5	0.0	2	2	0	0.50	0.50	0
	AN	0.5	0.5	0.0	1	1	0	0.50	0.50	0
	BN	0.0	0.3	0.3	0	0	0	NA	0.00	NA
	D	2.7	2.8	0.2	11	11	0	0.69	0.65	-0.04
	C	1.7	1.7	0.0	6	6	0	1.00	1.00	0
	All	1.1	1.2	0.1	20	20	0	0.71	0.67	-0.05
May	W	15.8	15.9	0.1	162	162	0	1.28	1.27	-0.01
	AN	14.6	12.2	-2.5	81	76	-5	1.37	1.55	0.18
	BN	5.3	8.8	3.5	10	24	14	0.56	0.80	0.24
	D	19.0	14.8	-4.2	181	150	-31	1.53	1.63	0.10
	C	25.3	23.7	-1.6	127	118	-9	1.35	1.34	-0.01
	All	16.4	15.2	-1.1	561	530	-31	1.35	1.37	0.02
Jun	W	12.7	12.4	-0.3	103	103	0	1.04	1.06	0.02
	AN	10.8	9.0	-1.8	39	37	-2	0.93	1.06	0.13
	BN	7.0	6.1	-0.9	23	21	-2	1.00	1.05	0.05
	D	4.3	2.8	-1.5	20	11	-9	0.77	0.65	-0.12
	C	46.7	40.8	-5.8	238	186	-52	1.42	1.27	-0.15
	All	14.6	12.8	-1.7	423	358	-65	1.18	1.13	-0.05
Jul	W	8.4	8.4	0.0	46	46	0	0.68	0.68	0
	AN	0.5	0.2	-0.2	1	1	0	0.50	1.00	0.50
	BN	5.0	2.9	-2.1	7	4	-3	0.41	0.40	-0.01
	D	10.5	9.5	-1.0	28	19	-9	0.43	0.32	-0.11
	C	66.1	72.6	6.5	470	548	78	1.91	2.03	0.12
	All	15.7	16.1	0.4	552	618	66	1.39	1.51	0.13
Aug	W	18.0	15.9	-2.1	134	117	-17	0.92	0.91	-0.01
	AN	12.7	9.7	-3.0	47	20	-27	0.92	0.51	-0.41
	BN	15.2	24.6	9.4	22	53	31	0.42	0.63	0.21
	D	57.7	51.6	-6.1	519	391	-128	1.45	1.22	-0.23
	C	85.5	79.0	-6.5	1,363	1,311	-52	4.29	4.46	0.17
	All	36.3	34.0	-2.3	2,085	1,892	-193	2.26	2.19	-0.07
Sep	W	3.5	2.7	-0.8	32	22	-10	1.19	1.05	-0.14
	AN	9.0	16.7	7.7	37	51	14	1.06	0.78	-0.27
	BN	74.8	85.2	10.3	503	669	166	2.04	2.38	0.34
	D	87.5	93.0	5.5	1,462	1,606	144	2.78	2.88	0.09
	C	97.5	97.8	0.3	2,504	2,513	9	7.13	7.14	0.01
	All	48.2	51.9	3.7	4,538	4,861	323	3.83	3.81	-0.02

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

5.D.2.5.1.3 Steelhead

Table 5.D-97. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, Sacramento River at Keswick, 53°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	98.2	97.2	-1.0	1,788	1,680	-108	2.33	2.22	-0.12
	AN	92.5	84.2	-8.3	664	563	-101	1.99	1.86	-0.14
	BN	85.2	88.2	3.0	571	533	-38	2.03	1.83	-0.20
	D	90.7	93.2	2.5	1,039	1,090	51	1.91	1.95	0.04
	C	99.4	99.4	0.0	1,313	1,304	-9	3.67	3.64	-0.03
	All	93.9	93.4	-0.5	5,375	5,170	-205	2.36	2.28	-0.08
Dec	W	28.5	27.0	-1.5	273	246	-27	1.19	1.13	-0.06
	AN	18.8	15.6	-3.2	83	54	-29	1.19	0.93	-0.25
	BN	22.0	20.2	-1.8	115	91	-24	1.53	1.32	-0.21
	D	13.5	13.9	0.3	74	80	6	0.88	0.93	0.05
	C	29.0	30.6	1.6	155	162	7	1.44	1.42	-0.01
	All	22.6	21.7	-0.9	700	633	-67	1.23	1.16	-0.07
Jan	W	0.2	0.1	-0.1	1	0	-1	0.50	0.00	-0.50
	AN	6.9	6.9	0.0	70	70	0	2.50	2.50	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	1.2	1.1	0.0	71	70	-1	2.37	2.41	0.05
Feb	W	1.4	1.4	0.0	8	8	0	0.80	0.80	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.4	0.4	0.0	8	8	0	0.80	0.80	0
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	1.3	1.3	0.0	4	4	0	0.40	0.40	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	1.8	1.8	0	2	2	NA	0.33	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.4	0.7	0.2	4	6	2	0.40	0.38	-0.03

[1] Only includes days on which temperature exceeded threshold

Table 5.D-98. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, Sacramento River at Keswick, 56°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	18.8	17.6	-1.3	51	43	-8	0.35	0.31	-0.03
	AN	14.7	8.1	-6.7	12	7	-5	0.23	0.24	0.01
	BN	22.4	16.7	-5.8	41	15	-26	0.55	0.27	-0.28
	D	11.2	12.3	1.2	18	28	10	0.27	0.38	0.11
	C	59.4	62.2	2.8	364	354	-10	1.70	1.58	-0.12
	All	22.8	21.4	-1.5	486	447	-39	0.88	0.86	-0.01
Dec	W	1.2	0.1	-1.1	1	0	-1	0.10	0	-0.10
	AN	0.5	0.0	-0.5	0	0	0	0.00	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.3	0.3	0	0	0	NA	0	NA
	All	0.5	0.1	-0.4	1	0	-1	0.08	0	-0.08
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	1.7	1.7	0.0	2	2	0	0.29	0.29	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.3	0.3	0.0	2	2	0	0.29	0.29	0
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-99. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, Sacramento River at Clear Creek, 53°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	97.8	97.1	-0.8	1,793	1,692	-101	2.35	2.24	-0.11
	AN	92.5	85.6	-6.9	654	556	-98	1.96	1.81	-0.16
	BN	83.9	86.4	2.4	581	543	-38	2.10	1.91	-0.19
	D	90.5	92.8	2.3	1,049	1,098	49	1.93	1.97	0.04
	C	99.7	99.7	0.0	1,304	1,294	-10	3.63	3.60	-0.03
	All	93.6	93.3	-0.4	5,381	5,183	-198	2.37	2.29	-0.08
Dec	W	27.2	25.7	-1.5	256	229	-27	1.17	1.11	-0.06
	AN	18.5	15.3	-3.2	77	48	-29	1.12	0.84	-0.27
	BN	20.5	19.1	-1.5	103	82	-21	1.47	1.26	-0.21
	D	11.8	12.3	0.5	65	71	6	0.89	0.93	0.04
	C	28.0	29.6	1.6	134	140	6	1.29	1.27	-0.02
	All	21.3	20.5	-0.8	635	570	-65	1.19	1.11	-0.08
Jan	W	0.2	0.1	-0.1	1	0	-1	0.50	0	-0.50
	AN	6.9	6.9	0.0	55	55	0	1.96	1.96	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	1.2	1.1	0.0	56	55	-1	1.87	1.90	0.03
Feb	W	1.4	1.4	0.0	8	8	0	0.80	0.80	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.4	0.4	0.0	8	8	0	0.80	0.80	0
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	1.8	1.8	0.0	17	17	0	1.21	1.21	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.3	2.7	2.4	0	11	11	0	1.22	1.22
	D	0.2	0.3	0.2	1	1	0	1.00	0.50	-0.50
	C	0.3	0.3	0.0	0	0	0	0	0	0
	All	0.7	1.1	0.4	18	29	11	1.06	1.12	0.06

[1] Only includes days on which temperature exceeded threshold

Table 5.D-100. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, Sacramento River at Clear Creek, 56°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	20.8	21.0	0.3	62	60	-2	0.38	0.37	-0.02
	AN	13.1	7.2	-5.8	13	8	-5	0.28	0.31	0.03
	BN	21.2	17.0	-4.2	46	20	-26	0.66	0.36	-0.30
	D	13.7	15.0	1.3	30	39	9	0.37	0.43	0.07
	C	60.6	63.9	3.3	380	367	-13	1.74	1.60	-0.15
	All	23.8	23.3	-0.5	531	494	-37	0.92	0.87	-0.04
Dec	W	0.6	0.1	-0.5	0	0	0	0	0	0
	AN	0.5	0.0	-0.5	0	0	0	0	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.3	0.0	-0.2	0	0	0	0	0	0
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.5	0.5	0.0	0	0	0	0	0	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.1	0.1	0.0	0	0	0	0	0	0
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-101. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, Sacramento River at Balls Ferry, 53°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold1			Degrees per day above threshold1		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	91.7	89.4	-2.3	1,502	1,356	-146	2.10	1.95	-0.16
	AN	85.6	73.9	-11.7	513	398	-115	1.67	1.50	-0.17
	BN	77.9	77.9	0.0	491	448	-43	1.91	1.74	-0.17
	D	74.3	77.5	3.2	747	790	43	1.67	1.70	0.02
	C	91.4	91.4	0.0	1,115	1,117	2	3.39	3.40	0.01
	All	84.6	82.9	-1.7	4,368	4,109	-259	2.13	2.04	-0.09
Dec	W	13.2	10.8	-2.4	98	82	-16	0.92	0.94	0.02
	AN	8.9	5.4	-3.5	30	15	-15	0.91	0.75	-0.16
	BN	15.0	12.6	-2.3	46	35	-11	0.90	0.81	-0.09
	D	4.8	5.5	0.6	19	20	1	0.63	0.59	-0.05
	C	10.5	10.8	0.3	26	28	2	0.67	0.70	0.03
	All	10.3	8.9	-1.4	219	180	-39	0.85	0.80	-0.04
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.7	0.7	0.0	0	0	0	0	0	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.1	0.1	0.0	0	0	0	0	0	0
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.2	0.2	0.0	0	0	0	0	0	0
	AN	0.2	0.2	0.0	0	0	0	0	0	0
	BN	4.7	3.8	-0.9	10	10	0	0.63	0.77	0.14
	D	3.2	3.2	0.0	17	18	1	0.85	0.90	0.05
	C	1.6	1.6	0.0	2	2	0	0.33	0.33	0
	All	1.8	1.7	-0.1	29	30	1	0.64	0.71	0.07
Apr	W	12.9	13.2	0.3	119	122	3	1.18	1.18	0.01
	AN	16.7	16.4	-0.3	42	46	4	0.65	0.72	0.07
	BN	11.8	13.6	1.8	27	45	18	0.69	1.00	0.31
	D	27.3	27.2	-0.2	178	181	3	1.09	1.11	0.03
	C	14.2	13.9	-0.3	58	57	-1	1.14	1.14	0
	All	17.1	17.3	0.2	424	451	27	1.01	1.06	0.05

[1] Only includes days on which temperature exceeded threshold

Table 5.D-102. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, Sacramento River at Balls Ferry, 56°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	13.8	12.4	-1.4	48	41	-7	0.44	0.42	-0.02
	AN	5.6	3.3	-2.2	9	5	-4	0.45	0.42	-0.03
	BN	17.9	12.7	-5.2	38	17	-21	0.64	0.40	-0.24
	D	7.0	8.7	1.7	13	19	6	0.31	0.37	0.06
	C	49.2	49.2	0.0	320	314	-6	1.81	1.77	-0.03
	All	16.7	15.6	-1.1	428	396	-32	1.05	1.04	-0.01
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	1.4	1.4	0.0	4	4	0	0.36	0.36	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	1.2	1.2	0	2	2	NA	0.50	NA
	D	0.7	0.5	-0.2	2	2	0	0.50	0.67	0.17
	C	0.6	0.6	0.0	1	1	0	0.50	0.50	0
	All	0.7	0.8	0.1	7	9	2	0.41	0.45	0.04

[1] Only includes days on which temperature exceeded threshold

Table 5.D-103. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, Sacramento River at Bend Bridge, 53°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	83.8	75.0	-8.8	1,149	982	-167	1.76	1.68	-0.08
	AN	68.1	51.9	-16.1	333	233	-100	1.36	1.25	-0.11
	BN	60.0	58.5	-1.5	386	347	-39	1.95	1.80	-0.15
	D	55.5	58.5	3.0	466	498	32	1.40	1.42	0.02
	C	73.9	75.0	1.1	798	819	21	3.00	3.03	0.03
	All	69.8	65.3	-4.5	3,132	2,879	-253	1.85	1.82	-0.03
Dec	W	4.6	3.5	-1.1	23	12	-11	0.62	0.43	-0.19
	AN	3.2	1.3	-1.9	9	2	-7	0.75	0.40	-0.35
	BN	3.5	2.1	-1.5	6	4	-2	0.50	0.57	0.07
	D	0.3	0.5	0.2	1	1	0	0.50	0.33	-0.17
	C	1.6	1.6	0.0	2	2	0	0.33	0.33	0
	All	2.7	2.0	-0.8	41	21	-20	0.59	0.43	-0.17
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	1.9	1.9	0.0	11	11	0	0.73	0.73	0
	AN	3.2	2.5	-0.7	10	8	-2	0.77	0.80	0.03
	BN	17.3	12.3	-5.0	64	51	-13	1.08	1.21	0.13
	D	16.8	16.9	0.2	114	114	0	1.10	1.09	-0.01
	C	19.9	18.3	-1.6	74	57	-17	1.00	0.84	-0.16
	All	10.4	9.4	-1.0	273	241	-32	1.03	1.00	-0.03
Apr	W	37.9	38.2	0.3	572	576	4	1.93	1.93	0
	AN	48.2	47.9	-0.3	387	390	3	2.06	2.09	0.03
	BN	66.4	68.2	1.8	374	402	28	1.71	1.79	0.08
	D	67.3	65.5	-1.8	925	900	-25	2.29	2.29	0
	C	58.3	58.9	0.6	364	350	-14	1.73	1.65	-0.08
	All	53.5	53.5	-0.1	2,622	2,618	-4	1.99	1.99	0

[1] Only includes days on which temperature exceeded threshold

Table 5.D-104. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, Sacramento River at Bend Bridge, 56°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	9.6	7.4	-2.2	30	25	-5	0.40	0.43	0.03
	AN	3.3	2.2	-1.1	6	3	-3	0.50	0.38	-0.13
	BN	13.3	10.0	-3.3	30	14	-16	0.68	0.42	-0.26
	D	2.7	3.8	1.2	4	7	3	0.25	0.30	0.05
	C	32.2	35.3	3.1	214	216	2	1.84	1.70	-0.14
	All	10.8	10.2	-0.6	284	265	-19	1.08	1.06	-0.02
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	1.2	1.2	0.0	3	3	0	0.75	0.75	0
	D	0.5	0.5	0.0	3	3	0	1.00	1.00	0
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.3	0.3	0.0	6	6	0	0.86	0.86	0
Apr	W	8.1	8.1	0.0	70	72	2	1.11	1.14	0.03
	AN	13.1	13.3	0.3	42	44	2	0.82	0.85	0.02
	BN	9.1	10.0	0.9	19	26	7	0.63	0.79	0.15
	D	21.8	21.3	-0.5	153	150	-3	1.17	1.17	0
	C	8.3	8.9	0.6	41	41	0	1.37	1.28	-0.09
	All	12.4	12.5	0.1	325	333	8	1.07	1.08	0.02

[1] Only includes days on which temperature exceeded threshold

Table 5.D-105. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, Sacramento River at Red Bluff, 53°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	82.7	74.4	-8.3	1,160	1,013	-147	1.80	1.75	-0.05
	AN	66.1	50.6	-15.6	331	243	-88	1.39	1.34	-0.06
	BN	60.9	60.6	-0.3	403	366	-37	2.00	1.83	-0.17
	D	55.7	58.0	2.3	504	536	32	1.51	1.54	0.03
	C	73.3	74.7	1.4	827	843	16	3.13	3.13	0
	All	69.2	65.0	-4.2	3,225	3,001	-224	1.92	1.90	-0.02
Dec	W	4.8	3.2	-1.6	23	12	-11	0.59	0.46	-0.13
	AN	3.0	1.3	-1.6	8	2	-6	0.73	0.40	-0.33
	BN	2.3	2.1	-0.3	5	4	-1	0.63	0.57	-0.05
	D	0.2	0.3	0.2	1	1	0	1.00	0.50	-0.50
	C	0.8	1.1	0.3	1	1	0	0.33	0.25	-0.08
	All	2.5	1.8	-0.7	38	20	-18	0.61	0.45	-0.16
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	1.0	1.3	0.3	1	1	0	0.33	0.25	-0.08
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	1.8	2.9	1.2	1	2	1	0.17	0.20	0.03
	All	0.4	0.6	0.2	2	3	1	0.22	0.21	-0.01
Mar	W	3.6	3.6	0.0	29	29	0	1.00	1.00	0
	AN	7.2	6.7	-0.5	23	19	-4	0.79	0.70	-0.09
	BN	28.2	21.4	-6.7	132	104	-28	1.38	1.42	0.05
	D	24.7	24.7	0.0	218	220	2	1.42	1.44	0.01
	C	36.0	33.6	-2.4	167	140	-27	1.25	1.12	-0.13
	All	17.3	16.0	-1.3	569	512	-57	1.29	1.26	-0.03
Apr	W	49.6	49.2	-0.4	836	837	1	2.16	2.18	0.02
	AN	61.5	61.5	0.0	559	561	2	2.33	2.34	0.01
	BN	80.3	81.5	1.2	618	650	32	2.33	2.42	0.08
	D	80.2	80.0	-0.2	1,352	1,317	-35	2.81	2.74	-0.07
	C	77.2	76.4	-0.8	626	607	-19	2.25	2.21	-0.04
	All	67.1	67.0	-0.1	3,991	3,972	-19	2.42	2.41	-0.01

[1] Only includes days on which temperature exceeded threshold

Table 5.D-106. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, Sacramento River at Red Bluff, 56°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	11.4	10.3	-1.2	42	41	-1	0.47	0.51	0.04
	AN	3.6	2.8	-0.8	8	5	-3	0.62	0.50	-0.12
	BN	14.5	12.1	-2.4	35	20	-15	0.73	0.50	-0.23
	D	5.5	5.5	0.0	11	14	3	0.33	0.42	0.09
	C	32.2	35.6	3.3	239	238	-1	2.06	1.86	-0.20
	All	12.3	12.0	-0.3	335	318	-17	1.12	1.09	-0.03
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.2	0.2	0.0	0	0	0	0.00	0.00	0
	BN	2.6	2.6	0.0	11	11	0	1.22	1.22	0
	D	2.1	2.3	0.2	10	10	0	0.77	0.71	-0.05
	C	1.6	1.1	-0.5	2	0	-2	0.33	0.00	-0.33
	All	1.1	1.1	0.0	23	21	-2	0.79	0.75	-0.04
Apr	W	14.1	14.0	-0.1	146	148	2	1.33	1.36	0.03
	AN	23.1	23.3	0.3	102	105	3	1.13	1.15	0.02
	BN	24.8	27.6	2.7	77	91	14	0.94	1.00	0.06
	D	33.8	34.2	0.3	341	332	-9	1.68	1.62	-0.06
	C	22.5	20.3	-2.2	99	96	-3	1.22	1.32	0.09
	All	23.0	23.1	0.1	765	772	7	1.35	1.36	0.01

[1] Only includes days on which temperature exceeded threshold

Table 5.D-107. Water Temperature Threshold Analysis Results, Steelhead, Kelt Emigration, Sacramento River at Keswick, 68°F 7DADM1

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-108. Water Temperature Threshold Analysis Results, Steelhead, Kelt Emigration, Sacramento River at Keswick, 70°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-109. Water Temperature Threshold Analysis Results, Steelhead, Kelt Emigration, Sacramento River at Bend Bridge, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-110. Water Temperature Threshold Analysis Results, Steelhead, Kelt Emigration, Sacramento River at Bend Bridge, 70°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-111. Water Temperature Threshold Analysis Results, Steelhead, Kelt Emigration, Sacramento River at Red Bluff, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-112. Water Temperature Threshold Analysis Results, Steelhead, Kelt Emigration, Sacramento River at Red Bluff, 70°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-113. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, Sacramento River at Keswick, 63°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	11.8	14.2	2.4	33	51	18	0.75	0.96	0.21
	All	1.7	2.1	0.4	33	51	18	0.75	0.96	0.21
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	53.9	46.1	-7.8	353	450	97	1.82	2.71	0.89
	All	7.9	6.7	-1.1	353	450	97	1.82	2.71	0.89
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	25.8	25.0	-0.8	122	92	-30	1.27	0.99	-0.28
	All	3.8	3.7	-0.1	122	92	-30	1.27	0.99	-0.28
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-114. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, Sacramento River at Keswick, 69°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] 7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-115. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, Sacramento River at Clear Creek, 63°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	21.8	22.3	0.5	85	112	27	1.05	1.35	0.30
	All	3.2	3.3	0.1	85	112	27	1.05	1.35	0.30
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	60.8	55.8	-5.0	504	586	82	2.30	2.92	0.61
	All	8.9	8.2	-0.7	504	586	82	2.30	2.92	0.61
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	29.3	28.2	-1.1	167	140	-27	1.53	1.33	-0.20
	All	4.3	4.2	-0.2	167	140	-27	1.53	1.33	-0.20
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-116. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, Sacramento River at Clear Creek, 69°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	9.7	15.0	5.3	27	40	13	0.77	0.74	-0.03
	All	1.4	2.2	0.8	27	40	13	0.77	0.74	-0.03
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-117. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, Sacramento River at Balls Ferry, 63°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.5	0.5	0	0	0	NA	0	NA
	All	0.0	0.1	0.1	0	0	0	NA	0	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	31.7	28.5	-3.2	210	234	24	1.78	2.21	0.43
	All	4.6	4.2	-0.5	210	234	24	1.78	2.21	0.43
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	64.2	61.9	-2.2	691	757	66	2.99	3.39	0.40
	All	9.4	9.1	-0.3	691	757	66	2.99	3.39	0.40
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	31.5	30.6	-0.8	208	184	-24	1.78	1.61	-0.16
	All	4.7	4.5	-0.1	208	184	-24	1.78	1.61	-0.16
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-118. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, Sacramento River at Balls Ferry, 69°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	1.6	3.5	1.9	4	6	2	0.67	0.46	-0.21
	All	0.2	0.5	0.3	4	6	2	0.67	0.46	-0.21
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	14.4	21.1	6.7	58	85	27	1.12	1.12	0
	All	2.1	3.1	1.0	58	85	27	1.12	1.12	0
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-119. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, Sacramento River at Bend Bridge, 63°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.2	0.2	0.0	2	2	0	1.00	1.00	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.1	0.1	0.0	2	2	0	1.00	1.00	0
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	2.7	3.8	1.1	11	12	1	1.10	0.86	-0.24
	All	0.4	0.6	0.2	11	12	1	1.10	0.86	-0.24
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.2	0.0	-0.2	0	0	0	0	NA	NA
	C	39.0	38.7	-0.3	434	446	12	2.99	3.10	0.10
	All	5.7	5.7	-0.1	434	446	12	2.97	3.10	0.12
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.9	2.1	1.2	0	7	7	0	1.00	1.00
	D	7.8	6.5	-1.3	28	25	-3	0.60	0.64	0.05
	C	74.2	67.8	-6.4	927	975	48	3.47	4.00	0.52
	All	12.9	11.8	-1.1	955	1,007	52	3.01	3.47	0.46
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	31.7	29.6	-2.2	234	214	-20	1.98	1.95	-0.04
	All	4.7	4.4	-0.3	234	214	-20	1.98	1.95	-0.04
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-120. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, Sacramento River at Bend Bridge, 69°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	6.5	7.5	1.1	27	39	12	1.13	1.39	0.27
	All	0.9	1.1	0.2	27	39	12	1.13	1.39	0.27
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	18.1	22.5	4.4	82	104	22	1.26	1.28	0.02
	All	2.6	3.3	0.7	82	104	22	1.26	1.28	0.02
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	1.1	0.8	-0.3	1	1	0	0.25	0.33	0.08
	All	0.2	0.1	0.0	1	1	0	0.25	0.33	0.08
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-121. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, Sacramento River at Red Bluff, 63°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.6	0.6	0.0	8	8	0	1.60	1.60	0
	AN	1.2	1.2	0.0	4	4	0	0.80	0.80	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	1.9	1.6	-0.3	6	5	-1	0.50	0.50	0
	C	1.9	1.1	-0.8	2	2	0	0.29	0.50	0.21
	All	1.1	0.9	-0.2	20	19	-1	0.69	0.79	0.10
Jun	W	0.9	1.0	0.1	6	6	0	0.86	0.75	-0.11
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	3.9	1.9	-1.9	8	4	-4	0.57	0.57	0
	All	0.9	0.6	-0.2	14	10	-4	0.67	0.67	0
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	15.1	19.4	4.3	52	69	17	0.93	0.96	0.03
	All	2.2	2.8	0.6	52	69	17	0.93	0.96	0.03
Aug	W	0.4	0.5	0.1	0	1	1	0.00	0.25	0.25

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	6.3	2.1	-4.2	25	5	-20	0.64	0.38	-0.26
	C	43.8	45.7	1.9	634	642	8	3.89	3.78	-0.11
	All	8.1	7.4	-0.7	659	648	-11	3.21	3.47	0.25
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	7.6	12.4	4.8	24	50	26	0.96	1.22	0.26
	D	24.0	28.0	4.0	217	223	6	1.51	1.33	-0.18
	C	85.8	81.9	-3.9	1,260	1,284	24	4.08	4.35	0.27
	All	19.4	20.5	1.1	1,501	1,557	56	3.14	3.09	-0.05
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	35.8	34.4	-1.3	299	276	-23	2.25	2.16	-0.09
	All	5.3	5.1	-0.2	299	276	-23	2.25	2.16	-0.09
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-122. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, Sacramento River at Red Bluff, 69°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	8.3	11.3	3.0	50	69	19	1.61	1.64	0.03
	All	1.2	1.7	0.4	50	69	19	1.61	1.64	0.03
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	37.8	47.2	9.4	248	290	42	1.82	1.71	-0.12
	All	5.5	6.9	1.4	248	290	42	1.82	1.71	-0.12
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	5.4	3.0	-2.4	19	11	-8	0.95	1.00	0.05
	All	0.8	0.4	-0.4	19	11	-8	0.95	1.00	0.05
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-123. Water Temperature Threshold Analysis Results, Steelhead, Smoltification, Sacramento River at Keswick, 54°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	6.9	6.9	0.0	42	42	0	1.50	1.50	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	1.1	1.1	0.0	42	42	0	1.50	1.50	0
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-124. Water Temperature Threshold Analysis Results, Steelhead, Smoltification, Sacramento River at Clear Creek, 54°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	6.0	6.0	0.0	29	29	0	1.21	1.21	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.9	0.9	0.0	29	29	0	1.21	1.21	0
Feb	W	0.4	0.4	0.0	0	0	0	0	0	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.1	0.1	0.0	0	0	0	0	0	0
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-125. Water Temperature Threshold Analysis Results, Steelhead, Smoltification, Sacramento River at Balls Ferry, 54°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	1.2	1.2	0.0	2	2	0	0.50	0.50	0
	D	1.1	1.3	0.2	5	5	0	0.71	0.63	-0.09
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.4	0.5	0.0	7	7	0	0.64	0.58	-0.05

[1] Only includes days on which temperature exceeded threshold

Table 5.D-126. Water Temperature Threshold Analysis Results, Steelhead, Smoltification, Sacramento River at Bend Bridge, 54°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.5	0.5	0.0	2	2	0	0.50	0.50	0
	AN	0.7	0.7	0.0	3	3	0	1.00	1.00	0
	BN	8.2	6.5	-1.8	26	24	-2	0.93	1.09	0.16
	D	7.7	7.7	0.0	41	41	0	0.85	0.85	0
	C	9.4	6.2	-3.2	20	13	-7	0.57	0.57	-0.01
	All	4.6	3.9	-0.7	92	83	-9	0.78	0.83	0.05

[1] Only includes days on which temperature exceeded threshold

Table 5.D-127. Water Temperature Threshold Analysis Results, Steelhead, Smoltification, Sacramento River at Red Bluff, 54°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	1.0	1.0	0.0	10	10	0	1.25	1.25	0
	AN	2.0	1.5	-0.5	6	5	-1	0.75	0.83	0.08
	BN	12.6	9.7	-2.9	59	50	-9	1.37	1.52	0.14
	D	13.2	13.2	0.0	100	100	0	1.22	1.22	0
	C	18.0	16.1	-1.9	68	50	-18	1.01	0.83	-0.18
	All	8.2	7.4	-0.7	243	215	-28	1.17	1.14	-0.03

[1] Only includes days on which temperature exceeded threshold

Table 5.D-128. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, Sacramento River at Keswick, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.0	-0.6	1	0	-1	0.50	NA	NA
	All	0.1	0.0	-0.1	1	0	-1	0.50	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-129. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, Sacramento River at Keswick, 64°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-130. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, Sacramento River at Clear Creek, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	5.8	4.2	-1.7	13	9	-4	NA	NA	NA
	All	0.9	0.6	-0.2	13	9	-4	0.62	0.60	-0.02
Dec	W	0.0	0.0	0.0	0	0	0	0.62	0.60	-0.02
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-131. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, Sacramento River at Clear Creek, 64°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-132. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, Sacramento River at Balls Ferry, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	4.4	4.2	-0.3	8	7	-1	0.50	0.47	-0.03
	All	0.7	0.6	0.0	8	7	-1	0.50	0.47	-0.03
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.7	0.7	0.0	3	3	0	0.50	0.50	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.2	0.2	0	0	0	NA	0	NA
	C	1.1	1.1	0.0	2	1	-1	0.50	0.25	-0.25
	All	0.4	0.4	0.0	5	4	-1	0.50	0.36	-0.14
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.3	-0.3	0	0	0	0	0	0
	All	0.1	0.0	0.0	0	0	0	0	0	0

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-133. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, Sacramento River at Balls Ferry, 64°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-134. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, Sacramento River at Bend Bridge, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	1.7	1.9	0.3	2	2	0	0.33	0.29	-0.05
	All	0.2	0.3	0.0	2	2	0	0.33	0.29	-0.05
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.2	0.2	0.0	1	1	0	1	1	0.00
	C	0.3	0.3	0.0	1	0	-1	1	0	-1.00
	All	0.1	0.1	0.0	2	1	-1	1	0.5	-0.50
May	W	6.2	6.2	0.0	50	50	0	1	1	0.00
	AN	5.5	5.5	0.0	26	26	0	1.18	1.18	0.00
	BN	0.3	2.9	2.6	0	7	7	0	0.7	0.70
	D	9.4	7.7	-1.6	66	55	-11	1.14	1.15	0.01
	C	9.4	9.4	0.0	36	32	-4	1.03	0.91	-0.11
	All	6.5	6.5	0.0	178	170	-8	1.07	1.03	-0.04
Jun	W	5.3	5.5	0.3	36	37	1	0.88	0.86	-0.02
	AN	4.4	4.4	0.0	16	16	0	0.94	0.94	0.00
	BN	3.6	3.3	-0.3	10	10	0	0.83	0.91	0.08
	D	0.3	0.2	-0.2	1	0	-1	0.5	0	-0.50
	C	29.7	26.9	-2.8	113	79	-34	1.06	0.81	-0.24
	All	7.3	6.9	-0.4	176	142	-34	0.98	0.84	-0.14

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-135. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, Sacramento River at Bend Bridge, 64°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.4	0.4	0.0	4	4	0	1.33	1.33	0
	AN	0.5	0.5	0.0	1	1	0	0.50	0.50	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.2	0.3	0.2	0	1	1	0	0.50	0.50
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.2	0.3	0.0	5	6	1	0.83	0.86	0.02
Jun	W	0.3	0.3	0.0	0	0	0	0	0	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.6	0.0	0	0	0	0	0	0
	All	0.2	0.2	0.0	0	0	0	0	0	0

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-136. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, Sacramento River at Red Bluff, 64°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	1.2	1.2	0.0	11	11	0	1.10	1.10	0
	AN	2.0	2.0	0.0	8	8	0	1.00	1.00	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	2.7	2.1	-0.6	12	10	-2	0.71	0.77	0.06
	C	3.2	2.7	-0.5	6	5	-1	0.50	0.50	0
	All	1.8	1.6	-0.2	37	34	-3	0.79	0.83	0.04
Jun	W	0.9	0.9	0.0	6	6	0	0.86	0.86	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	3.9	1.9	-1.9	7	4	-3	0.50	0.57	0.07
	All	0.9	0.6	-0.3	13	10	-3	0.62	0.71	0.10

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-137. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, Sacramento River at Red Bluff, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	4.7	4.4	-0.3	12	11	-1	0.71	0.69	-0.02
	All	0.7	0.7	0.0	12	11	-1	0.71	0.69	-0.02
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.5	0.5	0.0	2	2	0	0.50	0.50	0
	AN	0.5	0.5	0.0	1	1	0	0.50	0.50	0
	BN	0.0	0.3	0.3	0	0	0	NA	0	NA
	D	2.7	2.8	0.2	11	11	0	0.69	0.65	-0.04
	C	1.7	1.7	0.0	6	6	0	1.00	1.00	0
	All	1.1	1.2	0.1	20	20	0	0.71	0.67	-0.05
May	W	15.8	15.9	0.1	162	162	0	1.28	1.27	-0.01
	AN	14.6	12.2	-2.5	81	76	-5	1.37	1.55	0.18
	BN	5.3	8.8	3.5	10	24	14	0.56	0.80	0.24
	D	19.0	14.8	-4.2	181	150	-31	1.53	1.63	0.10
	C	25.3	23.7	-1.6	127	118	-9	1.35	1.34	-0.01
	All	16.4	15.2	-1.1	561	530	-31	1.35	1.37	0.02
Jun	W	12.7	12.4	-0.3	103	103	0	1.04	1.06	0.02
	AN	10.8	9.0	-1.8	39	37	-2	0.93	1.06	0.13
	BN	7.0	6.1	-0.9	23	21	-2	1.00	1.05	0.05
	D	4.3	2.8	-1.5	20	11	-9	0.77	0.65	-0.12
	C	46.7	40.8	-5.8	238	186	-52	1.42	1.27	-0.15
	All	14.6	12.8	-1.7	423	358	-65	1.18	1.13	-0.05

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-138. Water Temperature Threshold Analysis Results, Steelhead, Adult Immigration, Sacramento River at Keswick, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	2.2	2.2	0	3	3	NA	0.38	NA
	All	0.0	0.3	0.3	0	3	3	NA	0.38	NA
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-139. Water Temperature Threshold Analysis Results, Steelhead, Adult Immigration, Sacramento River at Keswick, 70°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-140. Water Temperature Threshold Analysis Results, Steelhead, Adult Immigration. Sacramento River at Bend Bridge, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	11.6	16.7	5.1	56	81	25	1.30	1.31	0
	All	1.7	2.4	0.7	56	81	25	1.30	1.31	0
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	28.1	33.3	5.3	163	203	40	1.61	1.69	0.08
	All	4.1	4.9	0.8	163	203	40	1.61	1.69	0.08
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	3.2	1.9	-1.3	10	5	-5	0.83	0.71	-0.12
	All	0.5	0.3	-0.2	10	5	-5	0.83	0.71	-0.12
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-141. Water Temperature Threshold Analysis Results, Steelhead, Adult Immigration. Sacramento River at Bend Bridge, 70°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	3.3	4.7	1.4	8	13	5	0.67	0.76	0.10
	All	0.5	0.7	0.2	8	13	5	0.67	0.76	0.10
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-142. Water Temperature Threshold Analysis Results, Steelhead, Adult Immigration, Sacramento River at Red Bluff, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold2			Degrees per day above threshold2		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	21.0	21.2	0.3	101	129	28	1.29	1.63	0.34
	All	3.1	3.1	0.0	101	129	28	1.29	1.63	0.34
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.6	0.6	0	1	1	NA	0.50	NA
	D	0.8	0.5	-0.3	1	1	0	0.20	0.33	0.13
	C	51.1	55.0	3.9	408	476	68	2.22	2.40	0.19
	All	7.7	8.3	0.6	409	478	69	2.16	2.35	0.19
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	10.5	9.7	-0.8	49	31	-18	1.26	0.86	-0.40
	All	1.6	1.4	-0.1	49	31	-18	1.26	0.86	-0.40
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-143. Water Temperature Threshold Analysis Results, Steelhead, Adult Immigration, Sacramento River at Red Bluff, 70°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	4.3	5.6	1.3	5	13	8	0.31	0.62	0.31
	All	0.6	0.8	0.2	5	13	8	0.31	0.62	0.31
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	9.7	10.8	1.1	37	45	8	1.06	1.15	0.10
	All	1.4	1.6	0.2	37	45	8	1.06	1.15	0.10
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-144. Water Temperature Threshold Analysis Results, Steelhead, Adult Holding, Sacramento River at Keswick, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	32.8	32.5	-0.3	245	269	24	2.01	2.22	0.21
	All	4.8	4.8	0.0	245	269	24	2.01	2.22	0.21
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	64.4	60.0	-4.4	857	909	52	3.69	4.21	0.51
	All	9.4	8.8	-0.7	857	909	52	3.69	4.21	0.51
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	52.7	49.5	-3.2	450	407	-43	2.30	2.21	-0.08
	All	7.8	7.3	-0.5	450	407	-43	2.30	2.21	-0.08
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.0	-0.6	1	0	-1	0.50	NA	NA
	All	0.1	0.0	-0.1	1	0	-1	0.50	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-145. Water Temperature Threshold Analysis Results, Steelhead, Adult Holding, Sacramento River at Balls Ferry, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	2.3	0.2	-2.1	4	0	-4	0.29	0	-0.29
	C	46.0	42.5	-3.5	799	802	3	4.67	5.08	0.40
	All	7.3	6.3	-1.0	803	802	-1	4.34	5.04	0.70
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	3.9	6.1	2.1	6	13	7	0.46	0.65	0.19
	D	12.2	11.0	-1.2	52	37	-15	0.71	0.56	-0.15
	C	83.9	73.9	-10.0	1,667	1,658	-9	5.52	6.23	0.71
	All	15.8	14.3	-1.5	1,725	1,708	-17	4.45	4.85	0.41
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.2	0.2	0	0	0	NA	0	NA
	C	76.6	62.6	-14.0	827	742	-85	2.90	3.18	0.28
	All	11.4	9.3	-2.0	827	742	-85	2.90	3.17	0.27
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	4.4	4.2	-0.3	8	7	-1	0.50	0.47	-0.03
	All	0.7	0.6	0.0	8	7	-1	0.50	0.47	-0.03

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-146. Water Temperature Threshold Analysis Results, Steelhead, Adult Holding, Sacramento River at Red Bluff, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	18.0	15.9	-2.1	134	117	-17	0.92	0.91	-0.01
	AN	12.7	9.7	-3.0	47	20	-27	0.92	0.51	-0.41
	BN	15.2	24.6	9.4	22	53	31	0.42	0.63	0.21
	D	57.7	51.6	-6.1	519	391	-128	1.45	1.22	-0.23
	C	85.5	79.0	-6.5	1,363	1,311	-52	4.29	4.46	0.17
	All	36.3	34.0	-2.3	2,085	1,892	-193	2.26	2.19	-0.07
Sep	W	3.5	2.7	-0.8	32	22	-10	1.19	1.05	-0.14
	AN	9.0	16.7	7.7	37	51	14	1.06	0.78	-0.27
	BN	74.8	85.2	10.3	503	669	166	2.04	2.38	0.34
	D	87.5	93.0	5.5	1,462	1,606	144	2.78	2.88	0.09
	C	97.5	97.8	0.3	2,504	2,513	9	7.13	7.14	0.01
	All	48.2	51.9	3.7	4,538	4,861	323	3.83	3.81	-0.02
Oct	W	0.7	2.0	1.2	2	7	5	0.33	0.44	0.10
	AN	1.6	2.2	0.5	2	4	2	0.33	0.50	0.17
	BN	4.7	3.8	-0.9	10	7	-3	0.63	0.54	-0.09
	D	12.1	10.3	-1.8	72	60	-12	0.96	0.94	-0.02
	C	80.9	81.2	0.3	1,123	1,043	-80	3.73	3.45	-0.28
	All	16.1	16.0	0.0	1,209	1,121	-88	2.99	2.78	-0.21
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	4.7	4.4	-0.3	12	11	-1	0.71	0.69	-0.02
	All	0.7	0.7	0.0	12	11	-1	0.71	0.69	-0.02

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

5.D.2.5.1.4 Green Sturgeon

Table 5.D-147. Water Temperature Threshold Analysis Results, Green Sturgeon, Spawning and Egg Incubation, Sacramento River at Bend Bridge, 63°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.2	0.2	0.0	2	2	0	1.00	1.00	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.1	0.1	0.0	2	2	0	1.00	1.00	0
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	2.7	3.8	1.1	11	12	1	1.10	0.86	-0.24
	All	0.4	0.6	0.2	11	12	1	1.10	0.86	-0.24

[1] Only includes days on which temperature exceeded threshold

Table 5.D-148. Water Temperature Threshold Analysis Results, Green Sturgeon, Spawning and Egg Incubation, Sacramento River at Red Bluff, 63°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.6	0.6	0.0	8	8	0	1.60	1.60	0
	AN	1.2	1.2	0.0	4	4	0	0.80	0.80	0
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	1.9	1.6	-0.3	6	5	-1	0.50	0.50	0
	C	1.9	1.1	-0.8	2	2	0	0.29	0.50	0.21
	All	1.1	0.9	-0.2	20	19	-1	0.69	0.79	0.10
Jun	W	0.9	1.0	0.1	6	6	0	0.86	0.75	-0.11
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	3.9	1.9	-1.9	8	4	-4	0.57	0.57	0
	All	0.9	0.6	-0.2	14	10	-4	0.67	0.67	0
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	15.1	19.4	4.3	52	69	17	0.93	0.96	0.03
	All	2.2	2.8	0.6	52	69	17	0.93	0.96	0.03

[1] Only includes days on which temperature exceeded threshold

Table 5.D-149. Water Temperature Threshold Analysis Results, Green Sturgeon, Spawning and Egg Incubation, Sacramento River at Hamilton City, 63°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.3	0.3	0.0	0	0	0	0	0	0
	D	1.8	1.7	-0.2	10	10	0	0.91	1.00	0.09
	C	1.4	1.4	0.0	5	5	0	1.00	1.00	0
	All	0.7	0.7	0.0	15	15	0	0.88	0.94	0.06
May	W	21.5	21.8	0.4	271	271	0	1.57	1.54	-0.03
	AN	28.0	28.0	0.0	206	201	-5	1.82	1.78	-0.04
	BN	13.5	16.4	2.9	56	64	8	1.22	1.14	-0.07
	D	27.4	23.4	-4.0	345	285	-60	2.03	1.97	-0.06
	C	37.6	35.8	-1.9	266	249	-17	1.90	1.87	-0.03
	All	25.3	24.5	-0.7	1,144	1,070	-74	1.78	1.72	-0.06
Jun	W	53.3	51.4	-1.9	721	701	-20	1.73	1.75	0.01
	AN	31.0	24.4	-6.7	221	178	-43	1.83	1.87	0.05
	BN	31.8	24.8	-7.0	160	137	-23	1.52	1.67	0.15
	D	34.3	24.0	-10.3	266	174	-92	1.29	1.21	-0.08
	C	67.8	63.1	-4.7	615	507	-108	2.52	2.23	-0.29
	All	44.4	38.6	-5.8	1,983	1,697	-286	1.82	1.79	-0.03
Jul	W	48.5	46.0	-2.5	606	562	-44	1.55	1.51	-0.04
	AN	8.9	7.2	-1.7	44	32	-12	1.22	1.10	-0.12
	BN	19.9	20.8	0.9	67	64	-3	0.99	0.90	-0.08
	D	43.4	48.7	5.3	396	401	5	1.47	1.33	-0.14
	C	90.6	92.2	1.6	964	1,085	121	2.86	3.16	0.30
	All	43.3	43.9	0.6	2,077	2,144	67	1.89	1.92	0.03

[1] Only includes days on which temperature exceeded threshold

Table 5.D-150. Water Temperature Threshold Analysis Results, Green Sturgeon, Non-Spawning Adult Presence, Sacramento River at Bend Bridge, 66°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	16.9	20.2	3.2	77	108	31	1.22	1.44	0.22
	All	2.5	3.0	0.5	77	108	31	1.22	1.44	0.22
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	43.9	46.7	2.8	272	325	53	1.72	1.93	0.21
	All	6.4	6.8	0.4	272	325	53	1.72	1.93	0.21
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	8.3	4.8	-3.5	33	16	-17	1.06	0.89	-0.18
	All	1.2	0.7	-0.5	33	16	-17	1.06	0.89	-0.18
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-151. Water Temperature Threshold Analysis Results, Green Sturgeon, Non-Spawning Adult Presence, Sacramento River at Bend Bridge, 73°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-152. Water Temperature Threshold Analysis Results, Green Sturgeon, Non-Spawning Adult Presence, Sacramento River at Red Bluff, 66°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	31.7	28.0	-3.8	208	227	19	1.76	2.18	0.42
	All	4.6	4.1	-0.6	208	227	19	1.76	2.18	0.42
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.9	0.9	0	2	2	NA	0.67	NA
	D	1.7	1.5	-0.2	3	3	0	0.30	0.33	0.03
	C	57.2	58.1	0.8	467	536	69	2.27	2.56	0.30
	All	8.8	9.0	0.2	470	541	71	2.18	2.45	0.27
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	11.6	10.5	-1.1	56	38	-18	1.30	0.97	-0.33
	All	1.7	1.6	-0.2	56	38	-18	1.30	0.97	-0.33
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-153. Water Temperature Threshold Analysis Results, Green Sturgeon, Non-Spawning Adult Presence, Sacramento River at Red Bluff, 73°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.6	0.6	0	0	0	NA	0	NA
	All	0.0	0.1	0.1	0	0	0	NA	0	NA
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-154. Water Temperature Threshold Analysis Results, Green Sturgeon, Non-Spawning Adult Presence, Sacramento River at Hamilton City, 66°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	10.2	8.2	-2.0	80	70	-10	0.98	1.06	0.08
	AN	8.2	4.5	-3.7	35	8	-27	1.06	0.44	-0.62
	BN	0.9	5.0	4.1	1	7	6	0.33	0.41	0.08
	D	31.5	22.3	-9.2	224	141	-83	1.15	1.02	-0.13
	C	68.8	59.7	-9.1	816	827	11	3.19	3.73	0.54
	All	22.4	18.1	-4.2	1,156	1,053	-103	2.03	2.28	0.25
Sep	W	0.6	0.4	-0.3	5	1	-4	1.00	0.33	-0.67
	AN	2.1	0.5	-1.5	3	0	-3	0.38	0	-0.38
	BN	26.1	40.3	14.2	117	186	69	1.36	1.40	0.04
	D	45.5	49.8	4.3	519	590	71	1.90	1.97	0.07
	C	92.2	89.4	-2.8	1,273	1,323	50	3.83	4.11	0.27
	All	28.6	30.9	2.2	1,917	2,100	183	2.72	2.77	0.04
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	22.8	23.4	0.5	172	160	-12	2.02	1.84	-0.18
	All	3.4	3.5	0.1	172	160	-12	2.02	1.84	-0.18
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-155. Water Temperature Threshold Analysis Results, Green Sturgeon, Non-Spawning Adult Presence, Sacramento River at Hamilton City, 73°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	6.5	6.7	0.3	24	32	8	1.00	1.28	0.28
	All	0.9	1.0	0.0	24	32	8	1.00	1.28	0.28
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	9.7	9.7	0.0	37	39	2	1.06	1.11	0.06
	All	1.4	1.4	0.0	37	39	2	1.06	1.11	0.06
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-156. Water Temperature Threshold Analysis Results, Green Sturgeon, Non-Spawning Adult Presence and Larval to Juvenile Rearing and Emigration, Sacramento River at Knights Landing, 66°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.1	0.1	0.0	0	0	0	0	0	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	3.9	4.2	0.3	7	7	0	0.54	0.5	-0.04
	D	6.0	5.7	-0.3	43	40	-3	1.19	1.18	-0.02
	C	6.4	6.4	0.0	16	16	0	0.70	0.70	0
	All	3.0	2.9	0.0	66	63	-3	0.90	0.88	-0.03
May	W	43.2	43.7	0.5	922	933	11	2.65	2.65	0
	AN	60.0	59.8	-0.2	701	691	-10	2.90	2.87	-0.03
	BN	68.9	68.6	-0.3	532	551	19	2.26	2.35	0.09
	D	75.0	69.5	-5.5	1,438	1,249	-189	3.09	2.90	-0.19
	C	75.3	74.5	-0.8	1,042	1,014	-28	3.72	3.66	-0.06
	All	61.8	60.4	-1.4	4,635	4,438	-197	2.95	2.89	-0.06
Jun	W	94.0	92.6	-1.4	3,468	3,343	-125	4.73	4.63	-0.10
	AN	99.2	96.2	-3.1	1,775	1,529	-246	4.59	4.08	-0.51
	BN	96.1	92.7	-3.3	1,314	1,116	-198	4.15	3.65	-0.50
	D	99.3	96.7	-2.7	2,950	2,496	-454	4.95	4.30	-0.65
	C	97.8	96.9	-0.8	2,117	1,941	-176	6.01	5.56	-0.45
	All	97.0	94.8	-2.2	11,624	10,425	-1,199	4.87	4.47	-0.40
Jul	W	100.0	100.0	0.0	4,706	4,606	-100	5.84	5.71	-0.12
	AN	100.0	100.0	0.0	1,692	1,696	4	4.20	4.21	0.01
	BN	100.0	100.0	0.0	1,559	1,505	-54	4.57	4.41	-0.16
	D	100.0	100.0	0.0	3,426	3,489	63	5.53	5.63	0.10
	C	100.0	100.0	0.0	2,806	2,961	155	7.54	7.96	0.42
	All	100.0	100.0	0.0	14,189	14,257	68	5.58	5.61	0.03
Aug	W	100.0	100.0	0.0	5,117	5,037	-80	6.35	6.25	-0.10

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	100.0	100.0	0.0	2,258	2,312	54	5.60	5.74	0.13
	BN	100.0	100.0	0.0	1,731	2,075	344	5.08	6.09	1.01
	D	100.0	100.0	0.0	4,377	4,236	-141	7.06	6.83	-0.23
	C	100.0	100.0	0.0	3,144	3,076	-68	8.45	8.27	-0.18
	All	100.0	100.0	0.0	16,627	16,736	109	6.54	6.58	0.04
Sep	W	27.8	29.1	1.3	533	519	-14	2.46	2.29	-0.17
	AN	58.7	77.4	18.7	473	687	214	2.07	2.27	0.21
	BN	97.6	100.0	2.4	1,566	1,824	258	4.86	5.53	0.66
	D	100.0	100.0	0.0	3,601	3,728	127	6.00	6.21	0.21
	C	100.0	100.0	0.0	2,783	2,821	38	7.73	7.84	0.11
	All	70.2	73.9	3.7	8,956	9,579	623	5.18	5.27	0.08
Oct	W	0.0	0.9	0.9	0	2	2	NA	0.29	NA
	AN	5.4	11.0	5.6	51	58	7	2.55	1.41	-1.14
	BN	15.8	14.4	-1.5	79	91	12	1.46	1.86	0.39
	D	20.6	19.4	-1.3	245	256	11	1.91	2.13	0.22
	C	52.2	50.5	-1.6	661	675	14	3.41	3.59	0.18
	All	15.8	16.1	0.4	1,036	1,082	46	2.62	2.67	0.06
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-157. Water Temperature Threshold Analysis Results, Green Sturgeon, Non-Spawning Adult Presence, Sacramento River at Knights Landing, 73°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	1.2	1.2	0.0	12	12	0	1.2	1.2	0.00
	AN	3.5	3.2	-0.2	11	11	0	0.79	0.85	0.06
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	3.1	1.9	-1.1	18	10	-8	0.95	0.83	-0.11
	C	2.4	3.0	0.5	4	4	0	0.44	0.36	-0.08
	All	2.0	1.8	-0.2	45	37	-8	0.87	0.80	-0.06
Jun	W	15.4	13.8	-1.5	120	104	-16	1.00	0.96	-0.04
	AN	14.4	8.7	-5.6	45	25	-20	0.80	0.74	-0.07
	BN	13.3	10.0	-3.3	39	32	-7	0.89	0.97	0.08
	D	23.2	12.8	-10.3	154	71	-83	1.11	0.92	-0.19
	C	33.1	26.1	-6.9	183	137	-46	1.54	1.46	-0.08
	All	19.4	14.1	-5.4	541	369	-172	1.13	1.07	-0.07
Jul	W	32.4	27.0	-5.3	314	272	-42	1.20	1.25	0.04
	AN	8.4	3.7	-4.7	30	18	-12	0.88	1.20	0.32
	BN	7.9	9.1	1.2	23	35	12	0.85	1.13	0.28
	D	26.6	27.7	1.1	255	202	-53	1.55	1.17	-0.37
	C	53.8	64.0	10.2	470	557	87	2.35	2.34	-0.01
	All	27.0	26.5	-0.5	1,092	1,084	-8	1.59	1.61	0.02
Aug	W	36.0	34.7	-1.2	384	356	-28	1.32	1.27	-0.05

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	23.8	26.1	2.2	136	109	-27	1.42	1.04	-0.38
	BN	16.7	28.2	11.4	54	95	41	0.95	0.99	0.04
	D	55.8	46.8	-9.0	499	424	-75	1.44	1.46	0.02
	C	74.5	69.9	-4.6	685	671	-14	2.47	2.58	0.11
	All	41.9	40.6	-1.4	1,758	1,655	-103	1.65	1.61	-0.04
Sep	W	0.6	0.4	-0.3	2	2	0	0.4	0.67	0.27
	AN	0.3	0.8	0.5	0	1	1	0	0.33	0.33
	BN	17.6	22.7	5.2	52	82	30	0.90	1.09	0.20
	D	27.7	32.7	5.0	232	235	3	1.40	1.20	-0.20
	C	60.6	65.0	4.4	443	468	25	2.03	2	-0.03
	All	18.2	20.8	2.6	729	788	59	1.63	1.54	-0.09
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	3.0	2.7	-0.3	10	7	-3	0.91	0.7	-0.21
	All	0.4	0.4	0.0	10	7	-3	0.91	0.7	-0.21
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-158. Water Temperature Threshold Analysis Results, Green Sturgeon, Larval to Juvenile Rearing and Emigration, Sacramento River at Bend Bridge, 66°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	16.9	20.2	3.2	77	108	31	1.22	1.44	0.22
	All	2.5	3.0	0.5	77	108	31	1.22	1.44	0.22
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	43.9	46.7	2.8	272	325	53	1.72	1.93	0.21
	All	6.4	6.8	0.4	272	325	53	1.72	1.93	0.21
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	8.3	4.8	-3.5	33	16	-17	1.06	0.89	-0.18
	All	1.2	0.7	-0.5	33	16	-17	1.06	0.89	-0.18
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-159. Water Temperature Threshold Analysis Results, Green Sturgeon, Larval to Juvenile Rearing and Emigration, Sacramento River at Red Bluff, 66°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.1	0.1	0.0	0	0	0	0	0	0
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	0	0	0
Jun	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jul	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.8	0.8	0.0	2	2	0	0.67	0.67	0
	All	0.1	0.1	0.0	2	2	0	0.67	0.67	0
Aug	W	0.0	0.0	0.0	0	0	0	NA	NA	NA

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	31.7	28.0	-3.8	208	227	19	1.76	2.18	0.42
	All	4.6	4.1	-0.6	208	227	19	1.76	2.18	0.42
Sep	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.9	0.9	0	2	2	NA	0.67	NA
	D	1.7	1.5	-0.2	3	3	0	0.30	0.33	0.03
	C	57.2	58.1	0.8	467	536	69	2.27	2.56	0.30
	All	8.8	9.0	0.2	470	541	71	2.18	2.45	0.27
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	11.6	10.5	-1.1	56	38	-18	1.30	0.97	-0.33
	All	1.7	1.6	-0.2	56	38	-18	1.30	0.97	-0.33
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-160. Water Temperature Threshold Analysis Results, Green Sturgeon, Larval to Juvenile Rearing and Emigration, Sacramento River at Hamilton City, 66°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	3.0	2.9	-0.1	29	29	0	1.21	1.26	0.05
	AN	5.5	5.5	0.0	39	38	-1	1.77	1.73	-0.05
	BN	1.2	0.9	-0.3	1	0	-1	0.25	0	-0.25
	D	6.9	5.8	-1.1	53	41	-12	1.23	1.14	-0.09
	C	8.1	7.8	-0.3	27	24	-3	0.9	0.83	-0.07
	All	4.8	4.4	-0.4	149	132	-17	1.21	1.17	-0.04
Jun	W	9.6	9.2	-0.4	77	77	0	1.03	1.07	0.04
	AN	7.2	6.7	-0.5	20	18	-2	0.71	0.69	-0.02
	BN	3.9	3.9	0.0	11	11	0	0.85	0.85	0.00
	D	3.2	1.5	-1.7	12	3	-9	0.63	0.33	-0.30
	C	25.0	19.2	-5.8	117	72	-45	1.3	1.04	-0.26
	All	9.1	7.7	-1.5	237	181	-56	1.05	0.96	-0.10
Jul	W	5.3	5.1	-0.2	32	31	-1	0.74	0.76	0.01

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.2	0.2	0.0	0	0	0	0	0	0.00
	BN	0.6	0.3	-0.3	2	1	-1	1	1	0.00
	D	3.5	0.8	-2.7	8	0	-8	0.36	0	-0.36
	C	39.2	46.0	6.7	249	300	51	1.71	1.75	0.05
	All	8.4	8.6	0.2	291	332	41	1.36	1.52	0.16
Aug	W	10.2	8.2	-2.0	80	70	-10	0.98	1.06	0.08
	AN	8.2	4.5	-3.7	35	8	-27	1.06	0.44	-0.62
	BN	0.9	5.0	4.1	1	7	6	0.33	0.41	0.08
	D	31.5	22.3	-9.2	224	141	-83	1.15	1.02	-0.13
	C	68.8	59.7	-9.1	816	827	11	3.19	3.73	0.54
	All	22.4	18.1	-4.2	1,156	1,053	-103	2.03	2.28	0.25
Sep	W	0.6	0.4	-0.3	5	1	-4	1	0.33	-0.67
	AN	2.1	0.5	-1.5	3	0	-3	0.38	0	-0.38
	BN	26.1	40.3	14.2	117	186	69	1.36	1.40	0.04
	D	45.5	49.8	4.3	519	590	71	1.90	1.97	0.07
	C	92.2	89.4	-2.8	1,273	1,323	50	3.83	4.11	0.27
	All	28.6	30.9	2.2	1,917	2,100	183	2.72	2.77	0.04
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	22.8	23.4	0.5	172	160	-12	2.02	1.84	-0.18
	All	3.4	3.5	0.1	172	160	-12	2.02	1.84	-0.18
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

5.D.2.5.2 American River

5.D.2.5.2.1 Steelhead

Table 5.D-161. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, American River at Hazel Avenue, 53°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Dec	W	24.8	26.3	1.5	497	501	4	2.49	2.36	-0.12
	AN	13.2	13.7	0.5	91	89	-2	1.86	1.75	-0.11
	BN	16.7	12.0	-4.7	106	67	-39	1.86	1.63	-0.23
	D	12.6	10.6	-1.9	80	66	-14	1.03	1.00	-0.03
	C	10.8	11.0	0.3	70	78	8	1.75	1.90	0.15
	All	16.9	16.4	-0.5	844	801	-43	1.99	1.95	-0.04
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.0	-0.6	0	0	0	0	NA	NA
	All	0.1	0.0	-0.1	0	0	0	0	NA	NA
Mar	W	0.5	0.5	0.0	1	1	0	0.25	0.25	0
	AN	0.7	0.7	0.0	1	1	0	0.33	0.33	0
	BN	4.4	5.3	0.9	9	8	-1	0.60	0.44	-0.16
	D	12.1	12.4	0.3	100	103	3	1.33	1.34	0
	C	39.5	37.4	-2.2	167	147	-20	1.14	1.06	-0.08
	All	9.6	9.5	-0.1	278	260	-18	1.14	1.08	-0.06
Apr	W	36.7	36.8	0.1	593	595	2	2.07	2.07	0
	AN	72.3	73.1	0.8	622	627	5	2.21	2.20	-0.01
	BN	82.1	82.7	0.6	1,098	1,098	0	4.05	4.02	-0.03
	D	85.2	86.0	0.8	1,572	1,505	-67	3.08	2.92	-0.16
	C	97.2	97.5	0.3	1,480	1,455	-25	4.23	4.15	-0.08
	All	69.1	69.6	0.5	5,365	5,280	-85	3.16	3.08	-0.07
May	W	97.3	94.7	-2.6	2,903	2,803	-100	3.70	3.67	-0.03
	AN	100.0	100.0	0.0	2,121	2,122	1	5.26	5.27	0
	BN	100.0	100.0	0.0	2,451	2,436	-15	7.19	7.14	-0.04
	D	99.7	99.8	0.2	4,446	4,316	-130	7.19	6.97	-0.22
	C	100.0	100.0	0.0	3,353	3,349	-4	9.01	9.00	-0.01
	All	99.1	98.3	-0.8	15,274	15,026	-248	6.07	6.02	-0.05

[1] Only includes days on which temperature exceeded threshold

Table 5.D-162. Water Temperature Threshold Analysis Results, Steelhead, Spawning, Egg Incubation, and Alevins, American River at Watt Avenue, 53°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Dec	W	22.0	23.0	1.0	390	391	1	2.20	2.11	-0.09
	AN	9.9	10.5	0.5	67	66	-1	1.81	1.69	-0.12
	BN	14.4	9.4	-5.0	75	43	-32	1.53	1.34	-0.19
	D	11.3	9.7	-1.6	67	55	-12	0.96	0.92	-0.04
	C	12.4	13.4	1.1	51	58	7	1.11	1.16	0.05
	All	15.1	14.6	-0.5	650	613	-37	1.72	1.67	-0.04
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	1.2	1.2	0.0	3	3	0	0.43	0.43	0
	C	19.1	20.0	0.9	129	131	2	1.98	1.93	-0.06
	All	3.1	3.2	0.1	132	134	2	1.83	1.79	-0.05
Mar	W	6.1	6.3	0.2	62	61	-1	1.27	1.20	-0.07
	AN	6.7	6.7	0.0	48	47	-1	1.78	1.74	-0.04
	BN	40.8	40.8	0.0	284	279	-5	2.04	2.01	-0.04
	D	47.1	46.1	-1.0	828	793	-35	2.84	2.77	-0.06
	C	83.1	83.9	0.8	1,025	1,095	70	3.32	3.51	0.19
	All	32.1	32.1	0.0	2,247	2,275	28	2.75	2.79	0.04
Apr	W	74.0	72.7	-1.3	1,553	1,534	-19	2.69	2.71	0.01
	AN	89.7	90.5	0.8	1,353	1,359	6	3.87	3.85	-0.02
	BN	93.6	93.3	-0.3	2,022	2,026	4	6.54	6.58	0.03
	D	95.3	95.3	0.0	3,326	3,267	-59	5.81	5.71	-0.10
	C	100.0	100.0	0.0	3,010	3,009	-1	8.36	8.36	0
	All	88.1	87.8	-0.3	11,264	11,195	-69	5.20	5.18	-0.01
May	W	99.9	99.6	-0.2	5,077	4,977	-100	6.31	6.20	-0.11
	AN	100.0	100.0	0.0	3,606	3,608	2	8.95	8.95	0
	BN	100.0	100.0	0.0	3,756	3,714	-42	11.01	10.89	-0.12
	D	100.0	100.0	0.0	6,956	6,858	-98	11.22	11.06	-0.16
	C	100.0	100.0	0.0	5,070	5,078	8	13.63	13.65	0.02
	All	100.0	99.9	-0.1	24,465	24,235	-230	9.63	9.55	-0.08

[1] Only includes days on which temperature exceeded threshold

Table 5.D-163. Water Temperature Threshold Analysis Results, Steelhead, Kelt Emigration, American River at Hazel Avenue, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	1.2	0.9	-0.3	2	2	0	0.50	0.67	0.17
	D	0.0	0.8	0.8	0	4	4	NA	0.80	NA
	C	2.2	3.5	1.3	2	7	5	0.25	0.54	0.29
	All	0.5	0.8	0.4	4	13	9	0.33	0.62	0.29

[1]7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-164. Water Temperature Threshold Analysis Results, Steelhead, Kelt Emigration, American River at Hazel Avenue, 70°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-165. Water Temperature Threshold Analysis Results, Steelhead, Kelt Emigration, American River at Watt Avenue, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.9	0.9	0.0	2	2	0	0.67	0.67	0.00
	D	0.2	0.0	-0.2	0	0	0	0	NA	NA
	C	3.9	3.6	-0.3	18	17	-1	1.29	1.31	0.02
	All	0.7	0.7	-0.1	20	19	-1	1.11	1.19	0.08
May	W	3.8	3.8	0.0	36	35	-1	1.16	1.13	-0.03
	AN	0.7	0.7	0.0	1	1	0	0.33	0.33	0.00
	BN	24.6	24.0	-0.6	148	143	-5	1.76	1.74	-0.02
	D	22.7	18.5	-4.2	252	203	-49	1.79	1.77	-0.02
	C	42.7	45.2	2.4	455	467	12	2.86	2.78	-0.08
	All	16.4	15.7	-0.7	892	849	-43	2.13	2.13	-0.01

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-166. Water Temperature Threshold Analysis Results, Steelhead, Kelt Emigration, American River at Watt Avenue, 70°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.6	0.0	2	2	0	1.00	1.00	0
	All	0.1	0.1	0.0	2	2	0	1.00	1.00	0
May	W	0.5	0.4	-0.1	1	1	0	0.25	0.33	0.08
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	7.0	7.0	0.0	33	35	2	1.38	1.46	0.08
	D	6.1	5.2	-1.0	41	33	-8	1.08	1.03	0
	C	21.8	21.8	0.0	177	181	4	2.19	2.23	0
	All	5.8	5.5	-0.3	252	250	-2	1.71	1.79	0.07

[1] Only includes days on which temperature exceeded threshold

Table 5.D-167. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, American River at Hazel Avenue, 63°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	3.7	3.7	0.0	42	40	-2	1.40	1.33	-0.07
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	22.9	24.0	1.2	128	137	9	1.64	1.67	0.03
	D	20.8	17.9	-2.9	253	189	-64	1.96	1.70	-0.26
	C	37.6	38.2	0.5	317	344	27	2.26	2.42	0.16
	All	14.8	14.4	-0.5	740	710	-30	1.96	1.95	-0.02
Jun	W	10.4	11.8	1.4	265	202	-63	3.27	2.20	-1.08
	AN	30.0	37.7	7.7	236	308	72	2.02	2.10	0.08
	BN	55.2	50.6	-4.5	694	498	-196	3.81	2.98	-0.83
	D	59.5	62.0	2.5	1,144	1,145	1	3.20	3.08	-0.13
	C	80.0	80.0	0.0	1,082	1,080	-2	3.76	3.75	-0.01
	All	41.7	43.3	1.7	3,421	3,233	-188	3.34	3.03	-0.30
Jul	W	69.2	70.5	1.2	1,001	953	-48	1.79	1.68	-0.12
	AN	88.8	83.9	-5.0	707	656	-51	1.97	1.94	-0.03
	BN	85.3	78.9	-6.5	826	799	-27	2.84	2.97	0.13
	D	82.4	80.5	-1.9	2,004	1,969	-35	3.92	3.95	0.02
	C	95.4	96.2	0.8	2,219	2,256	37	6.25	6.30	0.05
	All	81.5	79.9	-1.6	6,757	6,633	-124	3.26	3.26	0
Aug	W	49.6	48.3	-1.4	443	459	16	1.11	1.18	0.07

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	85.6	80.9	-4.7	479	477	-2	1.39	1.46	0.07
	BN	84.8	76.0	-8.8	798	731	-67	2.76	2.82	0.06
	D	96.8	95.5	-1.3	1,595	1,630	35	2.66	2.75	0.10
	C	89.2	93.0	3.8	1,459	1,795	336	4.39	5.19	0.79
	All	77.3	75.2	-2.1	4,774	5,092	318	2.43	2.66	0.23
Sep	W	69.2	66.4	-2.8	869	812	-57	1.61	1.57	-0.04
	AN	99.0	98.5	-0.5	754	789	35	1.95	2.05	0.10
	BN	98.8	98.8	0.0	850	941	91	2.61	2.89	0.28
	D	100.0	100.0	0.0	2,060	2,124	64	3.43	3.54	0.11
	C	99.4	99.4	0.0	1,846	1,774	-72	5.16	4.96	-0.20
	All	89.8	88.9	-1.0	6,379	6,440	61	2.89	2.95	0.06
Oct	W	37.3	36.8	-0.5	222	235	13	0.74	0.79	0.05
	AN	52.2	60.8	8.6	184	227	43	0.95	1.00	0.06
	BN	65.7	60.4	-5.3	432	417	-15	1.93	2.02	0.10
	D	75.2	69.7	-5.5	1,031	929	-102	2.21	2.15	-0.06
	C	82.8	77.7	-5.1	1,053	907	-146	3.42	3.14	-0.28
	All	59.5	57.7	-1.7	2,922	2,715	-207	1.96	1.87	-0.08
Nov	W	0.9	0.5	-0.4	9	5	-4	1.29	1.25	-0.04
	AN	0.6	0.3	-0.3	1	1	0	0.50	1.00	0.50
	BN	2.4	1.8	-0.6	11	6	-5	1.38	1.00	-0.38
	D	2.5	1.8	-0.7	18	11	-7	1.20	1.00	-0.20
	C	3.6	3.3	-0.3	17	13	-4	1.31	1.08	-0.22
	All	1.9	1.4	-0.5	56	36	-20	1.24	1.06	-0.19
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-168. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, American River at Hazel Avenue, 69°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
May	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.3	0.3	0.0	0	0	0	0	0	0
	D	0.0	0.3	0.3	0	0	0	NA	0	NA
	C	0.3	0.8	0.5	0	3	3	0	1.00	1.00
	All	0.1	0.2	0.2	0	3	3	0	0.50	0.50
Jun	W	0.8	0.0	-0.8	2	0	-2	0.33	NA	NA
	AN	0.5	0.8	0.3	1	2	1	0.50	0.67	0.17
	BN	13.6	1.8	-11.8	49	2	-47	1.09	0.33	-0.76
	D	9.7	10.0	0.3	106	87	-19	1.83	1.45	-0.38
	C	15.8	17.8	1.9	70	81	11	1.23	1.27	0.04
	All	6.8	5.4	-1.4	228	172	-56	1.36	1.29	-0.06
Jul	W	0.2	0.5	0.2	0	2	2	0	0.50	0.50

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	2.3	7.9	5.6	7	50	43	0.88	1.85	0.98
	D	17.9	18.7	0.8	146	162	16	1.32	1.40	0.08
	C	57.5	57.8	0.3	541	577	36	2.53	2.68	0.16
	All	13.2	14.2	1.1	694	791	97	2.07	2.19	0.11
Aug	W	0.2	0.0	-0.2	1	0	-1	0.50	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	9.7	4.1	-5.6	24	8	-16	0.73	0.57	-0.16
	D	2.9	3.5	0.6	9	13	4	0.50	0.59	0.09
	C	22.8	43.8	21.0	102	314	212	1.20	1.93	0.73
	All	5.4	7.8	2.4	136	335	199	0.99	1.68	0.70
Sep	W	0.8	0.4	-0.4	1	0	-1	0.17	0	-0.17
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	2.1	4.5	2.4	6	8	2	0.86	0.53	-0.32
	D	8.5	13.8	5.3	36	62	26	0.71	0.75	0.04
	C	48.9	46.1	-2.8	161	175	14	0.91	1.05	0.14
	All	9.8	10.9	1.1	204	245	41	0.85	0.92	0.07
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	1.9	1.9	0.0	6	7	1	0.50	0.58	0.08
	C	2.7	0.0	-2.7	5	0	-5	0.50	NA	NA
	All	0.9	0.5	-0.4	11	7	-4	0.50	0.58	0.08
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-169. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, American River at Watt Avenue, 63°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.4	0.4	0.0	1	1	0	0.33	0.33	0
	AN	0.3	0.3	0.0	0	0	0	0	0	0
	BN	20.0	20.3	0.3	131	134	3	1.98	2.00	0.02
	D	11.3	9.2	-2.2	125	92	-33	1.84	1.67	-0.17
	C	30.6	31.7	1.1	278	290	12	2.53	2.54	0.02
	All	10.1	9.8	-0.3	535	517	-18	2.16	2.15	0
May	W	13.6	13.8	0.1	330	329	-1	3.00	2.96	-0.04
	AN	32.0	32.0	0.0	232	233	1	1.80	1.81	0.01
	BN	56.3	54.5	-1.8	786	749	-37	4.09	4.03	-0.07
	D	59.2	58.9	-0.3	1,440	1,345	-95	3.92	3.68	-0.24
	C	78.8	77.7	-1.1	1,511	1,533	22	5.16	5.30	0.15
	All	42.9	42.5	-0.4	4,299	4,189	-110	3.94	3.88	-0.06
Jun	W	50.4	47.6	-2.8	1,091	939	-152	2.78	2.53	-0.25
	AN	84.1	81.8	-2.3	1,201	1,151	-50	3.66	3.61	-0.05
	BN	83.3	83.0	-0.3	1,722	1,297	-425	6.26	4.73	-1.53
	D	87.2	84.0	-3.2	2,941	2,772	-169	5.62	5.50	-0.12
	C	95.0	95.6	0.6	2,628	2,759	131	7.68	8.02	0.34
	All	75.7	73.7	-2.0	9,583	8,918	-665	5.15	4.92	-0.23
Jul	W	99.8	99.6	-0.1	3,534	3,377	-157	4.40	4.21	-0.19
	AN	95.5	96.3	0.7	1,706	1,709	3	4.43	4.40	-0.03
	BN	98.5	98.8	0.3	1,673	1,727	54	4.98	5.12	0.15
	D	98.5	98.7	0.2	4,044	4,022	-22	6.62	6.57	-0.05
	C	98.7	98.7	0.0	4,176	4,178	2	11.38	11.38	0.01
	All	98.5	98.6	0.2	15,133	15,013	-120	6.05	5.99	-0.06
Aug	W	98.9	98.6	-0.2	3,132	3,176	44	3.93	3.99	0.07

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	100.0	100.0	0.0	2,092	2,040	-52	5.19	5.06	-0.13
	BN	100.0	100.0	0.0	2,408	2,230	-178	7.06	6.54	-0.52
	D	100.0	100.0	0.0	4,506	4,710	204	7.27	7.60	0.33
	C	100.0	100.0	0.0	3,353	3,736	383	9.01	10.04	1.03
	All	99.6	99.6	-0.1	15,491	15,892	401	6.12	6.28	0.16
Sep	W	95.8	95.3	-0.5	2,130	2,135	5	2.85	2.87	0.02
	AN	100.0	100.0	0.0	1,589	1,669	80	4.07	4.28	0.21
	BN	100.0	100.0	0.0	1,892	1,947	55	5.73	5.90	0.17
	D	100.0	100.0	0.0	3,766	3,851	85	6.28	6.42	0.14
	C	100.0	100.0	0.0	3,042	3,051	9	8.45	8.48	0.03
	All	98.7	98.5	-0.2	12,419	12,653	234	5.12	5.22	0.11
Oct	W	49.0	48.9	-0.1	582	626	44	1.47	1.59	0.12
	AN	68.5	73.1	4.6	433	467	34	1.70	1.72	0.02
	BN	74.2	70.4	-3.8	590	578	-12	2.33	2.41	0.08
	D	79.8	75.6	-4.2	1,359	1,285	-74	2.75	2.74	-0.01
	C	84.7	82.5	-2.2	1,341	1,199	-142	4.26	3.91	-0.35
	All	68.2	67.0	-1.2	4,305	4,155	-150	2.51	2.47	-0.04
Nov	W	1.2	1.2	0.0	10	7	-3	1.11	0.78	-0.33
	AN	1.1	0.6	-0.6	3	2	-1	0.75	1.00	0.25
	BN	3.0	1.8	-1.2	14	7	-7	1.40	1.17	-0.23
	D	3.5	1.8	-1.7	22	13	-9	1.05	1.18	0.13
	C	3.9	5.0	1.1	15	14	-1	1.07	0.78	-0.29
	All	2.4	1.9	-0.5	64	43	-21	1.10	0.93	-0.17
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-170. Water Temperature Threshold Analysis Results, Steelhead, Juvenile Rearing, American River at Watt Avenue, 69°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	1.2	1.2	0.0	4	4	0	1.00	1.00	0.00
	D	0.7	0.2	-0.5	1	0	-1	0.25	0.00	-0.25
	C	6.1	6.9	0.8	27	25	-2	1.23	1.00	-0.23
	All	1.2	1.2	0.0	32	29	-3	1.07	0.97	-0.10
May	W	5.0	5.0	0.0	60	59	-1	1.50	1.48	-0.02
	AN	3.2	3.2	0.0	6	6	0	0.46	0.46	0.00
	BN	28.4	27.6	-0.9	211	203	-8	2.18	2.16	-0.02
	D	27.9	26.5	-1.5	360	301	-59	2.08	1.84	-0.25
	C	48.7	50.3	1.6	571	588	17	3.15	3.14	-0.01
	All	19.8	19.6	-0.2	1,208	1,157	-51	2.40	2.32	-0.07
Jun	W	13.5	12.9	-0.5	322	204	-118	3.07	2.02	-1.05
	AN	39.2	40.0	0.8	353	333	-20	2.31	2.13	-0.17
	BN	57.6	53.0	-4.5	939	562	-377	4.94	3.21	-1.73
	D	61.7	57.5	-4.2	1,396	1,276	-120	3.77	3.70	-0.07
	C	83.3	84.4	1.1	1,508	1,627	119	5.03	5.35	0.33
	All	45.4	43.9	-1.5	4,518	4,002	-516	4.04	3.70	-0.34
Jul	W	81.9	80.6	-1.2	1,367	1,248	-119	2.07	1.92	-0.15

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
	AN	86.4	82.6	-3.7	659	682	23	1.89	2.05	0.15
	BN	84.8	81.5	-3.2	772	853	81	2.67	3.07	0.40
	D	89.7	88.5	-1.1	2,369	2,370	1	4.26	4.32	0.06
	C	96.8	94.6	-2.2	3,147	3,148	1	8.74	8.94	0.20
	All	87.1	85.1	-2.0	8,314	8,301	-13	3.76	3.84	0.08
Aug	W	67.6	70.2	2.6	1,146	1,167	21	2.10	2.06	-0.04
	AN	95.5	90.3	-5.2	935	903	-32	2.43	2.48	0.05
	BN	90.9	80.4	-10.6	1,450	1,298	-152	4.68	4.74	0.06
	D	97.9	99.7	1.8	2,719	2,919	200	4.48	4.72	0.24
	C	94.6	94.9	0.3	2,286	2,675	389	6.49	7.58	1.08
	All	86.5	85.6	-0.9	8,536	8,962	426	3.88	4.12	0.24
Sep	W	31.9	28.2	-3.7	276	318	42	1.11	1.45	0.34
	AN	65.4	71.5	6.2	329	378	49	1.29	1.35	0.06
	BN	87.6	87.9	0.3	771	830	59	2.67	2.86	0.19
	D	91.8	91.2	-0.7	1,706	1,790	84	3.10	3.27	0.18
	C	94.2	97.2	3.1	1,813	1,803	-10	5.35	5.15	-0.20
	All	68.4	68.5	0.1	4,895	5,119	224	2.91	3.04	0.13
Oct	W	1.5	1.7	0.2	11	17	6	0.92	1.21	0.30
	AN	2.7	2.7	0.0	5	4	-1	0.50	0.40	-0.10
	BN	12.0	11.7	-0.3	38	35	-3	0.93	0.88	-0.05
	D	19.2	17.1	-2.1	153	160	7	1.29	1.51	0.22
	C	47.0	38.4	-8.6	317	258	-59	1.81	1.80	-0.01
	All	14.2	12.5	-1.8	524	474	-50	1.47	1.51	0.05
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-171. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, American River at Hazel Avenue, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	10.6	10.9	0.3	28	28	0	0.80	0.78	-0.02
	D	2.2	1.7	-0.5	11	5	-6	0.85	0.50	-0.35
	C	7.8	7.5	-0.3	18	29	11	0.64	1.07	0.43
	All	3.1	3.0	-0.1	57	62	5	0.75	0.85	0.10
May	W	7.6	7.6	0.0	145	143	-2	2.38	2.34	-0.03
	AN	9.7	9.7	0.0	46	46	0	1.18	1.18	0
	BN	43.4	42.5	-0.9	441	442	1	2.98	3.05	0.07
	D	43.5	42.6	-1.0	776	659	-117	2.87	2.50	-0.38
	C	64.2	64.8	0.5	808	834	26	3.38	3.46	0.08
	All	29.8	29.5	-0.3	2,216	2,124	-92	2.93	2.83	-0.10
Jun	W	26.5	28.5	1.9	549	522	-27	2.65	2.35	-0.30
	AN	59.0	63.1	4.1	642	771	129	2.79	3.13	0.34
	BN	67.3	64.5	-2.7	1,184	965	-219	5.33	4.53	-0.80
	D	76.5	79.8	3.3	2,124	2,202	78	4.63	4.60	-0.03
	C	91.4	91.4	0.0	1,850	1,843	-7	5.62	5.60	-0.02
	All	58.8	60.5	1.7	6,349	6,303	-46	4.39	4.23	-0.15

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-172. Water Temperature Threshold Analysis Results, Steelhead, Smolt Emigration, American River at Watt Avenue, 64°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.6	0.6	0.0	5	5	0	1.00	1.00	0
	AN	0.3	0.3	0.0	1	1	0	1.00	1.00	0
	BN	22.1	23.3	1.2	180	185	5	2.47	2.40	-0.06
	D	14.0	13.2	-0.8	179	141	-38	2.13	1.78	-0.35
	C	36.9	36.7	-0.3	367	378	11	2.76	2.86	0.10
	All	12.0	12.0	-0.1	732	710	-22	2.47	2.41	-0.06
May	W	17.7	18.0	0.2	461	461	0	3.22	3.18	-0.04
	AN	48.6	48.9	0.2	402	404	2	2.05	2.05	0
	BN	62.8	61.9	-0.9	996	957	-39	4.65	4.54	-0.12
	D	68.9	68.7	-0.2	1,856	1,761	-95	4.35	4.13	-0.21
	C	84.9	84.7	-0.3	1,832	1,851	19	5.80	5.88	0.08
	All	51.0	50.9	-0.1	5,547	5,434	-113	4.28	4.20	-0.08
Jun	W	71.4	69.0	-2.4	1,831	1,648	-183	3.29	3.06	-0.22
	AN	97.9	97.9	0.0	1,758	1,700	-58	4.60	4.45	-0.15
	BN	93.0	92.1	-0.9	2,172	1,745	-427	7.07	5.74	-1.33
	D	97.5	96.0	-1.5	3,812	3,610	-202	6.52	6.27	-0.25
	C	98.3	98.9	0.6	3,169	3,302	133	8.95	9.28	0.32
	All	88.8	87.6	-1.2	12,742	12,005	-737	5.83	5.57	-0.26

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-173. Water Temperature Threshold Analysis Results, Steelhead, Smoltification, American River at Hazel Avenue, 54°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.9	0.6	-0.3	1	0	-1	0.33	0	-0.33
	D	6.6	6.8	0.2	47	43	-4	1.15	1.02	-0.12
	C	16.7	13.4	-3.2	67	56	-11	1.08	1.12	0.04
	All	4.2	3.7	-0.5	115	99	-16	1.08	1.05	-0.03

[1] Only includes days on which temperature exceeded threshold

Table 5.D-174. Water Temperature Threshold Analysis Results, Steelhead, Smoltification, American River at Watt Avenue, 54°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	13.2	13.8	0.6	74	75	1	1.64	1.60	-0.05
	All	1.9	2.0	0.1	74	75	1	1.64	1.60	-0.05
Mar	W	2.1	2.1	0.0	32	32	0	1.88	1.88	0
	AN	4.7	4.7	0.0	24	24	0	1.26	1.26	0
	BN	24.0	23.2	-0.9	170	168	-2	2.07	2.13	0.05
	D	36.1	34.8	-1.3	573	546	-27	2.56	2.53	-0.03
	C	69.9	72.3	2.4	738	803	65	2.84	2.99	0.15
	All	23.7	23.6	-0.1	1,537	1,573	36	2.55	2.62	0.07

[1] Only includes days on which temperature exceeded threshold

Table 5.D-175. Water Temperature Threshold Analysis Results, Steelhead, Adult Immigration, American River at Hazel Avenue, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Oct	W	0.0	0.2	0.2	0	0	0	NA	0	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	2.6	0.9	-1.8	4	1	-3	0.44	0.33	-0.11
	D	4.7	5.2	0.5	25	25	0	0.86	0.78	-0.08
	C	22.6	20.7	-1.9	42	30	-12	0.50	0.39	-0.11
	All	4.9	4.5	-0.3	71	56	-15	0.58	0.49	-0.09
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-176. Water Temperature Threshold Analysis Results, Steelhead, Adult Immigration, American River at Hazel Avenue, 70°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA

[1] Only includes days on which temperature exceeded threshold

Table 5.D-177. Water Temperature Threshold Analysis Results, Steelhead, Adult Immigration, American River at Watt Avenue, 68°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Oct	W	3.7	4.5	0.7	30	37	7	1.00	1.03	0.03
	AN	9.7	13.7	4.0	25	33	8	0.69	0.65	-0.05
	BN	22.6	22.9	0.3	98	97	-1	1.27	1.24	-0.03
	D	31.9	31.3	-0.6	308	307	-1	1.56	1.58	0.03
	C	62.1	55.4	-6.7	521	436	-85	2.26	2.12	-0.14
	All	22.8	22.5	-0.3	982	910	-72	1.72	1.61	-0.11
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	2.7	2.7	0.0	10	9	-1	1.11	1.00	-0.11
	D	1.5	1.5	0.0	7	6	-1	0.78	0.67	-0.11
	C	9.4	9.7	0.3	53	54	1	1.56	1.54	-0.02
	All	2.1	2.2	0.0	70	69	-1	1.35	1.30	-0.04

[1]7DADM = Seven day average daily maximum

[2] Only includes days on which temperature exceeded threshold

Table 5.D-178. Water Temperature Threshold Analysis Results, Steelhead, Adult Immigration, American River at Watt Avenue, 70°F

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[1]			Degrees per day above threshold[1]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Oct	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	2.1	1.9	-0.2	16	20	4	1.23	1.67	0.44
	C	10.8	8.6	-2.2	31	16	-15	0.78	0.50	-0.28
	All	2.1	1.8	-0.4	47	36	-11	0.89	0.82	-0.07
Nov	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Dec	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Jan	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Feb	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Mar	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.0	0.0	0.0	0	0	0	NA	NA	NA
	All	0.0	0.0	0.0	0	0	0	NA	NA	NA
Apr	W	0.0	0.0	0.0	0	0	0	NA	NA	NA
	AN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	BN	0.0	0.0	0.0	0	0	0	NA	NA	NA
	D	0.0	0.0	0.0	0	0	0	NA	NA	NA
	C	0.6	0.6	0.0	2	2	0	1.00	1.00	0
	All	0.1	0.1	0.0	2	2	0	1.00	1.00	0

[1] Only includes days on which temperature exceeded threshold

Table 5.D-179. Water Temperature Threshold Analysis Results, Steelhead, Adult Holding, American River at Hazel Avenue, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Oct	W	67.4	67.9	0.5	1,475	1,485	10	2.72	2.71	0
	AN	98.9	99.2	0.3	1,001	1,084	83	2.72	2.94	0.22
	BN	95.3	94.7	-0.6	1,188	1,165	-23	3.66	3.61	-0.05
	D	99.0	95.2	-3.9	2,505	2,352	-153	4.08	3.99	-0.09
	C	98.7	99.7	1.1	1,950	1,788	-162	5.31	4.82	-0.49
	All	88.3	87.6	-0.7	8,119	7,874	-245	3.66	3.58	-0.08
Nov	W	5.6	5.1	-0.5	81	67	-14	1.84	1.68	-0.17
	AN	5.8	6.7	0.8	26	32	6	1.24	1.33	0.10
	BN	8.8	7.9	-0.9	55	45	-10	1.90	1.73	-0.17
	D	10.0	8.8	-1.2	117	93	-24	1.95	1.75	-0.20
	C	14.2	15.0	0.8	93	88	-5	1.82	1.63	-0.19
	All	8.4	8.1	-0.3	372	325	-47	1.81	1.65	-0.16

[1]7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

Table 5.D-180. Water Temperature Threshold Analysis Results, Steelhead, Adult Holding, American River at Watt Avenue, 61°F 7DADM[1]

Month	WYT	Percent of days above threshold			Sum of degree-days above threshold[2]			Degrees per day above threshold[2]		
		NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA	NAA	PA	PA vs. NAA
Oct	W	92.6	93.7	1.1	2,850	2,911	61	3.82	3.86	0.04
	AN	99.7	99.7	0.0	1,775	1,843	68	4.78	4.97	0.18
	BN	98.8	99.4	0.6	1,845	1,827	-18	5.47	5.39	-0.09
	D	100.0	99.0	-1.0	3,724	3,591	-133	6.01	5.85	-0.16
	C	99.7	99.7	0.0	2,754	2,616	-138	7.42	7.05	-0.37
	All	97.4	97.6	0.2	12,948	12,788	-160	5.30	5.22	-0.08
Nov	W	9.9	10.0	0.1	157	141	-16	2.04	1.81	-0.23
	AN	10.6	12.5	1.9	57	69	12	1.50	1.53	0.03
	BN	16.1	14.5	-1.5	107	95	-12	2.02	1.98	-0.04
	D	17.8	17.0	-0.8	223	191	-32	2.08	1.87	-0.21
	C	30.0	28.1	-1.9	192	204	12	1.78	2.02	0.24
	All	15.8	15.4	-0.4	736	700	-36	1.92	1.87	-0.05

[1]7DADM = Seven day average daily maximum
[2] Only includes days on which temperature exceeded threshold

5.D.2.6 Redd Dewatering Results, Sacramento River Segments 4 and 6

The redd dewatering results for winter-run and spring-run Chinook salmon and Central Valley steelhead in Segment 5 of the Sacramento River are presented in Section 5.4.2, *Upstream*

Hydrologic Changes. The redd dewatering results for Segments 4 and 6 are provided in this section.

5.D.2.6.1 Winter-run Chinook Salmon

5.D.2.6.1.1 Redd Dewatering Results, Exceedance Plots

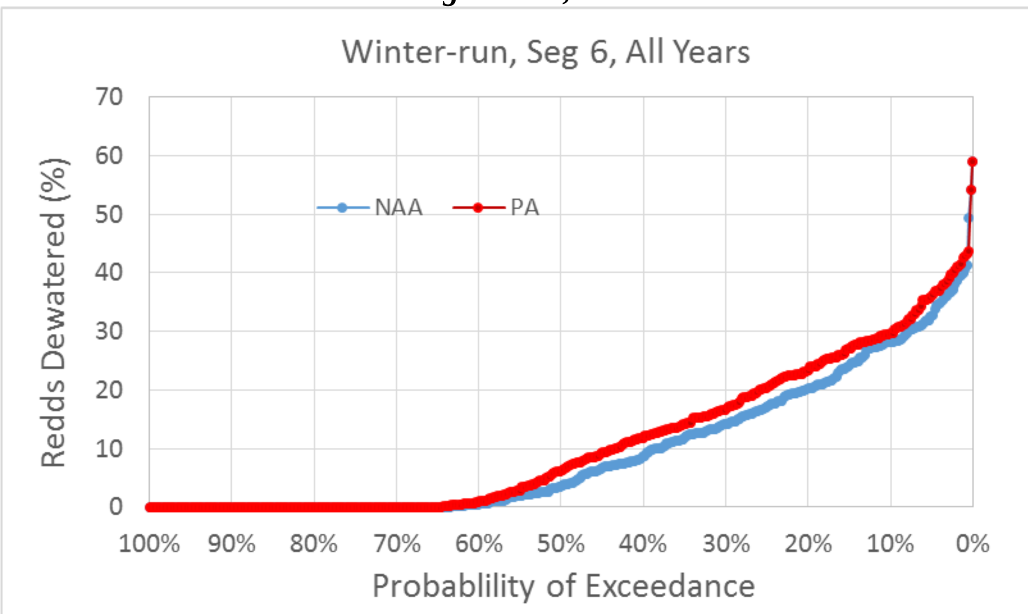


Figure 5.D-100. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, All Water Years

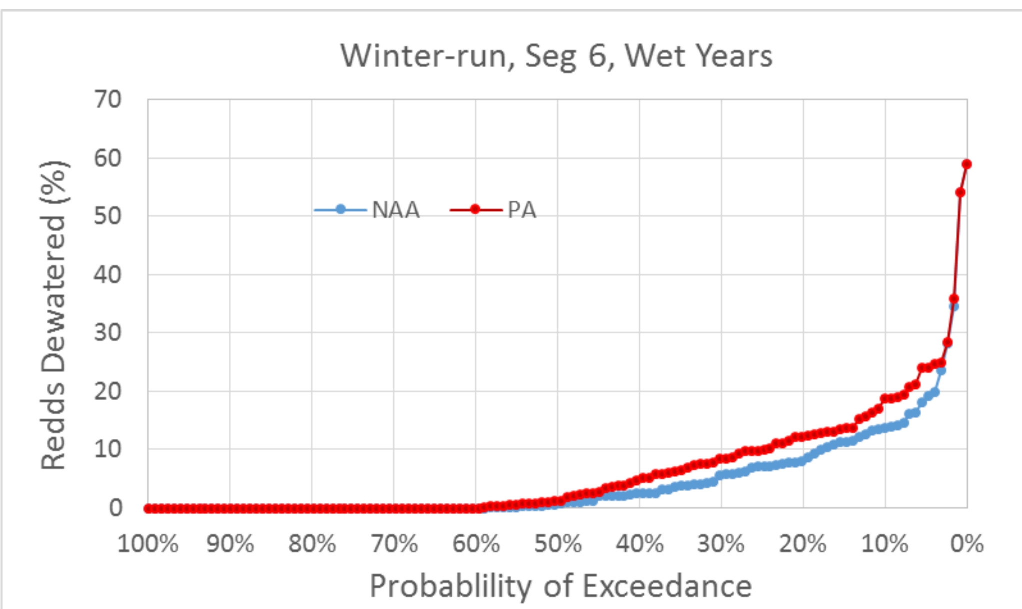


Figure 5.D-101. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Wet Water Years

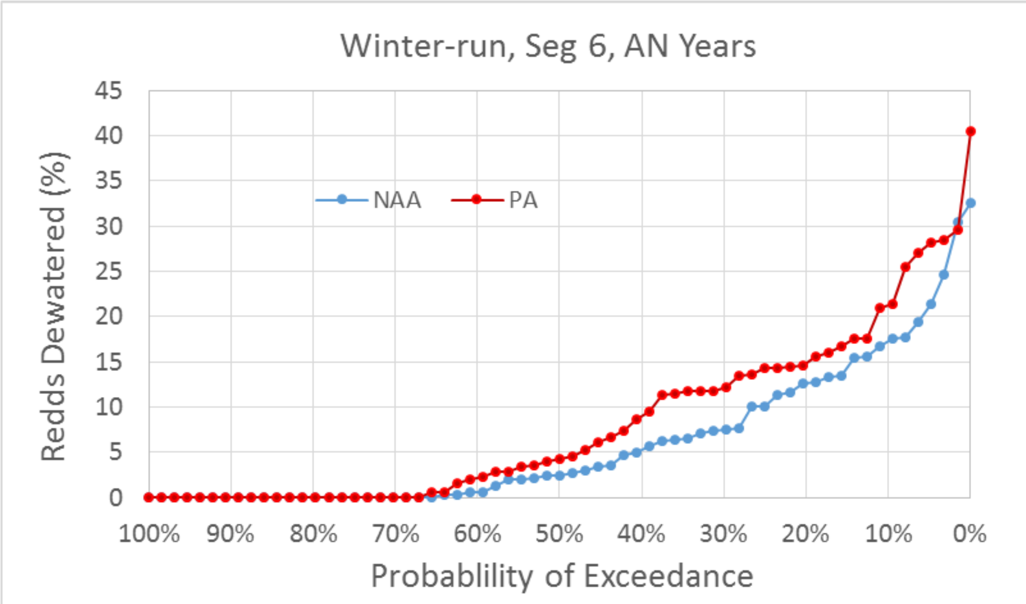


Figure 5.D-102. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Above Normal Water Years

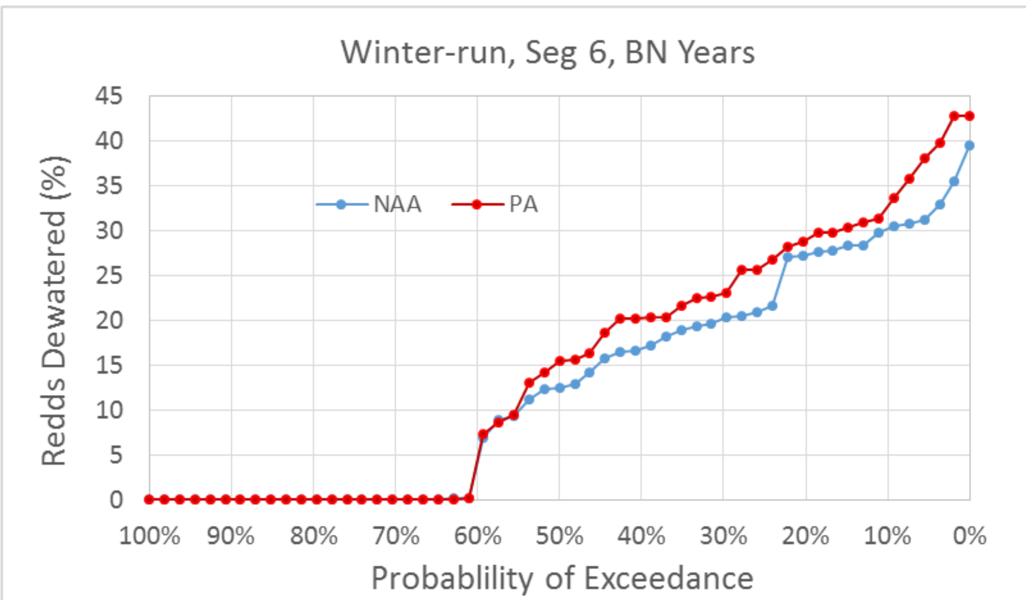


Figure 5.D-103. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Below Normal Water Years

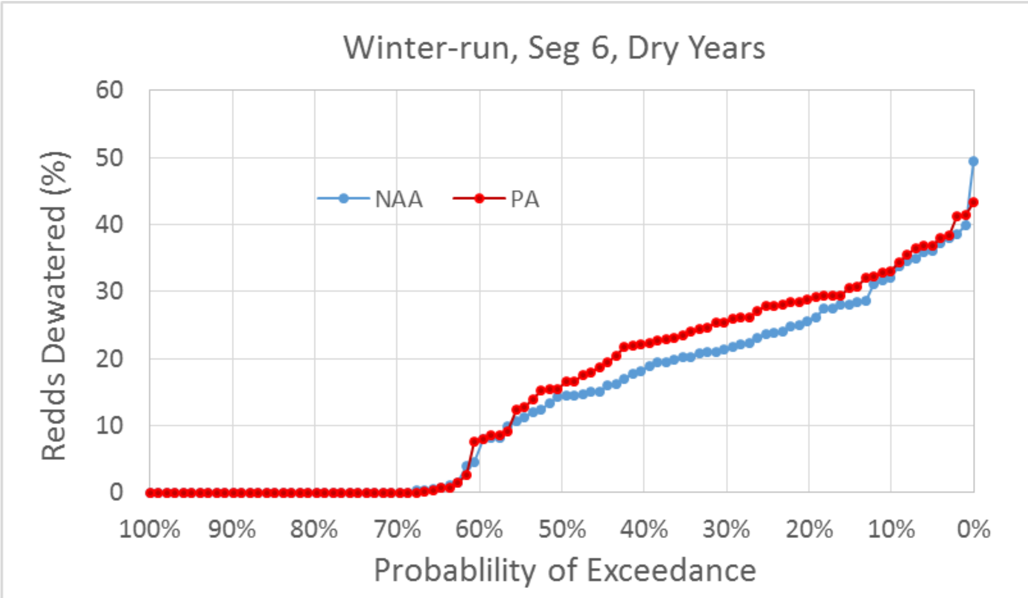


Figure 5.D-104. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Dry Water Years

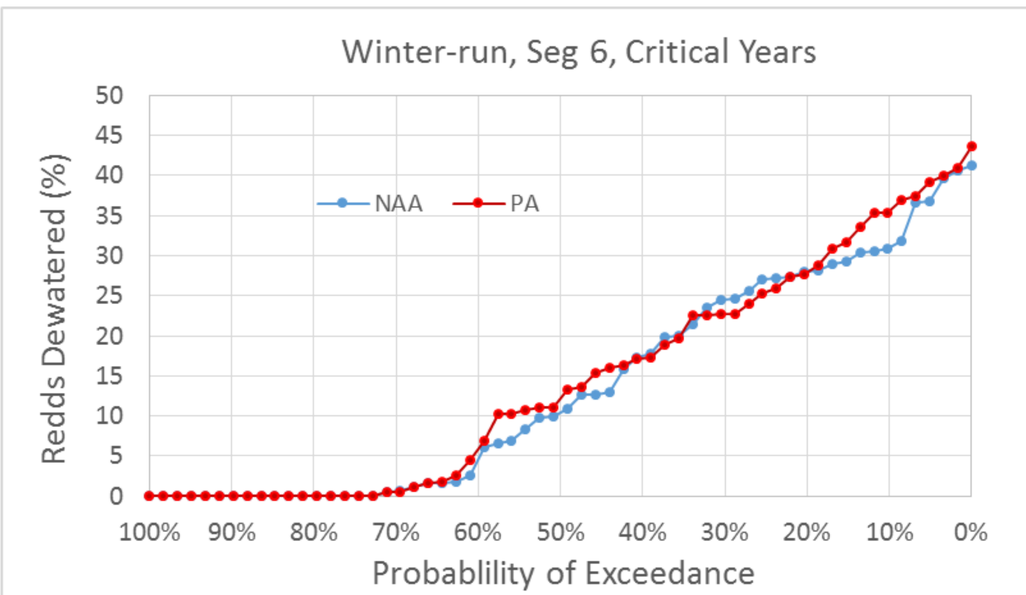


Figure 5.D-105. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Critical Water Years

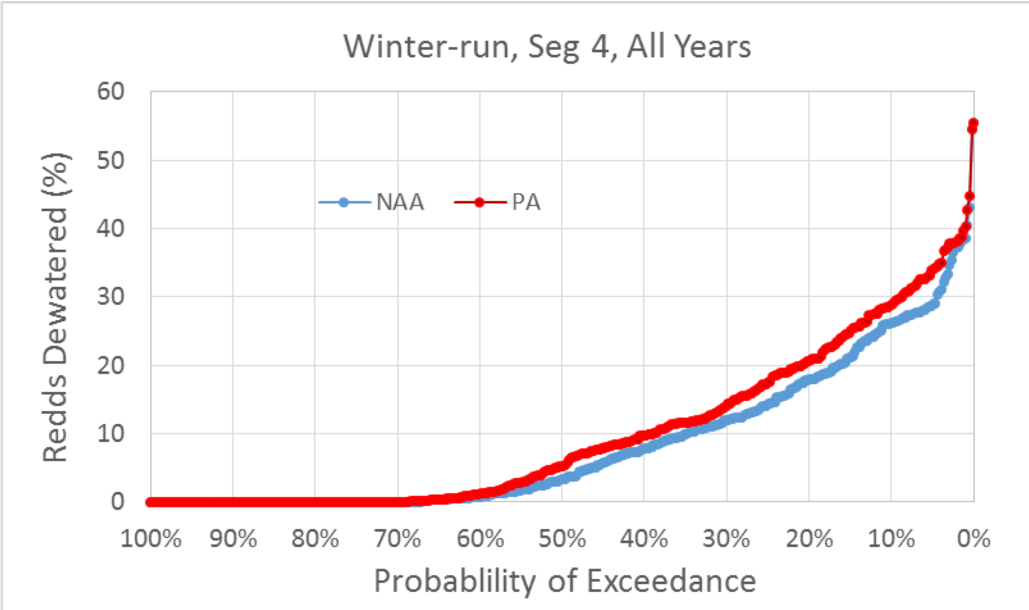


Figure 5.D-106. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, All Water Years

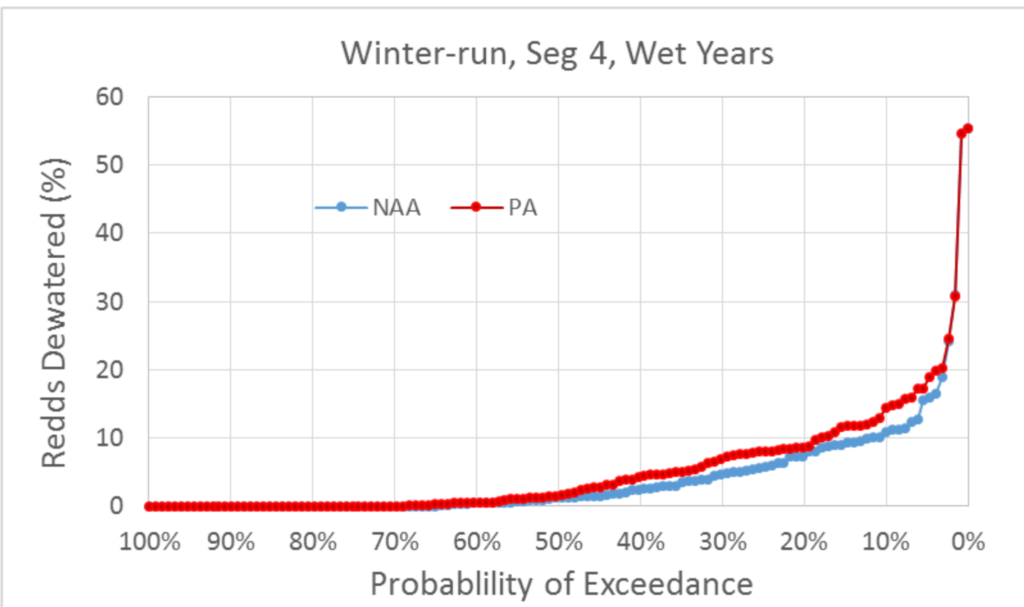


Figure 5.D-107. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Wet Water Years

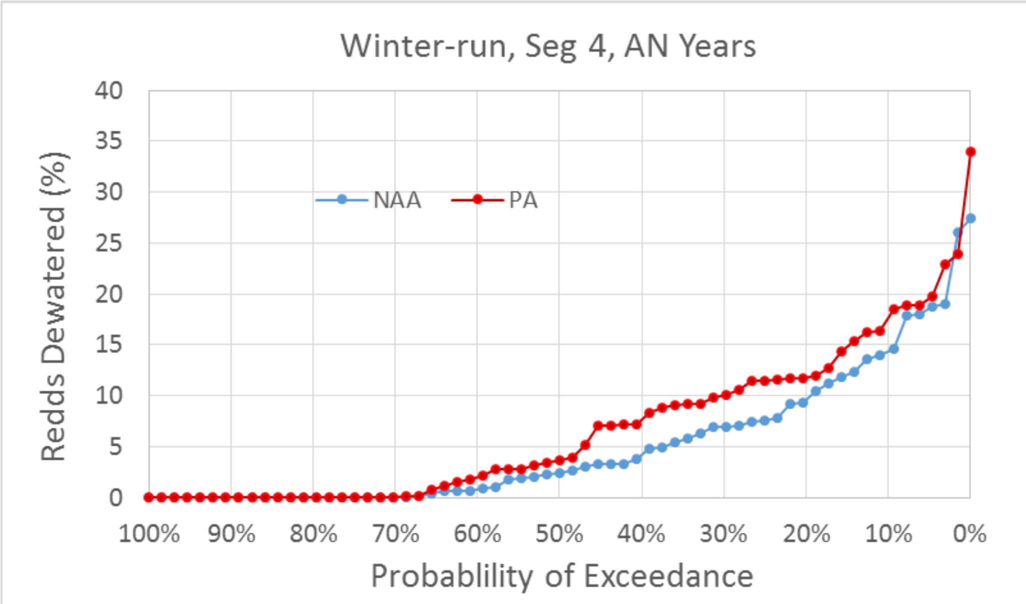


Figure 5.D-108. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Above Normal Water Years

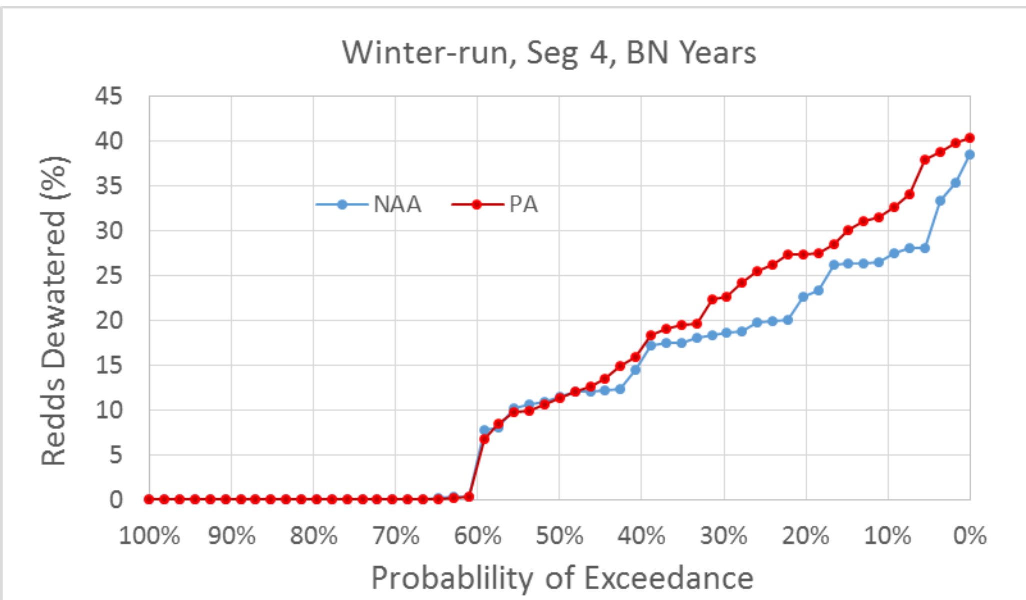


Figure 5.D-109. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Below Normal Water Years

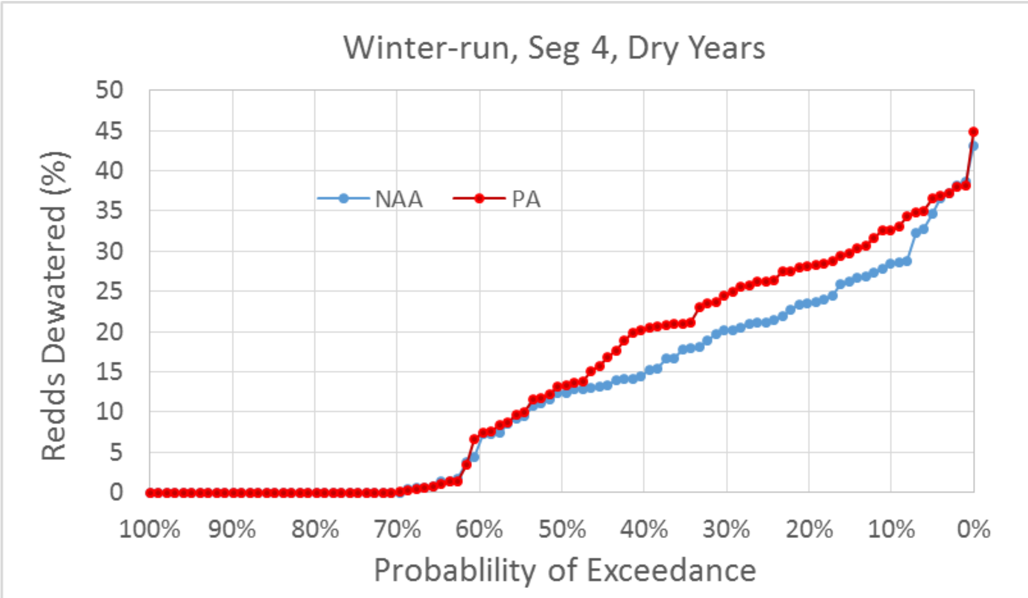


Figure 5.D-110. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Dry Water Years

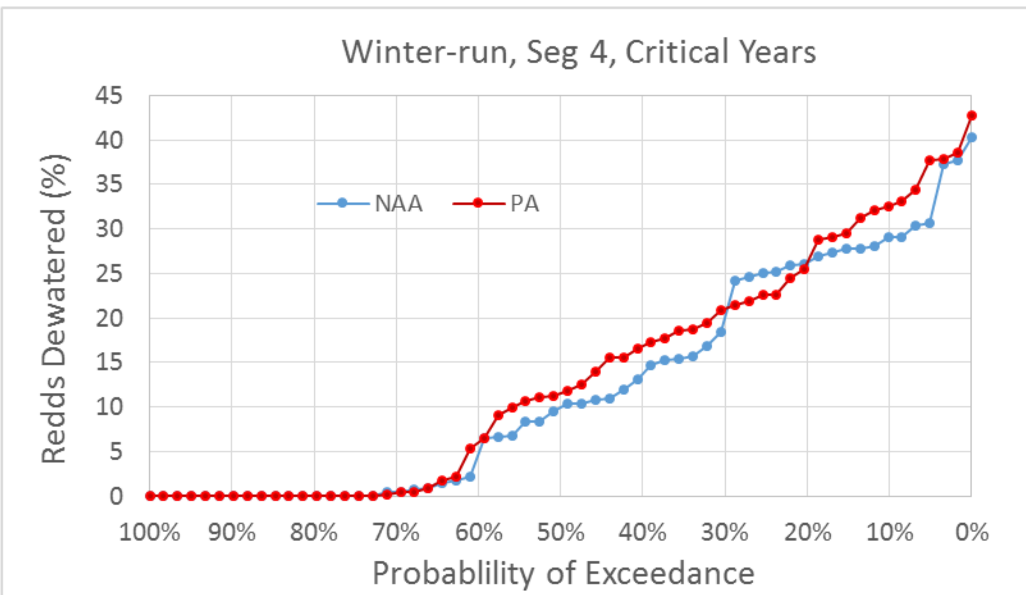


Figure 5.D-111. Exceedance Plot of Winter-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Critical Water Years

5.D.2.6.1.2 Redd DewateringResults, Tables

Table 5.D-181. Winter-Run Chinook Salmon Percent of Redds Dewatered (Percent of Total Redds) and Differences (Percent Differences) in River Segment 6 between Model Scenarios (green indicates PA is at least 5% lower [raw difference] than NAA; red indicates PA is at least 5% higher)

Month	WYT	NAA	PA	PA vs. NAA
April	Wet	5.8	5.7	0 (0%)
	Above Normal	0.7	0.8	0.09 (14%)
	Below Normal	0.0	0.0	0 (-60%)
	Dry	0.3	0.2	-0.2 (-54%)
	Critical	1.5	1.4	-0.1 (-8%)
	All	2.2	2.2	-0.1 (-2%)
May	Wet	0.4	0.4	0 (0%)
	Above Normal	0.3	0.3	0.1 (34%)
	Below Normal	0.0	0.0	0 (0%)
	Dry	0.7	0.5	-0.2 (-22%)
	Critical	0.2	0.2	0 (14%)
	All	0.4	0.3	0 (-5%)
June	Wet	1.1	1.1	0.1 (8%)
	Above Normal	3.5	6.4	2.9 (81%)
	Below Normal	16.0	22.8	6.7 (42%)
	Dry	20.3	25.3	5 (25%)
	Critical	16.4	21.6	5.3 (32%)
	All	10.4	13.8	3.4 (33%)
July	Wet	11.4	15.1	3.7 (32%)
	Above Normal	18.2	18.9	0.7 (4%)
	Below Normal	28.8	31.6	2.8 (10%)
	Dry	30.2	30.8	0.6 (2%)
	Critical	28.1	28.2	0 (0.1%)
	All	21.8	23.6	1.8 (8%)
August	Wet	6.2	9.5	3.4 (55.1%)
	Above Normal	7.9	14.7	6.9 (88%)
	Below Normal	19.7	19.1	-0.6 (-3%)
	Dry	17.7	19.7	2 (11%)
	Critical	23.2	21.6	-1.6 (-7%)
	All	13.6	15.9	2.3 (17%)

Table 5.D-182. Winter-Run Chinook Salmon Percent of Redds Dewatered (Percent of Total Redds) and Differences (Percent Differences) in River Segment 4 between Model Scenarios (green indicates PA is at least 5% lower [raw difference] than NAA; red indicates PA is at least 5% higher)

Month	WYT	NAA	PA	PA vs. NAA
April	Wet	6.1	6.0	0 (-1%)
	Above Normal	1.0	1.1	0.11 (11%)
	Below Normal	0.1	0.0	0 (-61%)
	Dry	0.4	0.2	-0.2 (-42%)
	Critical	1.2	1.1	-0.1 (-11%)
	All	2.4	2.3	-0.1 (-2%)
May	Wet	0.9	0.9	0 (-1%)
	Above Normal	0.4	0.5	0.1 (22%)
	Below Normal	0.0	0.0	0 (-9%)
	Dry	0.8	0.7	-0.1 (-15%)
	Critical	0.2	0.2	0 (-1%)
	All	0.6	0.5	0 (-3%)
June	Wet	1.3	1.4	0.1 (9%)
	Above Normal	3.6	6.4	2.8 (78%)
	Below Normal	16.1	22.8	6.7 (42%)
	Dry	20.3	25.6	5.3 (26%)
	Critical	16.3	21.6	5.3 (33%)
	All	10.4	13.9	3.5 (33%)
July	Wet	9.7	12.6	2.9 (30.2%)
	Above Normal	15.6	16.2	0.7 (4%)
	Below Normal	26.9	30.7	3.8 (14%)
	Dry	28.0	29.5	1.5 (5%)
	Critical	26.5	27.1	0.6 (2.1%)
	All	19.9	21.8	2 (10%)
August	Wet	3.8	5.9	2 (52.6%)
	Above Normal	5.4	9.5	4.1 (76%)
	Below Normal	16.1	14.7	-1.4 (-9%)
	Dry	13.1	16.0	2.9 (22%)
	Critical	17.6	17.9	0.4 (2%)
	All	10.0	11.9	1.9 (19%)

5.D.2.6.2 Spring-run Chinook Salmon

5.D.2.6.2.1 Redd Dewatering Results, Exceedance Plots

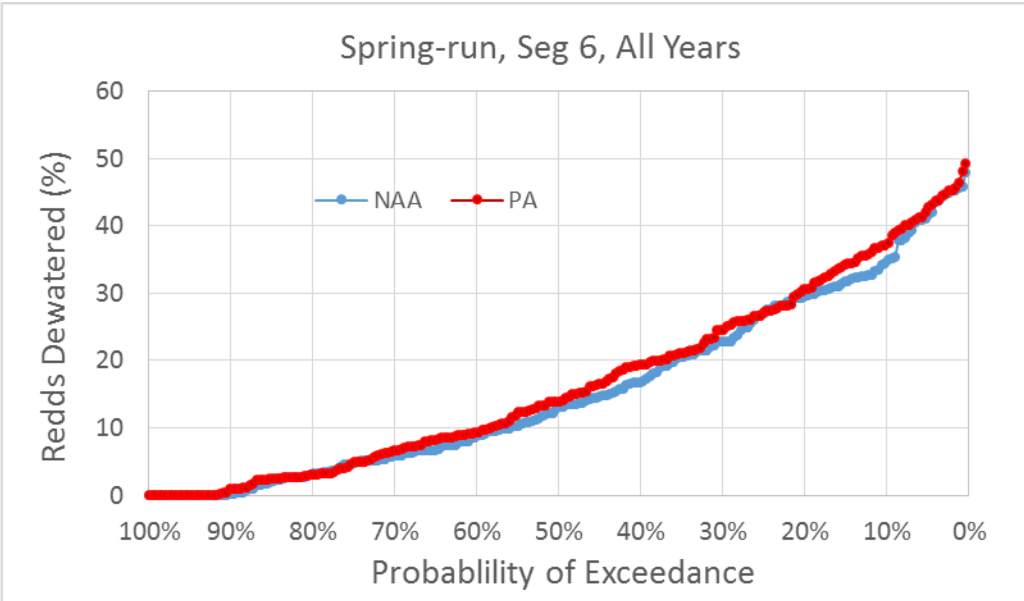


Figure 5.D-112. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, All Water Years

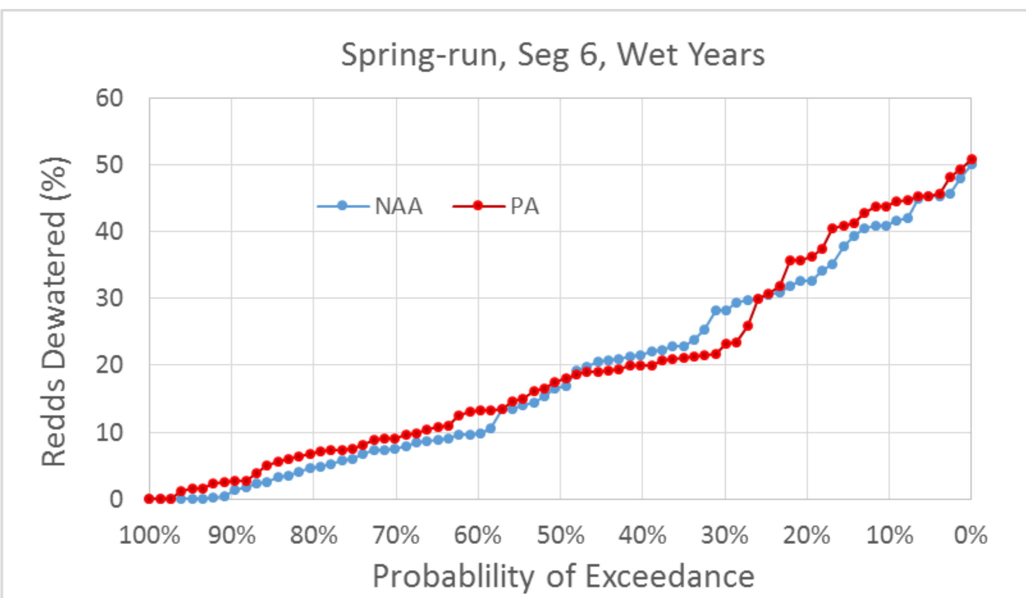


Figure 5.D-113. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Wet Water Years

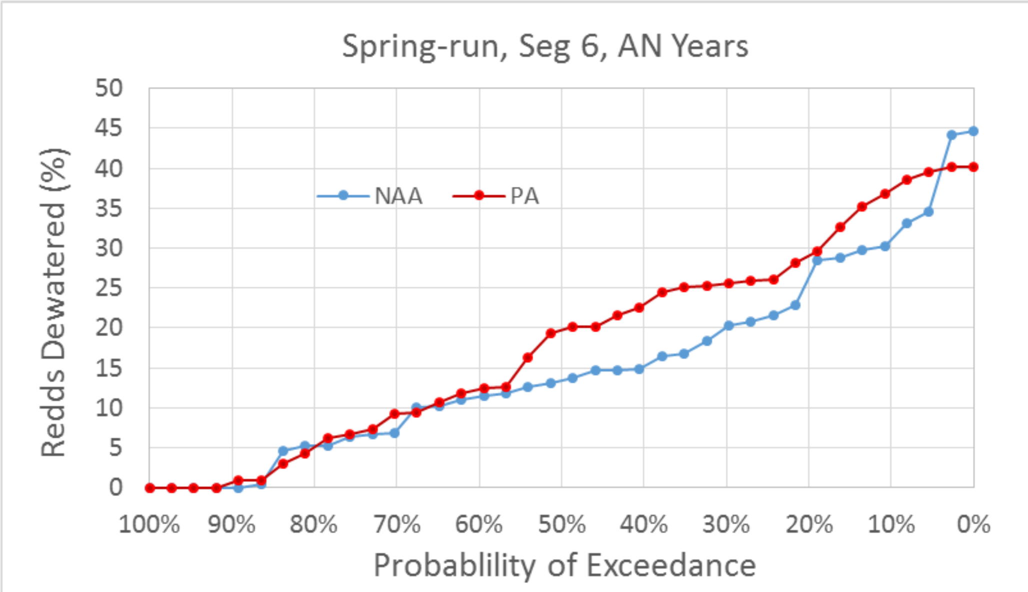


Figure 5.D-114. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Above Normal Water Years

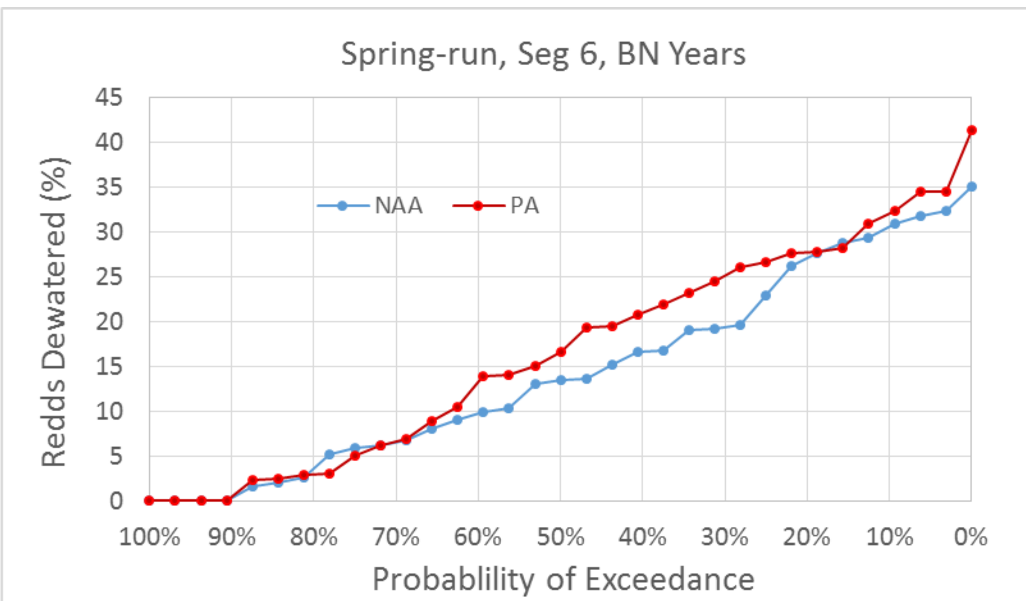


Figure 5.D-115. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Below Normal Water Years

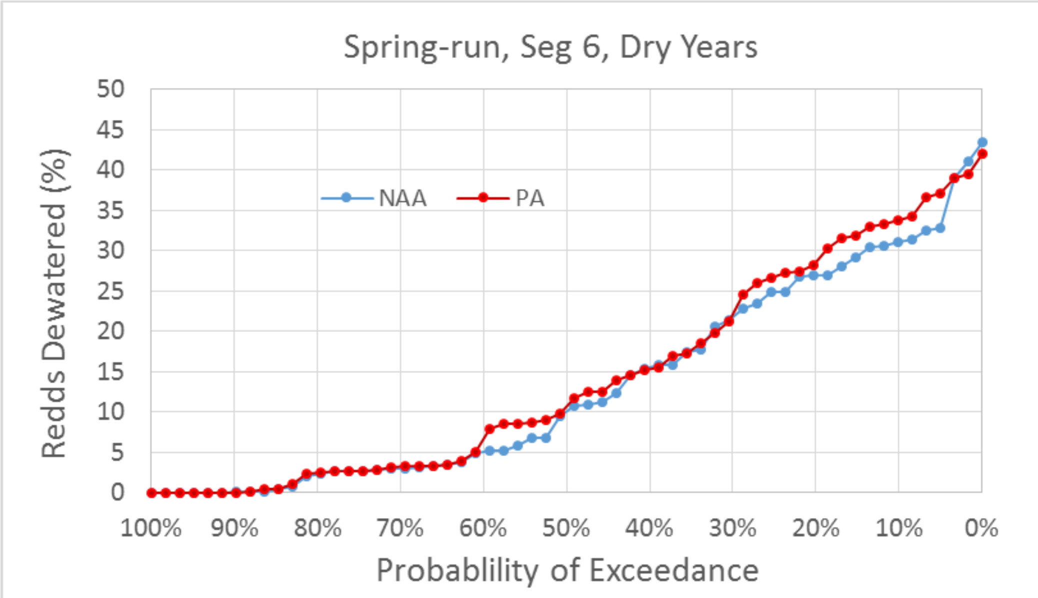


Figure 5.D-116. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Dry Water Years

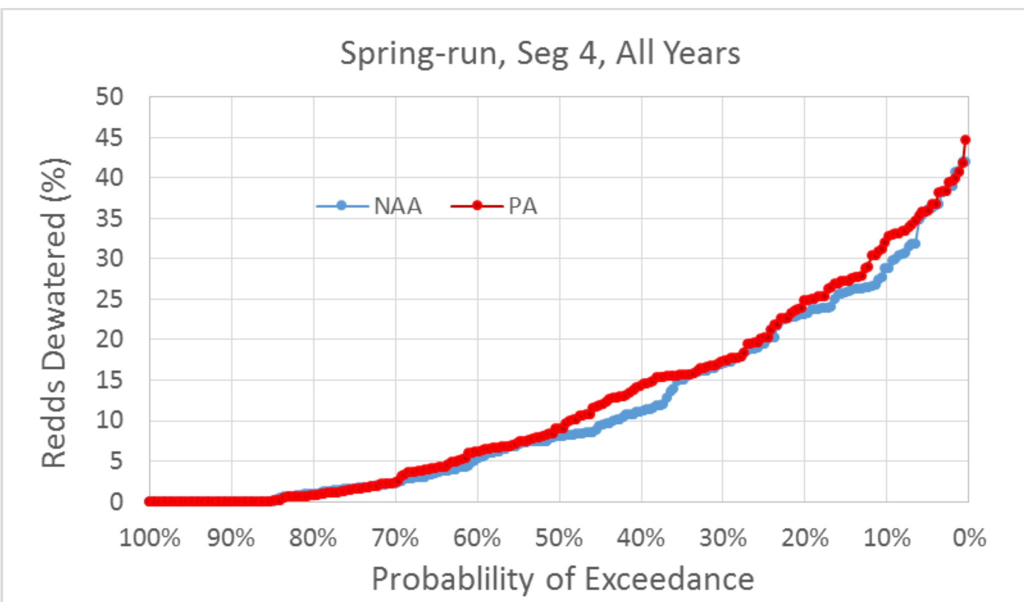


Figure 5.D-117. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, All Water Years

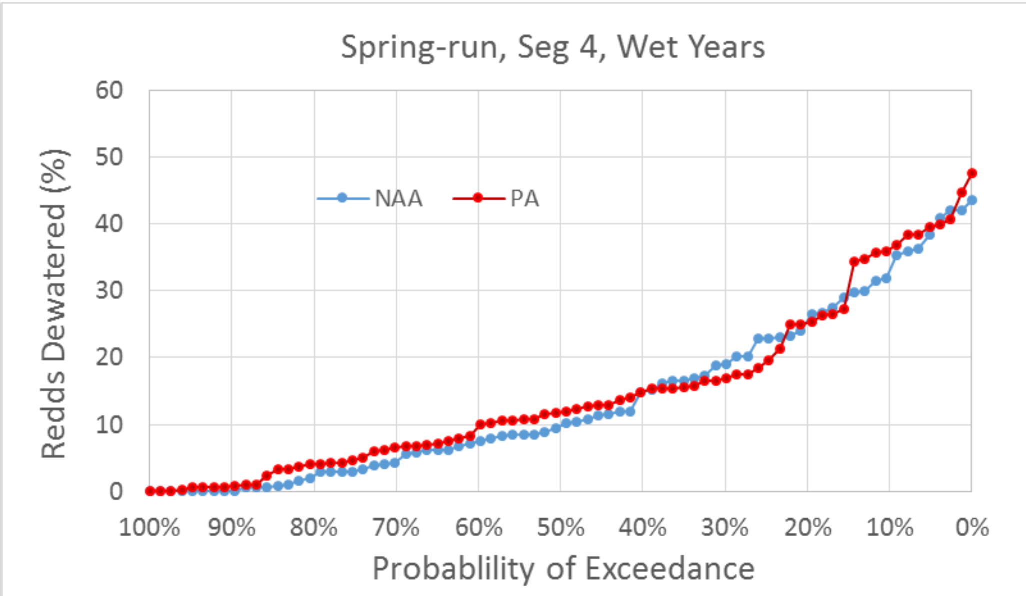


Figure 5.D-118. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Wet Water Years

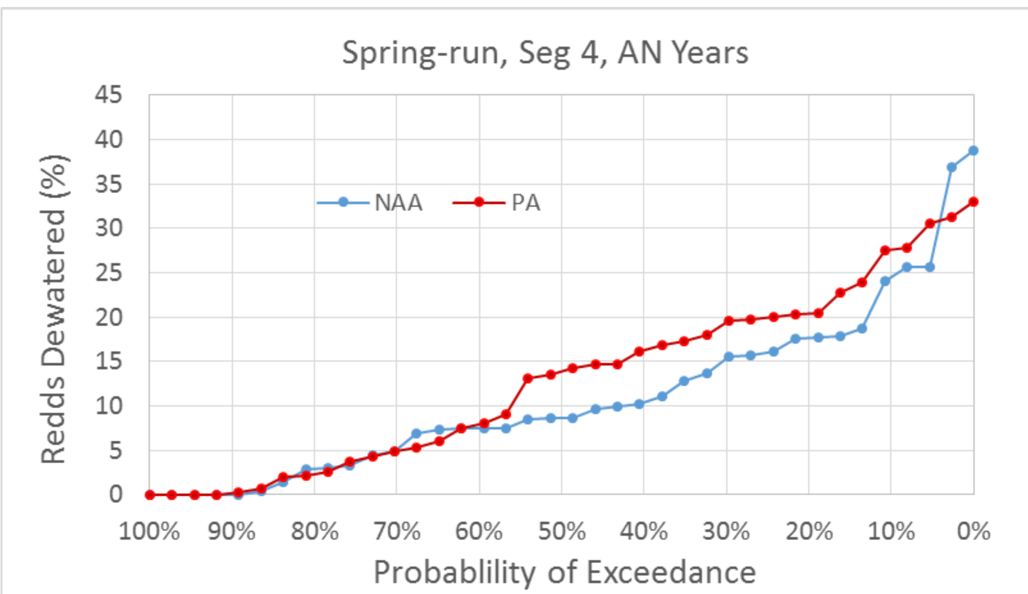


Figure 5.D-119. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Above Normal Water Years

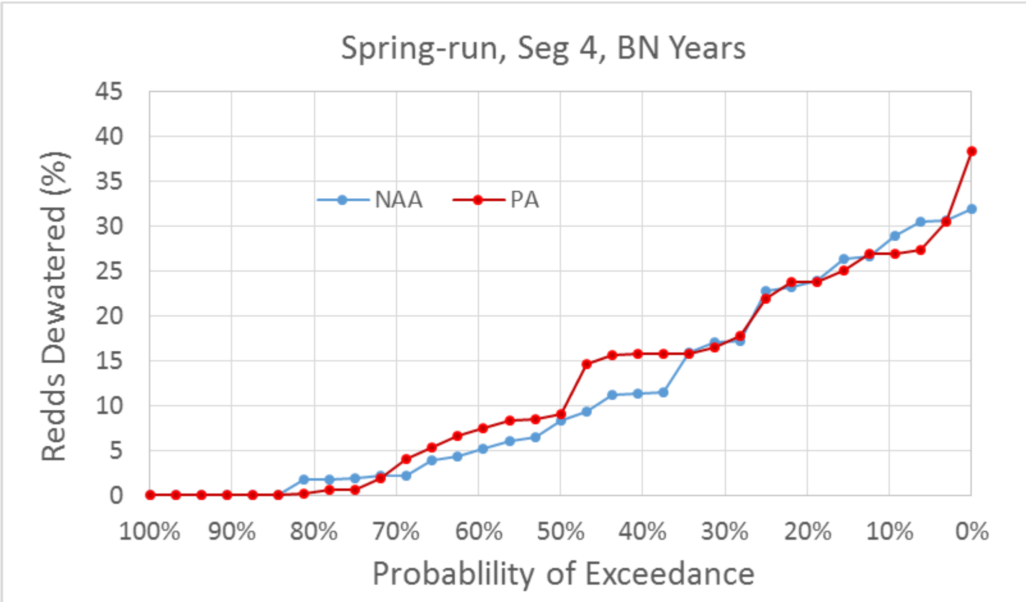


Figure 5.D-120. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Below Normal Water Years

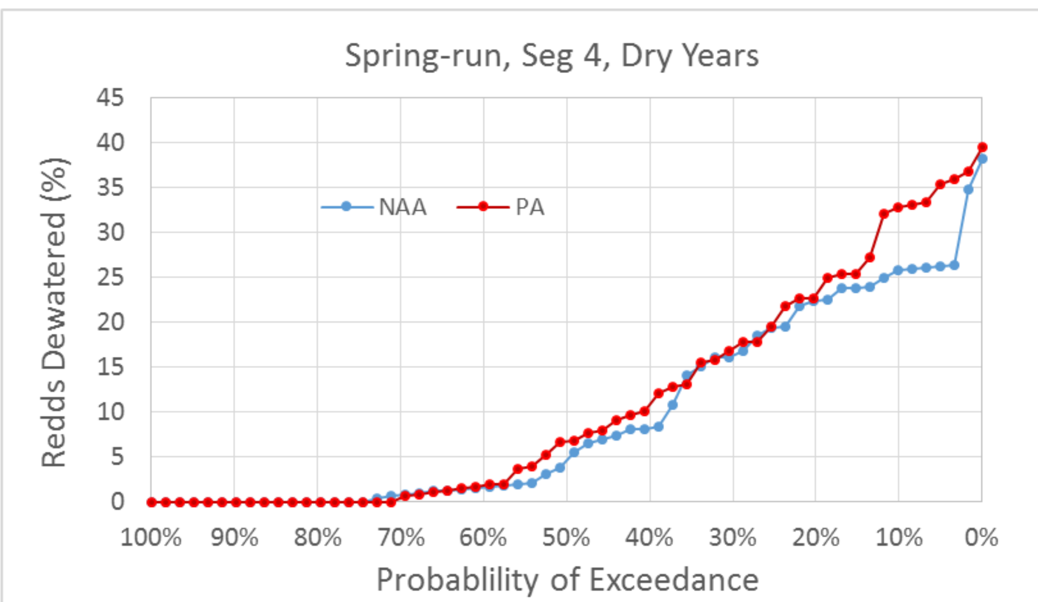


Figure 5.D-121. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Dry Water Years

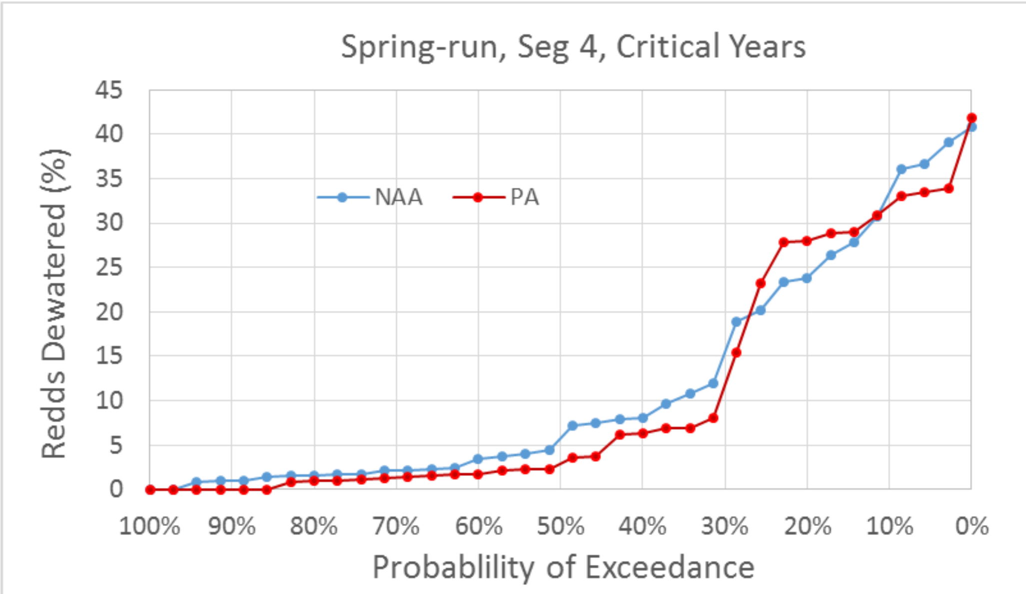


Figure 5.D-122. Exceedance Plot of Spring-Run Chinook Salmon Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Critical Water Years

5.D.2.6.2.2 Redd Dewatering Results, Tables

Table 5.D-183. Spring-Run Chinook Salmon Percent of Redds Dewatered (Percent of Total Redds) and Differences (Percent Differences) in River Segment 6 between Model Scenarios (green indicates PA is at least 5% lower [raw difference] than NAA; red indicates PA is at least 5% higher)

Month	WYT	NAA	PA	PA vs. NAA
August	Wet	10.9	16.2	5 (49%)
	Above Normal	14.0	22.7	9 (62%)
	Below Normal	27.5	30.4	3 (10%)
	Dry	28.4	30.4	2 (7%)
	Critical	32.4	30.4	-2 (-6%)
	All	21.0	24.7	4 (17%)
September	Wet	31.1	33.0	2 (6%)
	Above Normal	19.0	17.7	-1 (-7%)
	Below Normal	6.5	3.4	-3 (-47%)
	Dry	3.9	2.6	-1 (-33%)
	Critical	6.9	5.3	-2 (-24%)
	All	15.7	15.2	-0.5 (-3%)
October	Wet	15.0	10.3	-5 (-32%)
	Above Normal	13.0	13.6	1 (5%)
	Below Normal	9.5	15.9	6 (67%)
	Dry	8.2	10.3	2 (25%)
	Critical	7.0	6.4	-1 (-8%)
	All	11.1	11.0	-0.1 (-1%)

Table 5.D-184. Spring-Run Chinook Salmon Percent of Redds Dewatered (Percent of Total Redds) and Differences (Percent Differences) in River Segment 4 between Model Scenarios (green indicates PA is at least 5% lower [raw difference] than NAA; red indicates PA is at least 5% higher)

Month	WYT	NAA	PA	PA vs. NAA
August	Wet	7.3	11.1	4 (52%)
	Above Normal	10.5	16.5	6 (56%)
	Below Normal	25.2	25.1	0 (0%)
	Dry	23.4	26.7	3 (14%)
	Critical	27.7	27.7	0 (0%)
	All	17.1	20.1	3 (17%)
September	Wet	24.9	26.5	2 (6%)
	Above Normal	13.5	12.2	-1 (-10%)
	Below Normal	3.1	1.2	-2 (-63%)
	Dry	1.0	0.6	0 (-37%)
	Critical	3.5	1.7	-2 (-51%)
	All	11.2	10.9	-0.3 (-3%)
October	Wet	9.3	6.6	-3 (-29%)
	Above Normal	8.9	10.0	1 (12%)
	Below Normal	6.4	10.9	4 (69%)
	Dry	5.0	6.2	1 (25%)
	Critical	4.0	2.8	-1 (-31%)
	All	7.0	7.0	0 (0%)

5.D.2.6.3 Central Valley Steelhead

5.D.2.6.3.1 Redd Dewatering Results, Exceedance Plots

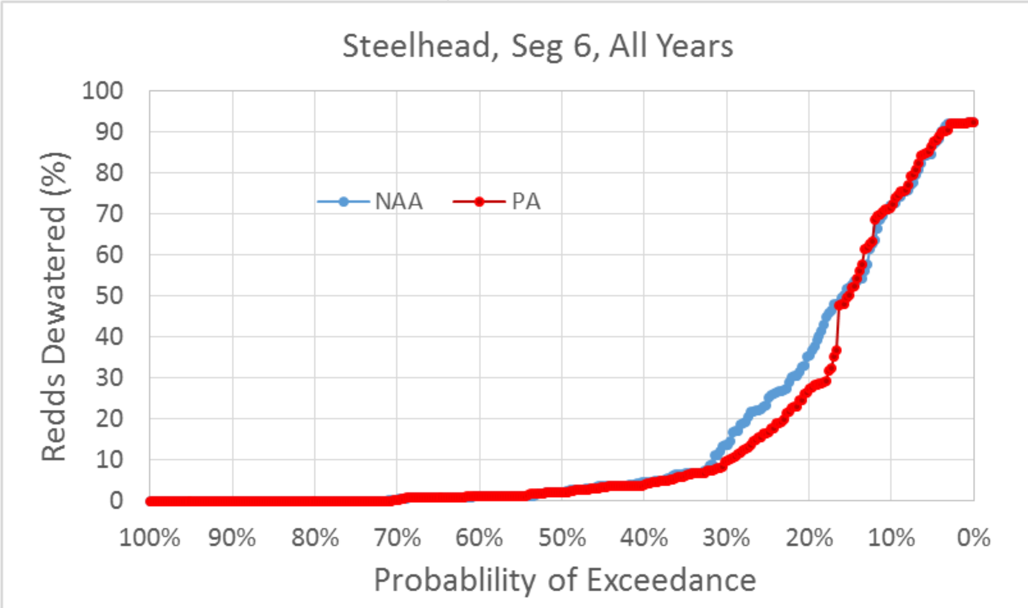


Figure 5.D-123. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, All Water Years

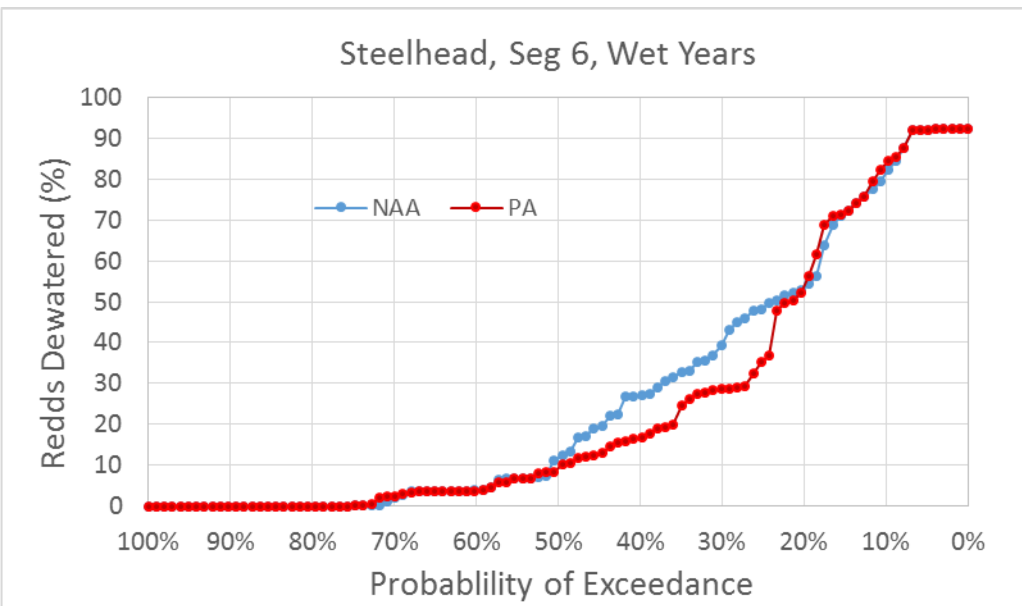


Figure 5.D-124. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Wet Water Years

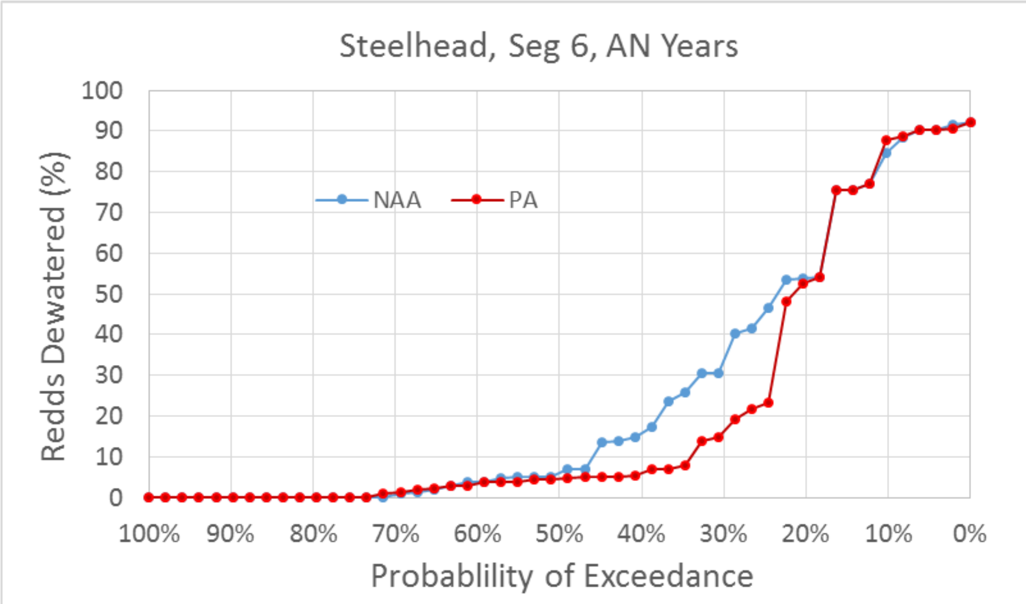


Figure 5.D-125. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Above Normal Water Years

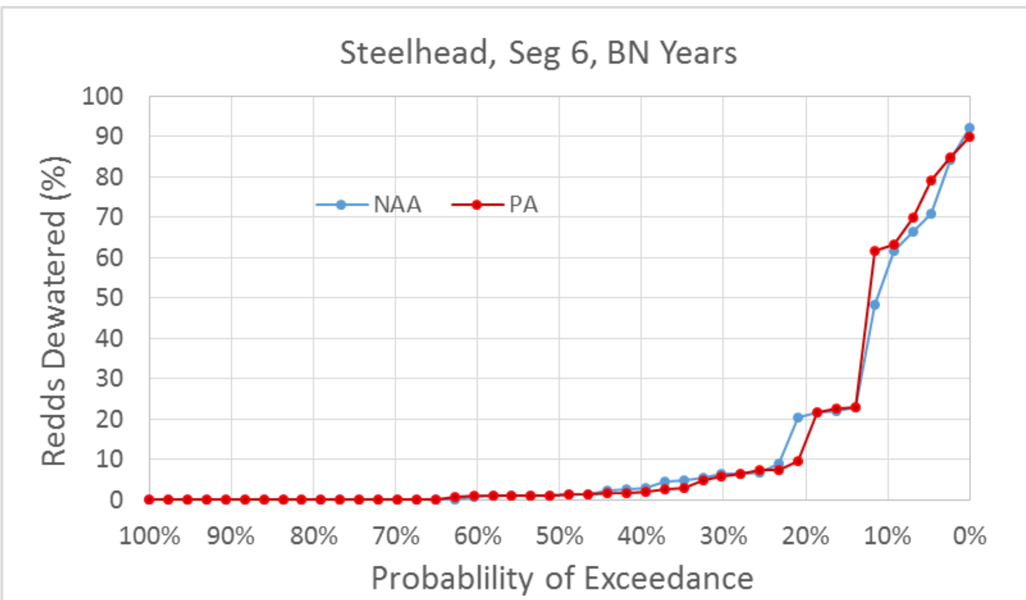


Figure 5.D-126. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Below Water Years

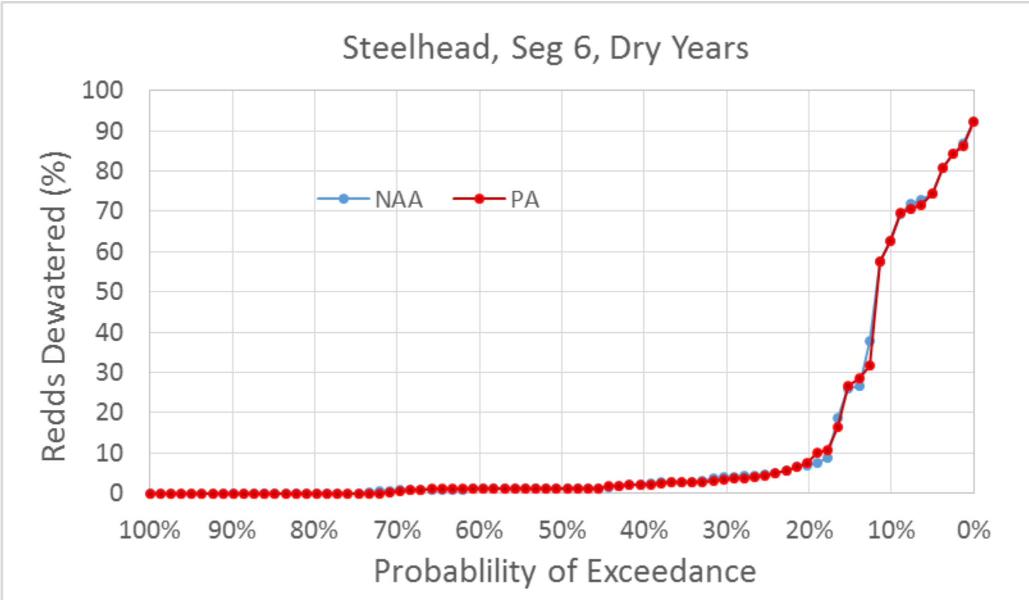


Figure 5.D-127. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Dry Water Years

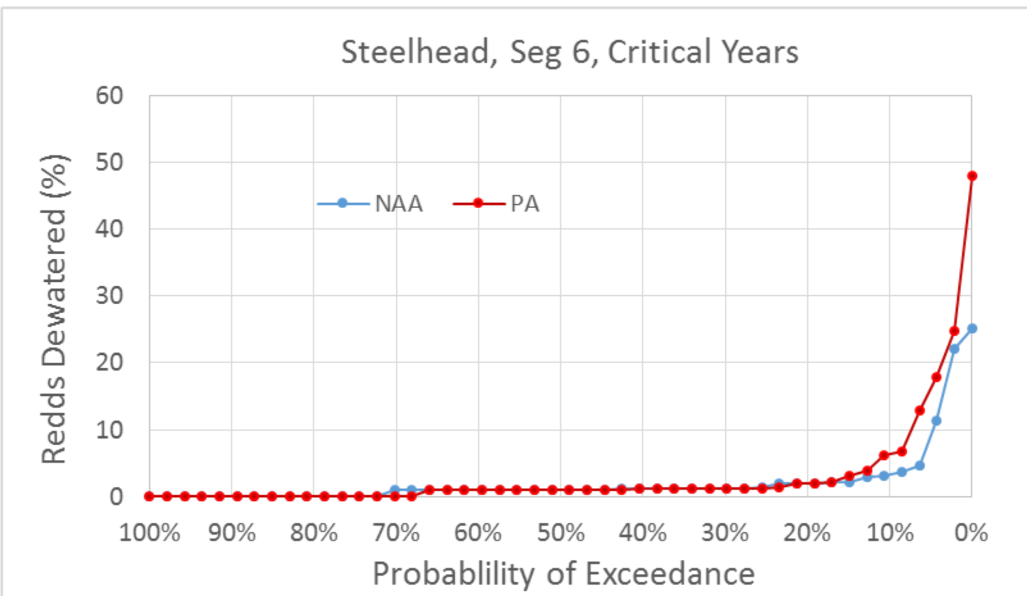


Figure 5.D-128. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 6, Critical Water Years

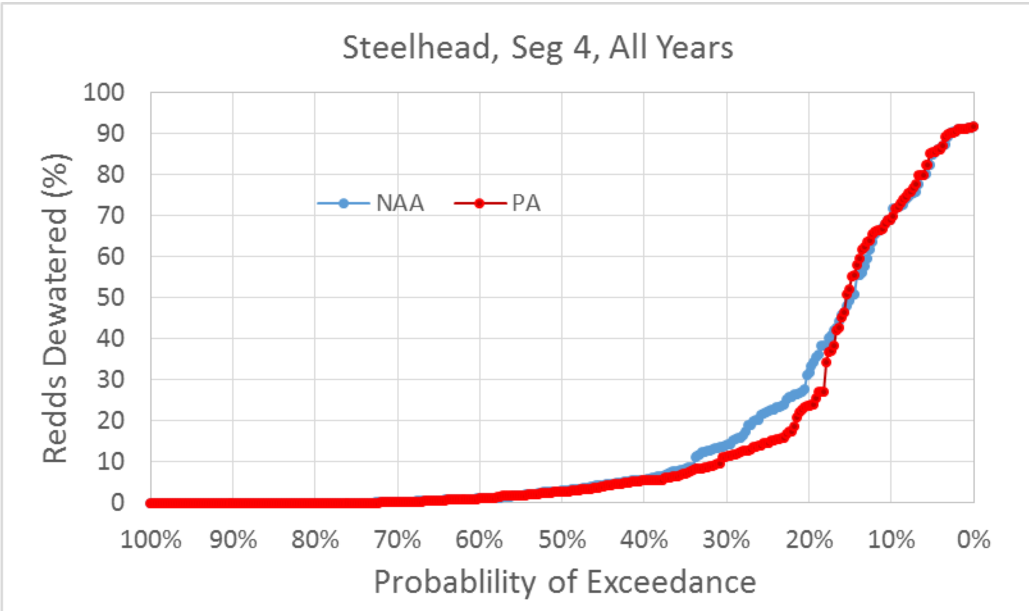


Figure 5.D-129. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, All Water Years

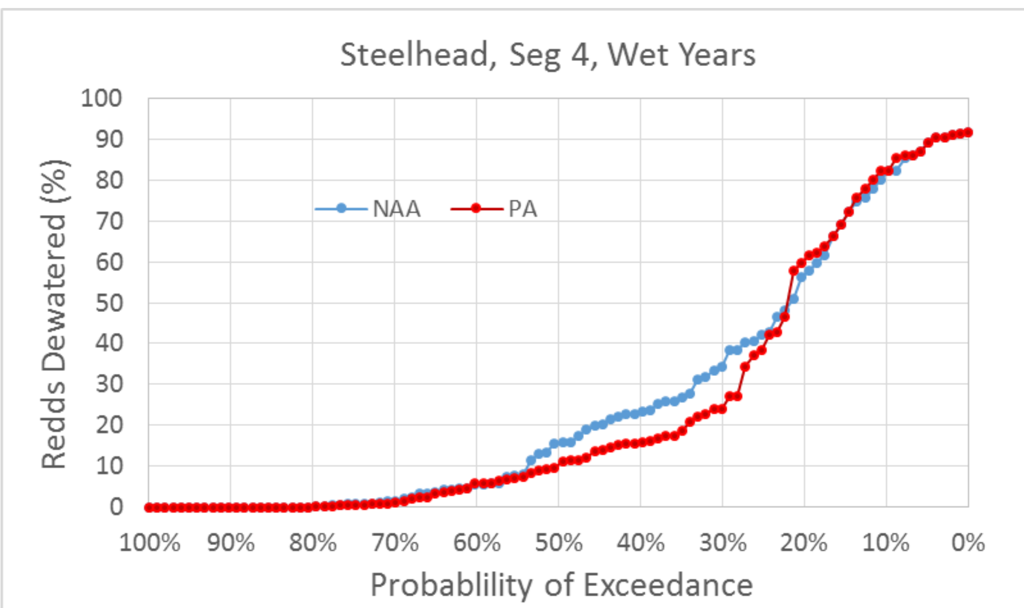


Figure 5.D-130. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Wet Water Years

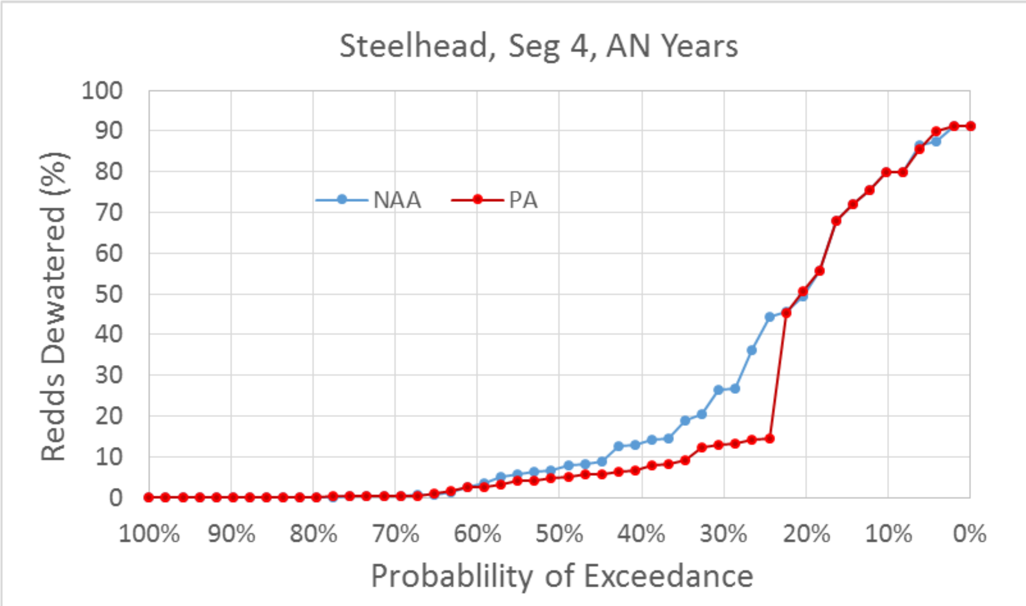


Figure 5.D-131. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Above Normal Water Years

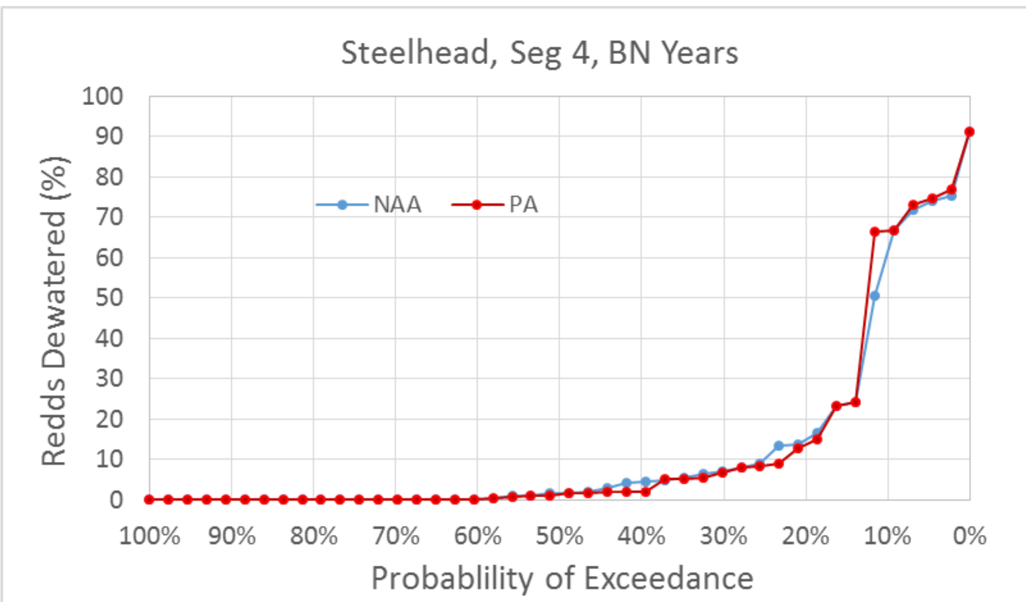


Figure 5.D-132. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Below Water Years

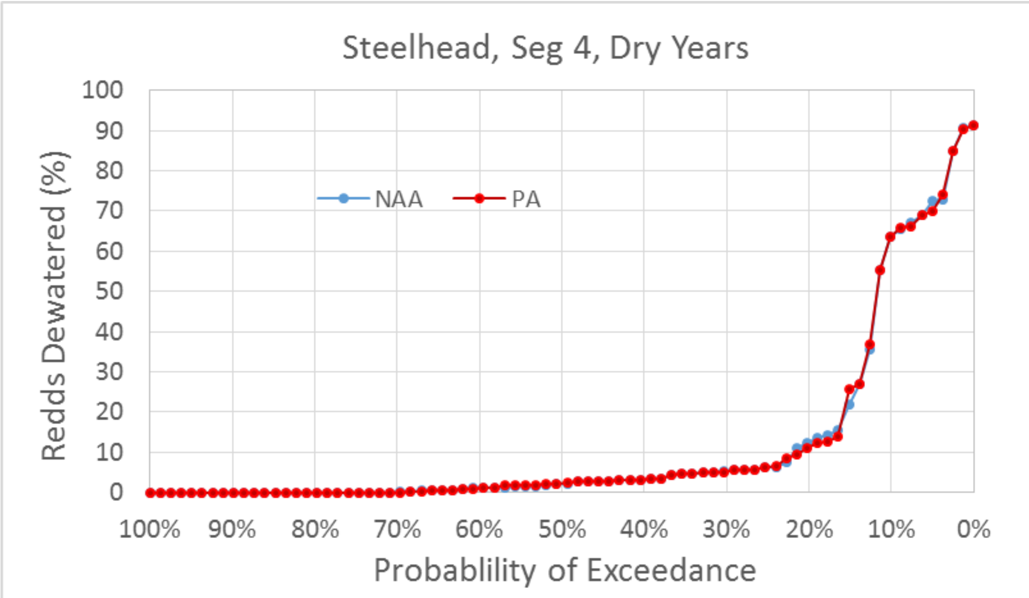


Figure 5.D-133. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Dry Water Years

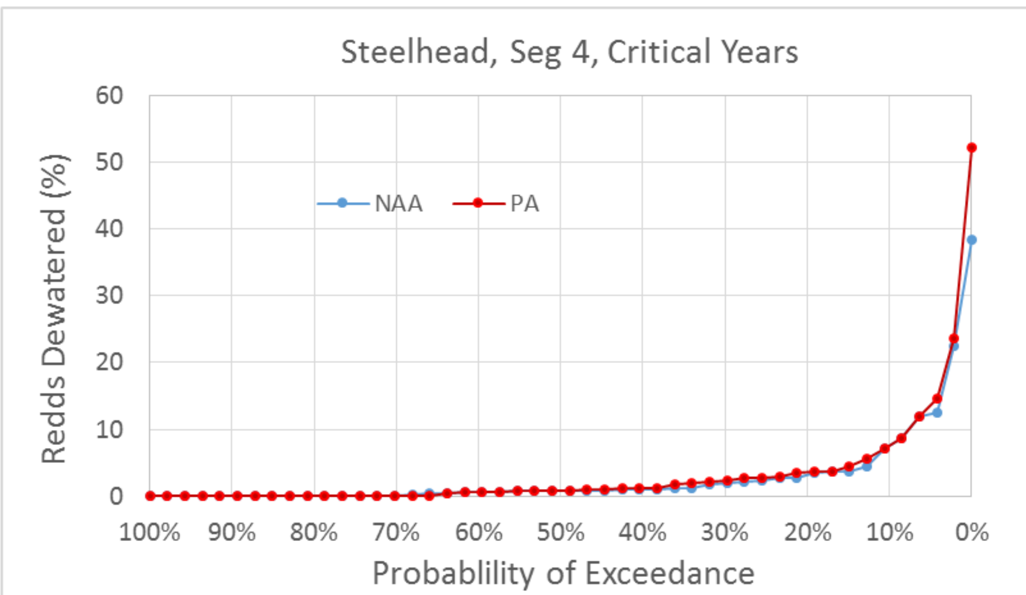


Figure 5.D-134. Exceedance Plot of Central Valley Steelhead Percent of Redds Dewatered for NAA and PA Model Scenarios in River Segment 4, Critical Water Years

5.D.2.6.3.2 Redd Dewatering Results, Tables

Table 5.D-185. Central Valley Steelhead Percent of Redds Dewatered (Percent of Total Redds) and Differences (Percent Differences) in River Segment 6 between Model Scenarios (green indicates PA is at least 5% lower [raw difference] than NAA; red indicates PA is at least 5% higher)

Month	WYT	NAA	PA	PA vs. NAA
November	Wet	29.6	15.7	-13.9 (-47%)
	Above Normal	29.3	15.6	-13.68 (-47%)
	Below Normal	6.8	5.2	-1.6 (-23%)
	Dry	4.5	3.4	-1.1 (-25%)
	Critical	1.9	4.7	2.8 (152%)
	All	16.1	9.6	-6.6 (-41%)
December	Wet	14.0	14.6	0.6 (4%)
	Above Normal	10.2	8.7	-1.5 (-14%)
	Below Normal	11.9	11.7	-0.2 (-1%)
	Dry	22.1	22.3	0.2 (1%)
	Critical	1.1	0.9	-0.3 (-23%)
	All	13.2	13.2	0 (0%)
January	Wet	22.4	25.8	3.4 (15%)
	Above Normal	14.0	14.1	0.1 (1%)
	Below Normal	14.6	14.0	-0.6 (-4%)
	Dry	21.4	21.8	0.5 (2%)
	Critical	2.5	6.6	4.1 (166%)
	All	16.8	18.6	1.7 (10%)
February	Wet	43.1	43.8	0.7 (1.7%)
	Above Normal	47.5	47.6	0.2 (0%)
	Below Normal	18.6	21.6	3 (16%)
	Dry	0.8	0.9	0.1 (9%)
	Critical	3.5	0.5	-2.9 (-84.7%)
	All	24.4	24.6	0.3 (1%)

Table 5.D-186. Central Valley Steelhead Percent of Redds Dewatered (Percent of Total Redds) and Differences (Percent Differences) in River Segment 4 between Model Scenarios (green indicates PA is at least 5% lower [raw difference] than NAA; red indicates PA is at least 5% higher)

Month	WYT	NAA	PA	PA vs. NAA
November	Wet	25.0	12.8	-12.2 (-49%)
	Above Normal	23.5	12.3	-11.14 (-47%)
	Below Normal	4.6	3.3	-1.4 (-29%)
	Dry	3.2	2.5	-0.7 (-21%)
	Critical	0.9	2.6	1.8 (204%)
	All	13.0	7.4	-5.6 (-43%)
December	Wet	14.2	15.2	1 (7%)
	Above Normal	8.9	8.4	-0.5 (-5%)
	Below Normal	11.3	11.4	0.1 (1%)
	Dry	22.3	22.3	0 (0%)
	Critical	1.9	1.8	-0.1 (-3%)
	All	13.2	13.5	0.3 (2%)
January	Wet	23.4	26.4	3 (13%)
	Above Normal	13.9	14.0	0.1 (1%)
	Below Normal	17.3	16.8	-0.5 (-3%)
	Dry	22.0	22.3	0.3 (2%)
	Critical	5.1	8.2	3 (59%)
	All	18.0	19.5	1.4 (8%)
February	Wet	43.4	44.2	0.8 (1.8%)
	Above Normal	46.1	46.3	0.2 (0%)
	Below Normal	19.6	21.7	2.1 (11%)
	Dry	2.4	2.5	0.1 (5%)
	Critical	4.1	1.2	-2.8 (-69.5%)
	All	24.9	25.0	0.2 (1%)

5.D.3 Life Cycle Models

Two life cycle models were used to assess the potential effects of the PA on winter-run Chinook salmon: IOS and OBAN. The methods and results from these models are presented in this section.

5.D.3.1 IOS (Interactive Object-Oriented Simulation)

5.D.3.1.1 Model Structure

The IOS Model is composed of six model stages defined by a specific spatiotemporal context and are arranged sequentially to account for the entire life cycle of winter-run Chinook salmon, from eggs to returning spawners (Figure 5.D-135). In sequential order, the IOS Model stages are listed below.

1. Spawning, which models the number and temporal distribution of eggs deposited in the gravel at the spawning grounds in the upper Sacramento River between Red Bluff Diversion Dam and Keswick Dam.

2. Early Development, which models the effect of temperature on maturation timing and mortality of eggs at the spawning grounds.

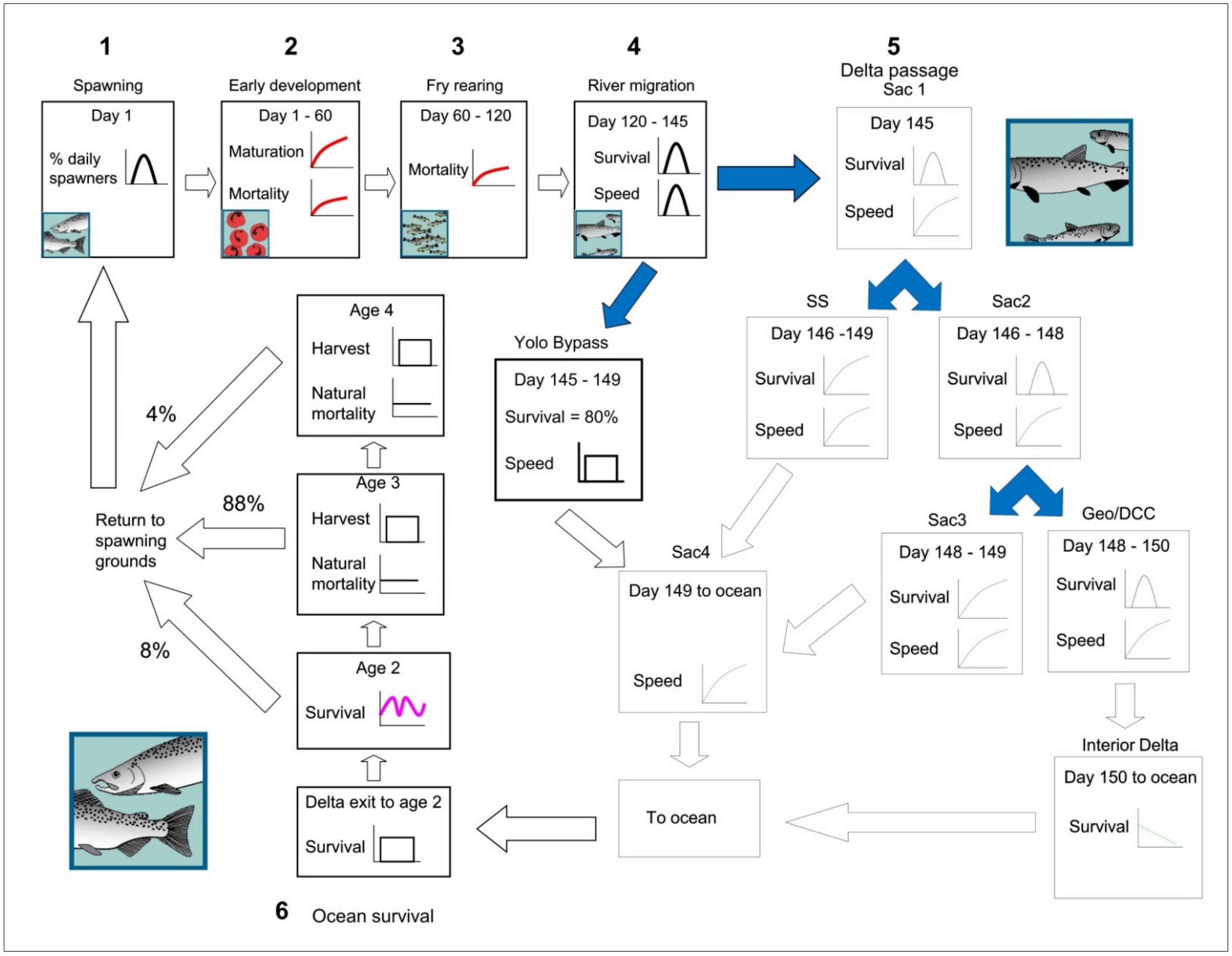
3. Fry Rearing, which models the relationship between temperature and mortality of fry during the river rearing period in the upper Sacramento River between Red Bluff Diversion Dam and Keswick Dam.

4. River Migration, which estimates mortality of migrating smolts in the Sacramento River between the spawning and rearing grounds and the Delta.

5. Delta Passage, which models the effect of flow, route selection, and water exports on the survival of smolts migrating through the Delta to San Francisco Bay.

6. Ocean Survival, which estimates the effect of natural mortality and ocean harvest to predict survival and spawning returns by age.

A detailed description of each model stage follows.



Note: Red = temperature, blue = flow, green = water exports, pink = ocean productivity.

Figure 5.D-135. Conceptual Diagram of the IOS Model Stages and Environmental Influences on Survival and Development of Winter-Run Chinook Salmon at Each Stage

5.D.3.1.1.1 Spawning

For the first four simulation years of the 82-year CalSim simulation period, the model is seeded with 5,000 spawners, of which 3,087.5 are female based on the wild male to female ratio of spawners. In each subsequent simulation year, the number of female spawners is determined by the model's probabilistic simulation of survival to this life stage. To ensure that developing fish experience the correct environmental conditions during each year, spawn timing mimics the observed arrival of salmon on the spawning grounds as determined by 8 years of carcass surveys (2002–2009) conducted by the U.S. Fish and Wildlife Service (USFWS). Eggs deposited on a particular date are treated as cohorts that experience temperature and flow on a daily time step during the early development stage. The daily number of female spawners is calculated by multiplying the daily proportion of the total carcasses observed during the USFWS surveys by the total Jolly-Seber estimate of female spawners (Poytress and Carillo 2010).

(Equation 1) $S_d = C_d S_{JS}$

where, S_d is the daily number of female spawners, C_d is the daily proportion of total carcasses and S_{JS} is the total Jolly-Seber estimate of female spawners.

To account for the time difference between egg deposition and carcass observations, the date of egg deposition is assumed 14 days prior to carcass observations (Niemela pers. comm.).

To obtain estimates of juvenile production, a Ricker stock-recruitment curve (Ricker 1975) was fit between the number of emergent fry produced each year (estimated by rotary screw–trap sampling at Red Bluff Diversion Dam) and the number of female spawners (from USFWS carcass surveys) for years 1996–1999 and 2002–2007:

(Equation 2) $R = \alpha S e^{-\beta S} + \varepsilon$

where α is a parameter that describes recruitment rate, and β is a parameter that measures the level of density dependence.

The density-dependent parameter (β) did not differ significantly from 0 (95% CI = $-6.3\text{x}10^{-6}$ – $5.5\text{x}10^{-6}$), indicating that the relationships between emergent fry and female spawners was linear (density-independent). Therefore, β was removed from the equation and a linear version of the stock-recruitment relationship was estimated. The number of female spawners explained 86% of the variation in fry production ($F_{1,9} = 268$, $p<0.001$) in the data, so the value of α was taken from the regression:

(Equation 3) $R = 1043*S$

In the IOS Model, this linear relationship is used to predict values for mean fry production along with the confidence intervals for the predicted values. These values are then used to define a normal probability distribution, which is randomly sampled to determine the annual fry production. Although the Ricker model accounts for mortality during egg incubation, the data used to fit the Ricker model were from a limited time period (1996–1999, 2002–2007) when water temperatures during egg incubation were too cool (<14°C) to cause temperature-related egg mortality (U.S. Fish and Wildlife Service 1999). Thus, additional mortality was imposed at higher temperatures not experienced during the years used to construct the Ricker model.

5.D.3.1.1.2 Early Development

Data from three laboratory studies were used to estimate the relationship between temperature, egg mortality, and development time (Murray and McPhail 1988; Beacham and Murray 1989; U.S. Fish and Wildlife Service 1999). Using data from these experiments, a relationship was constructed between maturation time and water temperature. First *maturation time* (days) was converted to a *daily maturation rate* (1/day):

(Equation 4) $\text{daily maturation rate} = \text{maturation time}^{-1}$

A significant linear relationship between maturation rate and water temperature was detected using linear regression. Daily water temperature explained 99% of the variation in *daily maturation rate* (F =2188; df =1,15; p<0.001):

(Equation 5) $\text{daily maturation rate} = 0.00058*\text{Temp}-0.018$

In the IOS Model, the daily mean maturation rate of the incubating eggs is predicted from daily water temperatures using a linear function; the predicted mean maturation rate, along with the confidence intervals of the predicted values, is used to define a normal probability distribution, which then is randomly sampled to determine the daily maturation rate. A cohort of eggs accumulates a percentage of total maturation each day from the above equation until 100% maturation is reached.

Data from experimental work (U.S. Fish and Wildlife Service 1999) was used to parameterize the relationship between temperature and mortality of developing winter-run Chinook salmon eggs. Predicted proportional mortality over the entire incubation period was converted to a daily mortality rate to apply these temperature effects in the IOS Model. This conversion was used to calculate daily mortality using the methods described by Bartholow and Heasley (2006):

(Equation 6) $\text{mortality} = 1\text{-}(1\text{-total mortality})^{(1/\text{development time})}$

where *total mortality* is the predicted mortality over the entire incubation period observed for a particular water temperature and *development time* was the time to develop from fertilization to emergence.

Limited sample size (n = 3) in the USFWS study (1999) did not allow a statistically valid test for effects of temperature on mortality (e.g., a general additive model) to be performed. However, the following exponential relationship was fitted between observed *daily mortality* and observed water temperatures (U.S. Fish and Wildlife Service 1999) to provide the required values for the IOS Model:

(Equation 7) $\text{daily mortality} = 1.38*10^{-15}e^{(0.503*\text{Temp})}$

Equation 7 yields the following graphic (Figure 5.D-136), which indicates that proportional daily egg mortality increases rapidly with only small changes in water temperature. For example, within the predominant water temperature range found in model scenarios (55°F to 60°F), proportional daily mortality increases over ten-fold (~0.001 at 55°F to ~0.018 at 60°F).

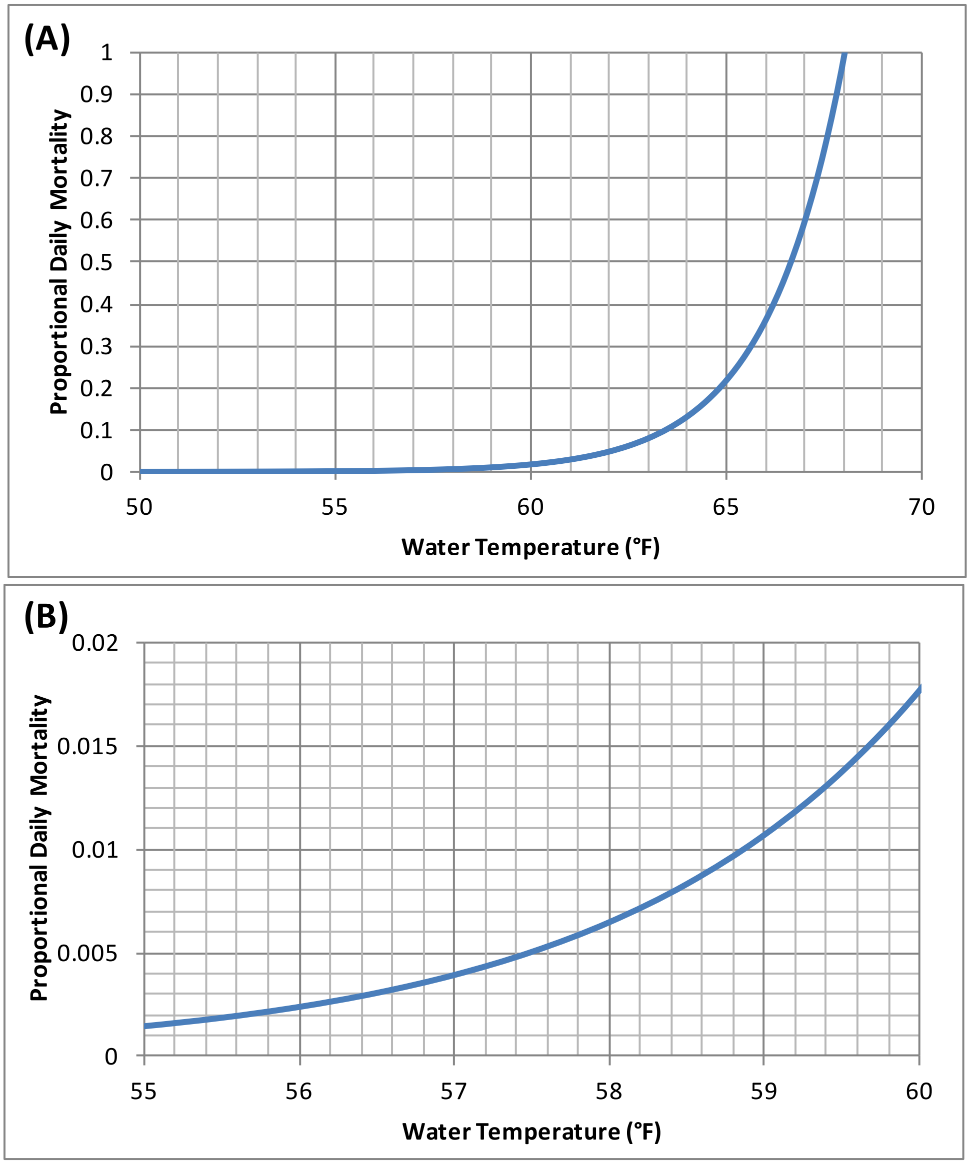


Figure 5.D-136. Relationship between Proportional Daily Mortality of Winter-Run Chinook Salmon Eggs and Water Temperature (Equation 7) for (A) the Entire Temperature Range, and (B) the Predominant Range Found in Model Scenarios

In the IOS Model, mean daily mortality rates of the incubating eggs are predicted from daily water temperatures measured at Bend Bridge on the Sacramento River using the exponential function above. The predicted mean mortality rate, along with the confidence intervals of the predicted values, is used to define a normal probability distribution, which then is randomly sampled to determine the daily egg mortality rate.

5.D.3.1.1.3 Fry Rearing

Data from USFWS (1999) was used to model fry mortality during rearing as a function of water temperature. Again, because of a limited sample size from the study by USFWS, statistical analyses to test for the effects of water temperature on rearing mortality could not be run. However, to acquire predicted values for the model, the following exponential relationship was fitted between observed daily mortality and observed water temperatures (U.S. Fish and Wildlife Service 1999):

(Equation 8) $\text{daily mortality} = 3.92*10\text{-}12e\ (0.349*\text{Temp})$

Equation 8 yields the following graphic (Figure 5.D-137), which indicates that proportional daily fry mortality increases rapidly with only small changes in water temperature. For example, within the predominant water temperature range found in model scenarios (55°F to 60°F), proportional daily mortality increases over five-fold (~0.001 at 55°F to ~0.005 at 60°F). This indicates that, although fry mortality is highly sensitive to changes in water temperature, this sensitivity is not as great as that of egg mortality within the predominant range observed in the model scenarios in focus.

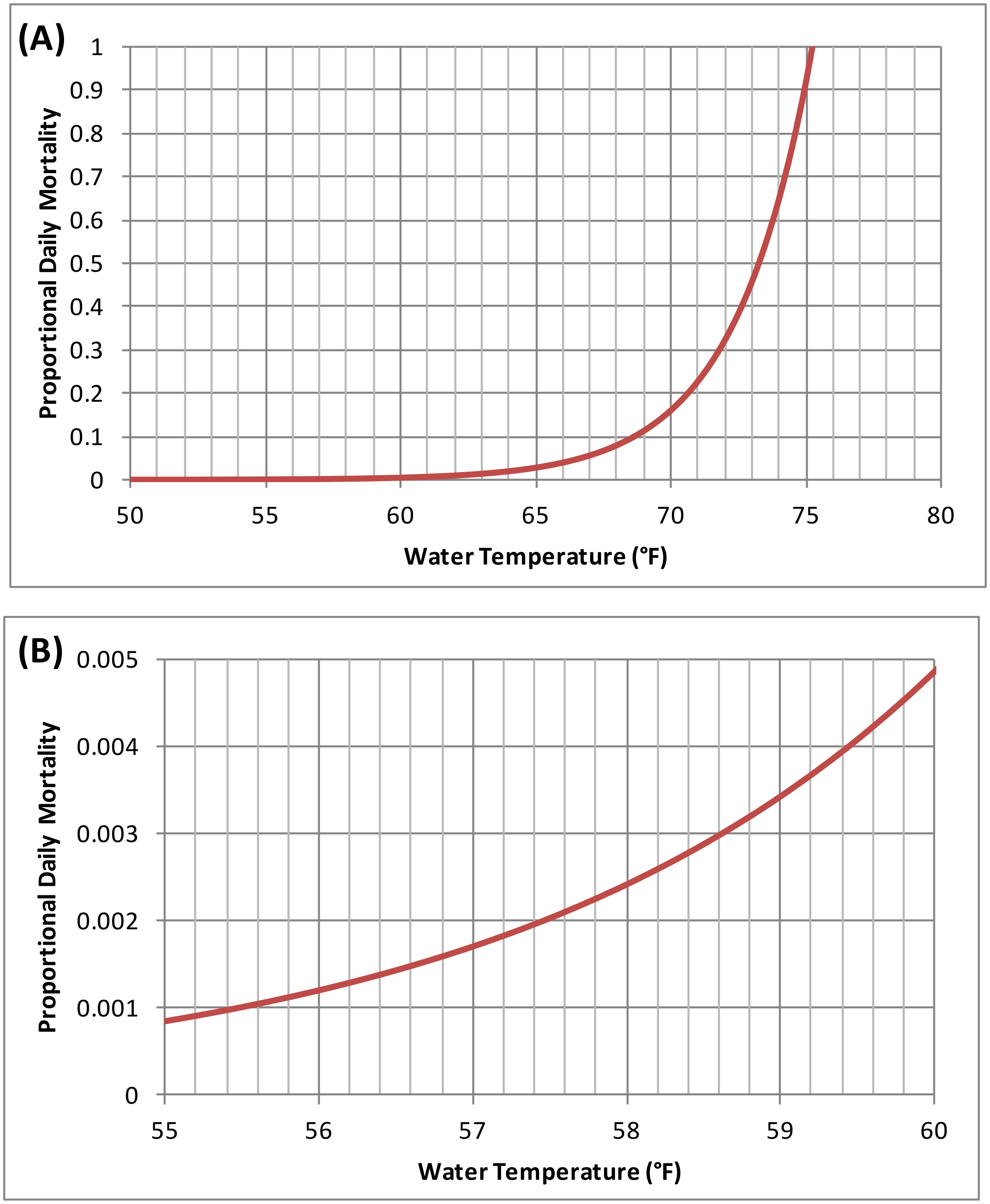


Figure 5.D-137. Relationship between Proportional Daily Mortality of Winter-Run Chinook Salmon Fry and Water Temperature (Equation 8) for (A) the Entire Temperature Range, and (B) the Predominant Range Found in Model Scenarios

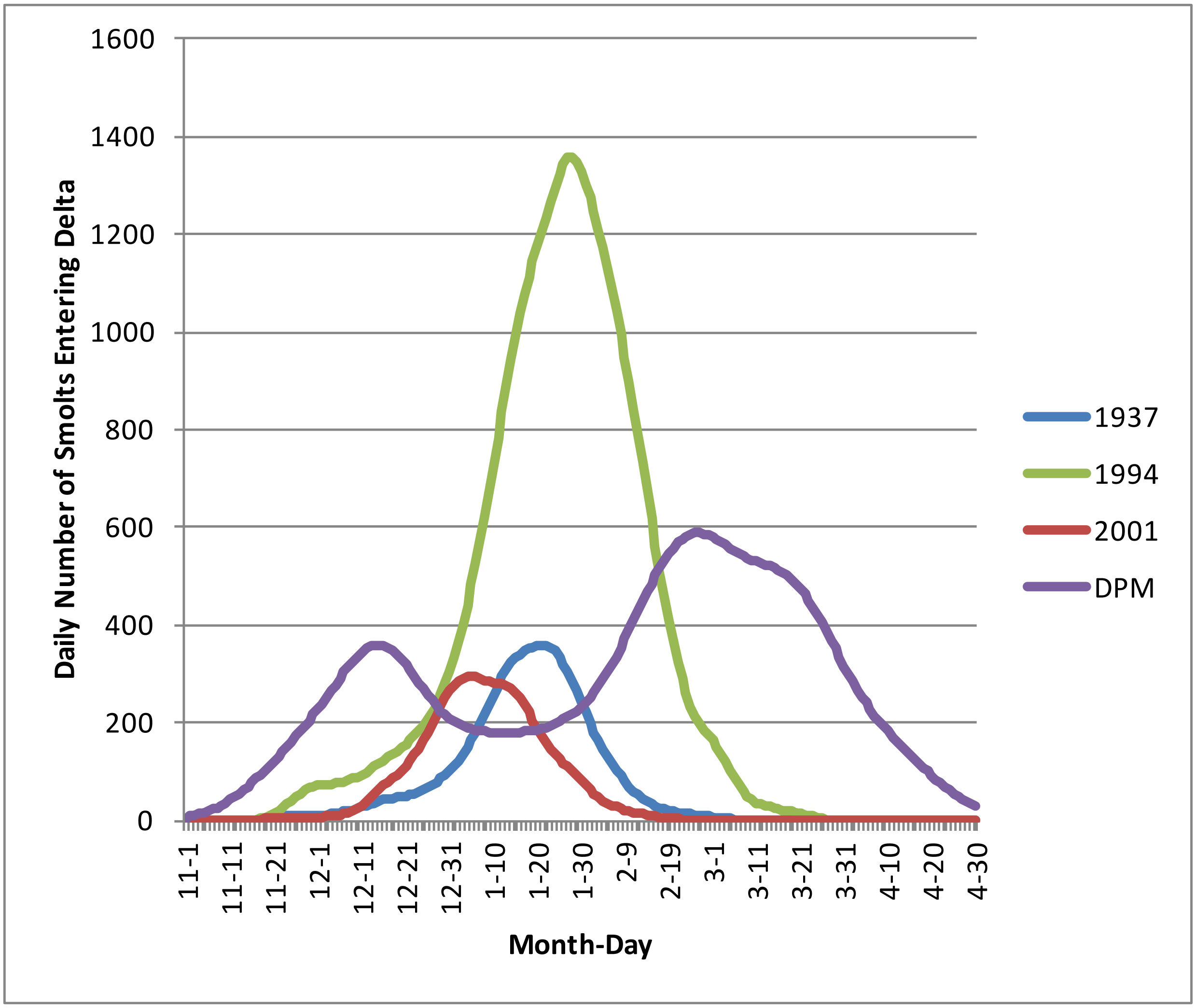
Each day the mean proportional mortality of the rearing fish is predicted from the daily water temperature using the above exponential relationship; the predicted mean mortality, along with the confidence intervals of the predicted values, is used to define a normal probability distribution, which then is randomly sampled to determine the daily mortality of the rearing fish. Temperature mortality is applied to rearing fry for 60 days, which is the approximate time required for fry to transition into smolts (U.S. Fish and Wildlife Service 1999) and enter the *River Migration* stage. All fish migrating through the Delta are assumed smolts.

5.D.3.1.1.4 River Migration

Survival of smolts from the spawning and rearing grounds to the Delta (city of Freeport on the Sacramento River) is a normally distributed random variable with a mean of 23.5% and a standard error of 1.7%. Mortality in this stage is applied only once in the model and occurs on the same day that a cohort of smolts enters the model stage because there were no data to support a relationship with flow or water temperature. Smolts are delayed from entering the next model stage to account for travel time. Mean travel time (20 days) is used along with the standard error (3.6 days) to define a normal probability distribution, which is randomly sampled to provide estimates of the total travel time of migrating smolts. Survival and travel time means and standard deviations were acquired from a study of late-fall run Chinook salmon smolt migration in the Sacramento River that employed acoustic tags and several monitoring stations (including Freeport) between Coleman National Fish Hatchery (Battle Creek) and the Golden Gate Bridge (Michel 2010).

5.D.3.1.1.5 Delta Passage

Winter-run Chinook salmon passage through the Delta within IOS is modeled with the DPM, which is described fully in Section 5.D.1.2.2, *Delta Passage Model*. Note that there is one difference between the implementation of the DPM in IOS and the standalone DPM as presented in Section 5.D.1.2.2. The timing of winter-run entry into the Delta is a function of upstream fry/egg rearing and so timing changes annually, in contrast to the fixed nature of Delta entry for the standalone DPM. Also, the IOS entry distribution is a unimodal term that tends to peak between the bimodal peaks of the standalone DPM entry distribution (Figure 5.D-138). As each cohort of smolts exits the final reaches of the Delta (Sac4 and the interior Delta), the cohorts accumulate until all cohorts from that year have exited the Delta. After all cohorts have arrived, they all enter the *Ocean Survival* model as a single cohort and the model begins applying mortality on an annual time step.



DPM: purple line, fixed bimodal distribution.
IOS in 1937: blue line, an average peak of January 21.
IOS in 1994: green line, a late peak of January 28.
IOS in 2001: red line, an early peak of January 4.
IOS data are from scenario ALT9_LLT of the BDCP EIR/EIS.

Figure 5.D-138. Winter-Run Chinook Salmon Smolt Delta Entry Distributions Assumed under the Delta Passage Model Compared with Entry Distributions for IOS in 1937, 1994, and 2001

5.D.3.1.1.6 Ocean Survival

As described by Zeug et al. (2012), this model stage uses a set of equations for smolt-to-age-2 mortality, winter mortality, ocean harvest, and spawning returns to predict yearly survival and escapement numbers (i.e., individuals exiting the ocean to spawn). Certain values during the ocean survival life stage were fixed constant among model scenarios. Ocean survival model-stage elements are listed in Table 5.D-187 and discussed below.

Table 5.D-187. Functions and Environmental Variables Used in the Ocean Survival Stage of the IOS Model

Model Element	Environmental Variable	Value
Smolt-age 2 mortality	None	Uniform random variable between 94% and 98%
Age 2 ocean survival	Wells' Index of Ocean productivity	Equation 13
Age 3 ocean survival	None	Equation 14
Age 4 ocean survival	None	Equation 15
Age 3 harvest	None	Fixed at 17.5%
Age 4 harvest	None	Fixed at 45%

Relying on ocean harvest, mortality, and returning spawner data from Grover et al. (2004), a uniformly distributed random variable between 94% and 98% mortality was applied for winter-run Chinook salmon from ocean entry to age 2 and functional relationships were developed to predict ocean survival and returning spawners for age 2 (8%), age 3 (88%), and age 4 (4%), assuming that 100% of individuals that survive to age 4 return for spawning. In the IOS Model, ocean survival to age 2 is given by:

(Equation 13) $A_2 = A_i(1\text{-}M_2)(1\text{-}M_w)(1\text{-}H_2)(1\text{-}S_{r2})*W$

Survival to age 3 is given by:

(Equation 14) $A_3 = A_2(1\text{-}M_w)(1\text{-}H3)(1\text{-}S_{r3})$

And survival to age 4 is given by:

(Equation 15) $A_4 = A_3(1\text{-}M_w)(1\text{-}H_4)$

where A_i is initial abundance at ocean entry (from the DPM stage), $A_{2,3,4}$ are abundances at ages 2–4, $H_{2,3,4}$ are harvest percentages at ages 3–4 represented by uniform distributions bounded by historical harvest levels, M_2 is smolt-to-age-2 mortality, M_w is winter mortality for ages 2–4, and $S_{r2,r3}$ are returning spawner percentages at age 2 and age 3.

Harvest mortality is represented by a uniform distribution that is bounded by historical levels of harvest. Age 2 survival is multiplied by a scalar *W* that corresponds to the value of Wells Index of ocean productivity. This metric was shown to significantly influence over-winter survival of age 2 fish (Wells et al. 2007). The value of Wells Index is a normally distributed random variable that is resampled each year of the simulation. In the analysis, the following values from Grover et al. (2004) were used: H_2 = 0%, H_3 = 0-39%, H_4 = 0-74%, M_2 = 94-98%, M_w = 20%, S_{r2} = 8%, and S_{r3} = 96%.

Adult fish designated for return to the spawning grounds are assumed 65% female and are assigned a pre-spawn mortality of 5% to determine the final number of female returning spawners (Snider et al. 2001).

5.D.3.1.2 Time Step

The IOS Model operates on a daily time step, advancing the age of each cohort/life stage and thus tracking their numerical fate throughout the different stages of the life cycle. Some variables (e.g., annual mortality estimates) are randomly sampled from a distribution of values and are applied once per year. In addition, for the ocean phase of the life cycle, the model operates on an annual time step by applying annual survival estimates to each ocean cohort.

5.D.3.1.3 Model Inputs

Delta flows and export flow into SWP and CVP pumping plants were modeled using the DSM2-HYDRO data described for the Delta Passage Model in Section 5.D.1.2.2, *Delta Passage Model*. Flows into the Yolo Bypass over Fremont Weir were based on disaggregated monthly CALSIM II data based on historical patterns of variability. Temperature data for the Sacramento River were obtained from the SRWQM developed by the Bureau of Reclamation (Reclamation) and were used to provide a weighted mean temperature of Keswick (river km 302) and Balls Ferry (river km 276) temperature based on spawning distribution (Figure 5.D-139).

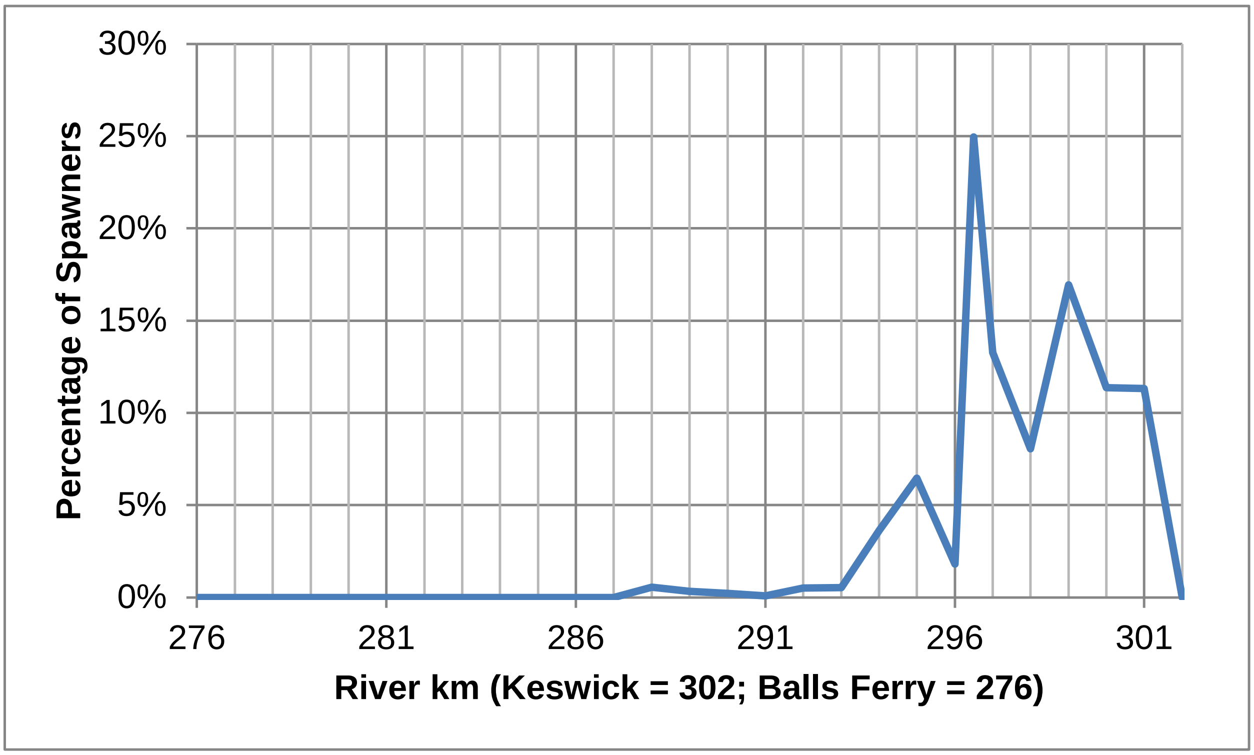


Figure 5.D-139. Mean Spawning Distribution of Winter-Run Chinook Salmon From 2010-2012 Surveys, Used to Weight SRWQM Keswick and Balls Ferry Water Temperatures Outputs for Input into IOS.

5.D.3.1.4 Model Outputs

Four model outputs were used to determine differences among model scenarios.

1. Egg survival: The Sacramento River between Keswick Dam and the Red Bluff Diversion Dam provides egg incubation habitat for winter-run Chinook salmon. Water temperature has a large effect on the survival of Chinook salmon during the egg incubation period by controlling mortality as well as development rate. Temperatures in this reach are partially

controlled by releases of cold water from Shasta Reservoir and ambient weather conditions.

2. Fry survival: The Sacramento River between Keswick Dam and Red Bluff Diversion Dam provides rearing habitat for juvenile winter-run Chinook salmon. Water temperature can have a large effect on the survival of Chinook salmon during the fry rearing stage by controlling mortality and development rate. Temperatures in this reach are partially controlled by releases of cold water from Shasta Reservoir and ambient weather conditions.

3. Through-Delta survival: The Delta between the Fremont Weir on the Sacramento River and Chipps Island is a migration route for juvenile winter-run Chinook salmon. Flow magnitude in different reaches of the Delta influences survival and travel time through the Delta and entrainment into alternative migration routes. Fish entering the interior Delta via the Geo/DCC reach are potentially exposed to mortality from water exports in the interior Delta.

4. Escapement: Each year of the IOS Model simulation, escapement is calculated as the combined number of 2-, 3-, and 4-year-old fish that leave the ocean and migrate back into the Sacramento River to spawn between Keswick Dam and the Red Bluff Diversion Dam. These numbers are influenced by the combination of all previous life stages and the functional relationships between environmental variables and survival rates. Only the 1926–2002 water years were considered because the first four years of the CALSIM modeling (1922–1925) were used to seed the model and had fixed numbers of spawners assumed, as described above.

5.D.3.1.5 Randomization to Illustrate Uncertainty

As described previously for the DPM (Section 5.D.1.2.2, *Delta Passage Model*), various IOS model functions incorporate uncertainty in relationships between fish response and physical parameters, e.g., survival in response to river flow for some reaches within the DPM; re-sampling from these relationships on each modeled day allows this uncertainty to be captured in the model effects. In order to illustrate the uncertainty in modeled annual estimates of IOS outputs (egg survival, fry survival, through-Delta survival, and escapement), 75 iterations of IOS were run, each with different randomizations of the model functions. As noted for the DPM, 75 iterations were sufficient to allow the error in the estimates to stabilize so that no additional iterations were required. The 75 iterations gave 75 estimates of the IOS outputs for each year in the simulation period, from which 95% confidence intervals (the 2.5th and 97.5th percentiles of the 75 iterations) were calculated for each annual estimate. This allowed comparison of the number of years that the confidence intervals overlapped for the NAA and PA scenarios.

5.D.3.1.6 Model Limitations and Assumptions

The following model limitations and assumptions should be recognized when interpreting results.

1. The model focuses only on flow-related operational effects (river flow, exports, and water temperature) and does not consider other potential PA effects (e.g., near-field

predation at the NDD) or the effects of conservation measures (e.g., nonphysical barriers).

2. Other important ecological relationships likely exist but quantitative relationships are not available for integration into IOS (e.g., the interaction among flow, turbidity, and predation). To the extent that these unrepresented relationships are important and alter IOS outcomes, each alternative considered is assumed to be affected in the same way.

3. For relationships that are represented in IOS, the operational alternatives considered are not assumed to alter those underlying functional relationships.

4. There is a specific range of environmental conditions (temperature, flow, exports, and ocean productivity) under which functional relationships were derived. These functional relationships are assumed to hold true for the environmental conditions in the scenarios considered.

5. Differential growth because of different environmental conditions (e.g., river temperature) and subsequent potential differences in survival and other factors are not directly included in the model. Differences in survival related to growth are indirectly included to an unknown extent in flow-survival, temperature-survival, and ocean productivity-survival relationships.

6. Survival and travel time during Stages 4 (River Migration) and 5 (Delta Passage) are based on studies of yearling late fall–run Chinook salmon (c. 150–170-mm fork length) (Stage 4: Michel 2010; Stage 5: Perry et al. 2010), which are appreciably larger than downstream-migrating winter-run Chinook salmon (c. 70–100-mm fork length during the peak downstream migration) (Williams 2006:101); however, differences between model scenarios do not occur during stage 4 because survival and travel time during River Migration are independent of flow.

7. Juvenile winter-run Chinook salmon migrating through the Delta all are assumed smolts that are not rearing in the Delta.

8. Between Stage 5 (Delta Passage) and Stage 1 (Spawning), the only differences in survival between model scenarios comes from random differences based on probability distributions, although some functions have been fixed at constant values to minimize these random differences. There are no modeled flow effects on adult upstream migration (e.g., attraction flows) because there are no data available for such effects to be modeled.

5.D.3.1.7 Model Sensitivity and Influence of Environmental Variables

Zeug et al. (2012) examined the sensitivity of the IOS model estimates of escapement to its input parameter values, input parameters being the functional relationships between environmental inputs and biological outputs. Although revisions have been undertaken to IOS since that time, the main points from their analysis are still likely to be valid.

Zeug et al. (2012) found that escapement of different age classes was sensitive to different input parameters (Table 5.D-188). Escapement of age-2 fish (which compose 8% of the total returning fish in a given cohort) was most sensitive to smolt-to-age-2-survival and water year when considering either independent or interactive effects of these parameters, and there was sensitivity to river migration survival when considering interactive effects of this parameter with other parameters. Escapement of age-3 fish (which compose 88% of the total returning fish in a given cohort) was sensitive to several input parameters when considering the independent effects of these parameters but was sensitive to through-Delta survival alone when considering first-order interactions between parameters. Escapement of age-4 fish (which compose 4% of the total returning fish in a given cohort) was sensitive to nearly all input parameters when considering the independent effects of these parameters, but was not sensitive to any of the parameters when considering first-order interactions between parameters (Zeug et al. 2012).

Zeug et al. (2012) also explored how uncertainty in model parameter estimates influences model output by increasing by 10–50% the variation around the mean of selected parameters that could be addressed by management actions (egg survival, fry-to-smolt survival, river migration survival, Delta survival, age-3 harvest, and age-4 harvest). They found that model output was robust to parameter uncertainty and that age-3 and age-4 harvest had the greatest coefficients of variation because of the uniform distribution of these parameters. Zeug et al. (2012) noted that there are limitations in the data used to inform certain parameters in the model that may be ecologically relevant but that are not sensitive in the current IOS configuration: river survival is a good example because it is based on a three-year field study of relatively low-flow conditions that does not cover the range of potential conditions that may be experienced by downstream-migrating juvenile Chinook salmon.

To understand the influence of environmental parameter inputs on escapement estimates from IOS, Zeug et al. (2012) performed three sets of simulations of a baseline condition and either a 10% increase or a 10% decrease in river flow, exports, water temperature (on the Sacramento River at Bend Bridge, as in the original formulation of the model), and ocean productivity (i.e., Wells Index; see above). They found that only 10% changes in temperature produced a statistically significant change in escapement; a 10% increase in temperature produced a far greater reduction in escapement (>95%) than a 10% decrease in temperature gave an increase in escapement (>10%). Zeug et al. (2012) suggested that the lack of significant changes in escapement with 10% changes of flow, exports, and ocean productivity may reflect the fact that these variables' relationships within the model were based on observational studies with large error estimates associated with the responses. In contrast, temperature functions were parameterized with data from controlled experiments with small error estimates. Also, Zeug et al. (2012) noted that water temperatures within the winter-run Chinook salmon spawning and rearing area are close to the upper tolerance limit for the species; therefore, even small changes have the potential to significantly affect the population.

Table 5.D-188. Sobol' Sensitivity Indices (Standard Deviation in Parentheses) for Each Age Class of Returning Spawners Based on 1,000 Monte Carlo Iterations, Conducted to Test Sensitivity of IOS Input Parameters by Zeug et al. (2012)

Input Parameter	Age 2		Age 3		Age 4	
	Main Index (Effect Independent of Other Input Parameters)	Total Index (Effect Accounting for First-Order Interactions with Other Input Parameters)	Main Index (Effect Independent of Other Input Parameters)	Total Index (Effect Accounting for First-Order Interactions with Other Input Parameters)	Main Index (Effect Independent of Other Input Parameters)	Total Index (Effect Accounting for First-Order Interactions with Other Input Parameters)
Water year	0.300[a] (0.083)	0.306[a] (0.079)	0.181[a] (0.091)	0.150 (0.091)	0.073 (0.067)	0.012 (0.065)
Egg survival	0.030 (0.016)	-0.006 (0.016)	0.222[a] (0.081)	-0.021 (0.081)	0.102[a] (0.044)	-0.072 (0.044)
Fry-to-smolt survival	0.039 (0.020)	-0.009 (0.020)	0.166 (0.090)	0.091 (0.092)	0.079a (0.017)	-0.071 (0.017)
River migration survival	0.007 (0.034)	0.135a (0.034)	0.164 (0.084)	0.062 (0.085)	0.079 (0.018)	-0.07 (0.018)
Delta survival	0.010[a] (0.002)	-0.009 (0.002)	0.404[a] (0.180)	0.643[a] (0.177)	0.313[a] (0.134)	-0.009 (0.132)
Smolt to age 2 survival	0.734[a] (0.118)	0.454[a] (0.113)	0.015 (0.016)	-0.006 (0.016)	0.057a (0.017)	-0.052 (0.017)
Ocean productivity	0.003 (0.009)	0.009 (0.009)	0.034[a] (0.015)	-0.034 (0.015)	0.061[a] (0.030)	-0.048 (0.029)
Age 3 harvest	N/A	N/A	0.029[a] (0.001)	-0.028 (0.001)	1.48[a] (0.306)	0.188 (0.293)
Age 4 harvest	N/A	N/A	N/A	N/A	0.055a (0.003)	-0.054 (0.003)

Source: Zeug et al. 2012.
[a] Index value was statistically significant at α=0.05.

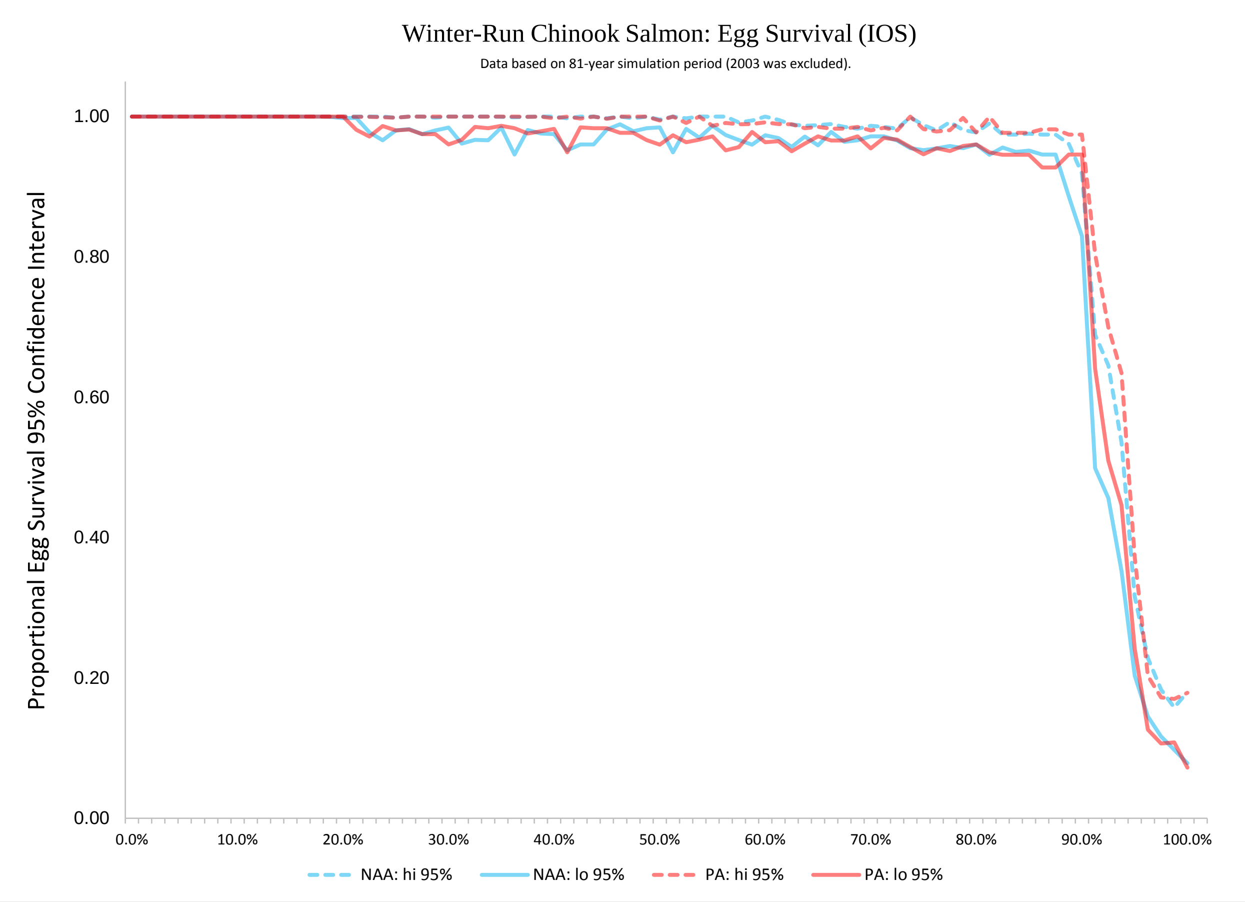
5.D.3.1.8 Results

As with other quantitative analyses conducted for the effects analysis, it is important to bear in mind that IOS provides inference for future conditions on a relative basis. That is, the predictions are not expected to be accurate in an absolute sense, but do provide important information when evaluating scenarios relative to each other.

5.D.3.1.8.1 Egg Survival

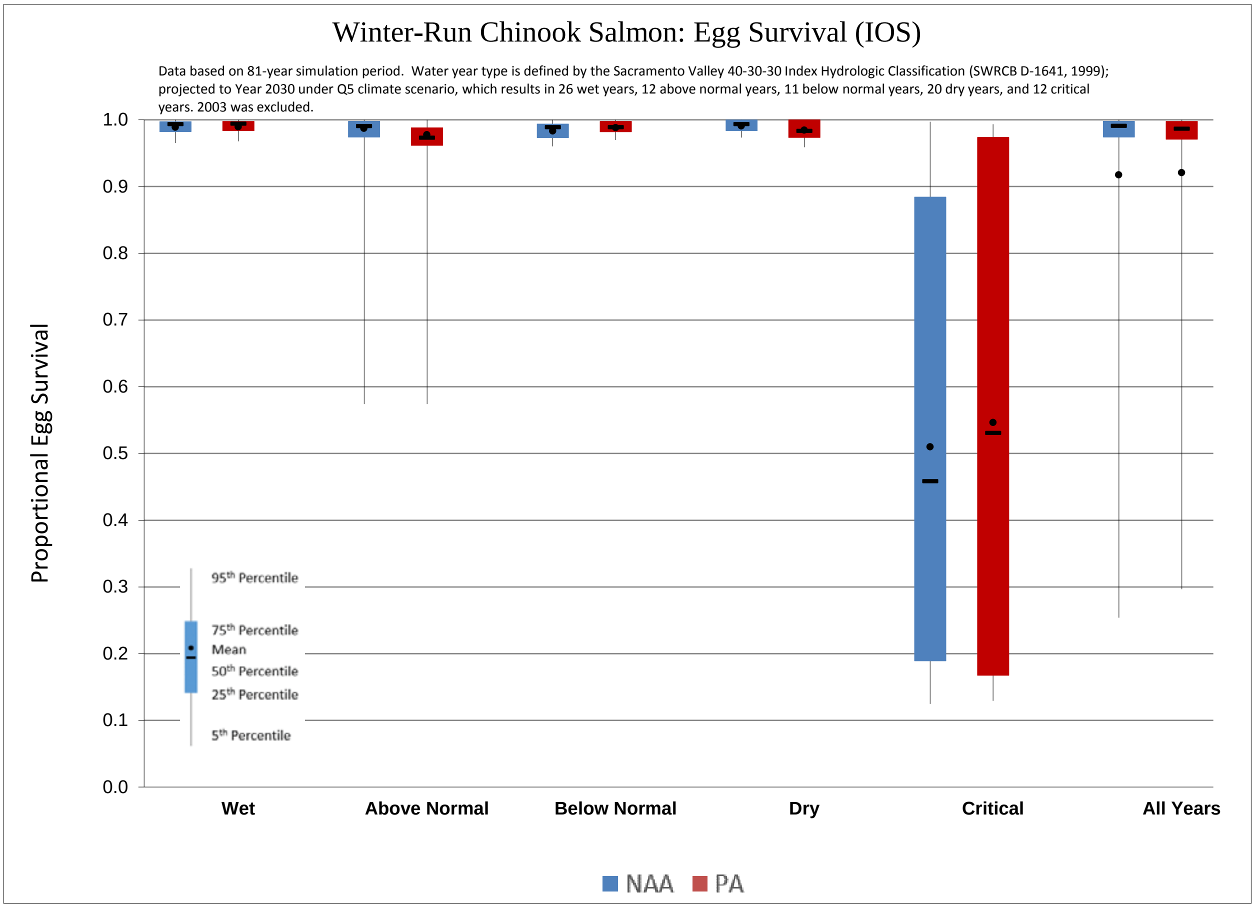
The IOS model predicted very similar egg survival for winter-Run Chinook salmon between the NAA and PA (Figure 5.D-140 and Figure 5.D-141). NAA median egg survival was 0.990 and PA median egg survival was 0.991 (Figure 5.D-140). In 12 of the 81 years simulated, the 95% confidence intervals of the annual estimates did not overlap for NAA and PA; of these, egg survival under PA was greater than NAA in 6 years and less than PA in 6 years (Figure

5.D-142). This illustrates that while there was variability between years, the overall pattern in egg survival was very similar between NAA and PA.



Note: Data are sorted by mean estimate, with only 95% confidence intervals shown.

Figure 5.D-140. Exceedance Plots of Annual egg survival for Winter-Run Chinook Salmon across all 81 water years estimated by the IOS Model for the comparison between the NAA (NAA) and the PA (PA).



Note: Plot only includes annual mean responses and does not consider model uncertainty.

Figure 5.D-141. Box Plots of Annual egg survival for Winter-Run Chinook Salmon across all 81 water years estimated by the IOS Model for the comparison between the NAA (NAA) and the PA (PA).

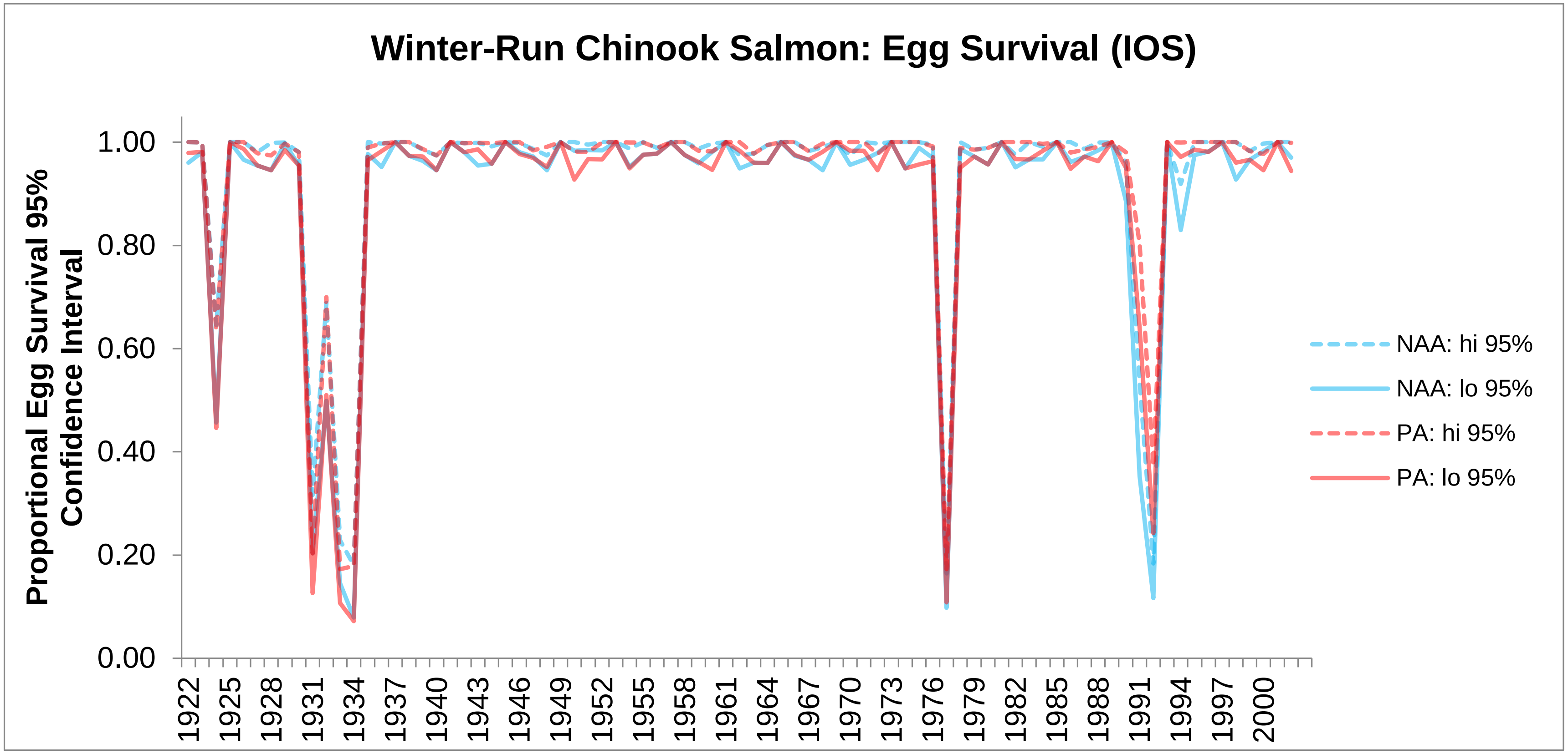
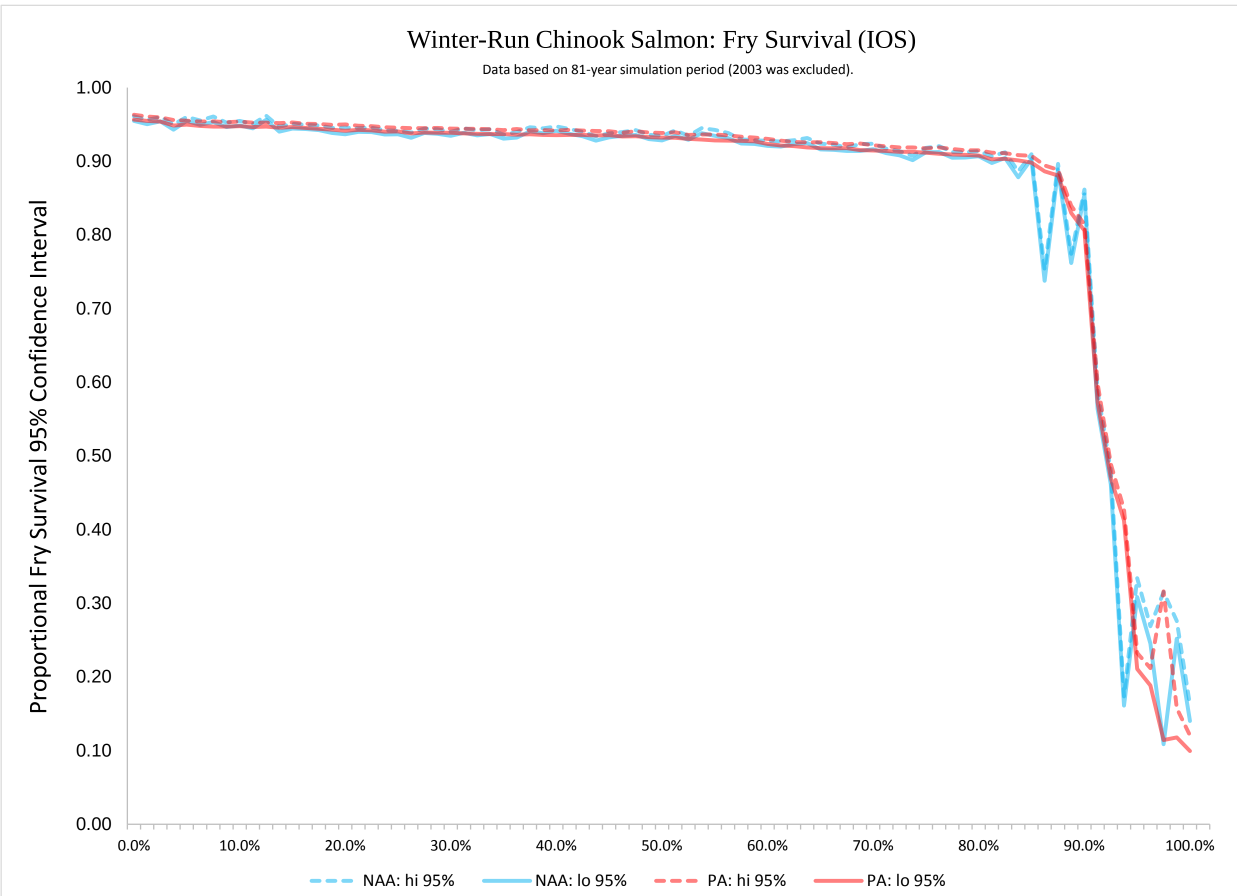


Figure 5.D-142. Time Series of 95% Confidence Interval IOS Annual Winter-Run Chinook Salmon Egg Survival Estimates.

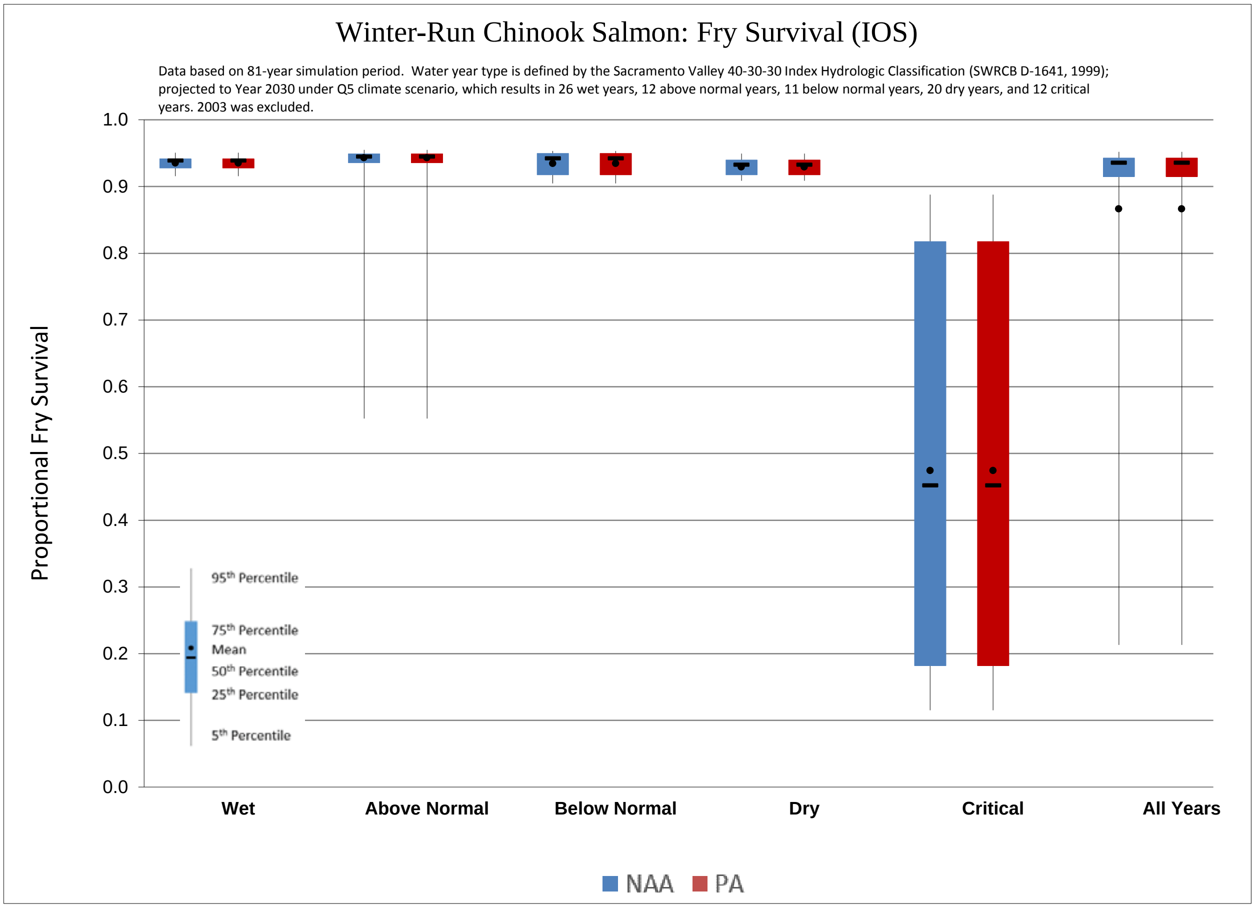
5.D.3.1.8.2 Fry Survival

The IOS model predicted very similar egg survival for winter-Run Chinook salmon between the NAA and PA (Figure 5.D-140 and Figure 5.D-141). NAA median egg survival was 0.935 and PA median egg survival was 0.936. In 15 of the 81 years simulated, the 95% confidence intervals of the annual estimates did not overlap for NAA and PA; of these, fry survival under PA was greater than NAA in 8 years and less than PA in 7 years (Figure 5.D-145). As noted for egg survival, this illustrates that while there was variability between years, the overall pattern in fry survival was very similar between NAA and PA.



Note: Data are sorted by mean estimate, with only 95% confidence intervals shown.

Figure 5.D-143. Exceedance Plots of Annual fry survival for Winter-Run Chinook Salmon across all 81 water years estimated by the IOS Model for the comparison between the NAA (NAA) and the PA (PA).



Note: Plot only includes annual mean responses and does not consider model uncertainty.

Figure 5.D-144. Box Plots of Annual fry survival for Winter-Run Chinook Salmon across all 81 water years estimated by the IOS Model for the comparison between the NAA (NAA) and the PA (PA).

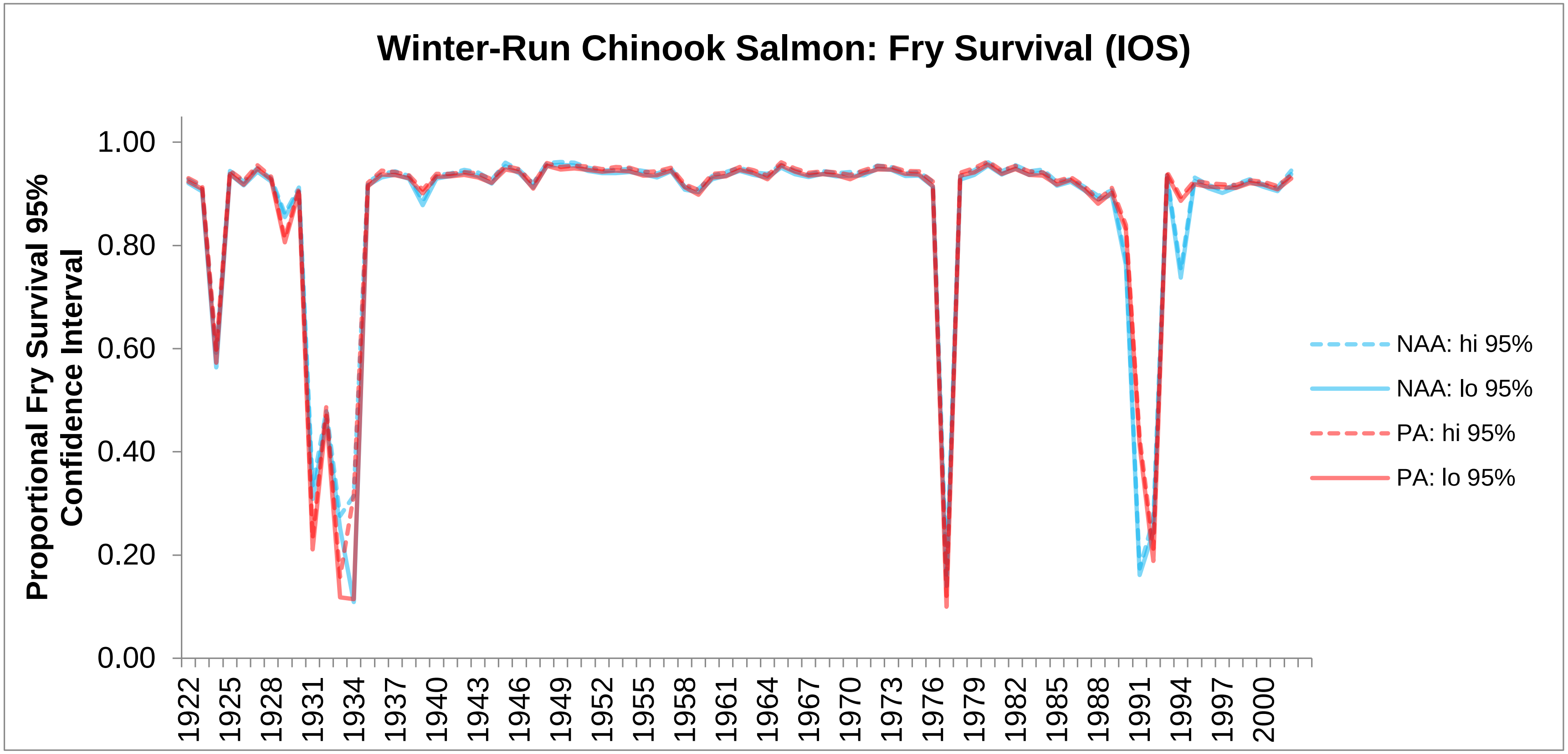
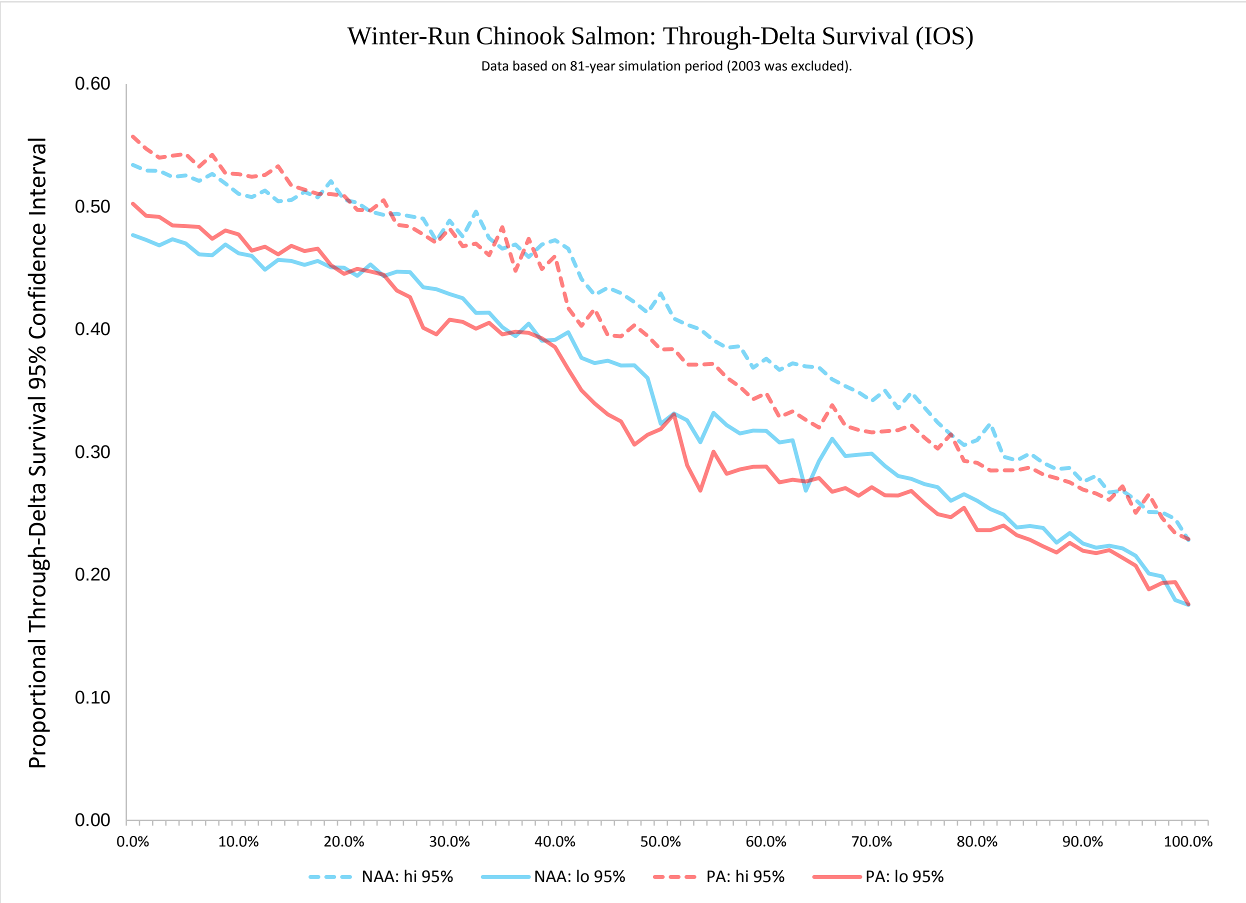


Figure 5.D-145. Time Series of 95% Confidence Interval IOS Annual Winter-Run Chinook Salmon Fry Survival Estimates.

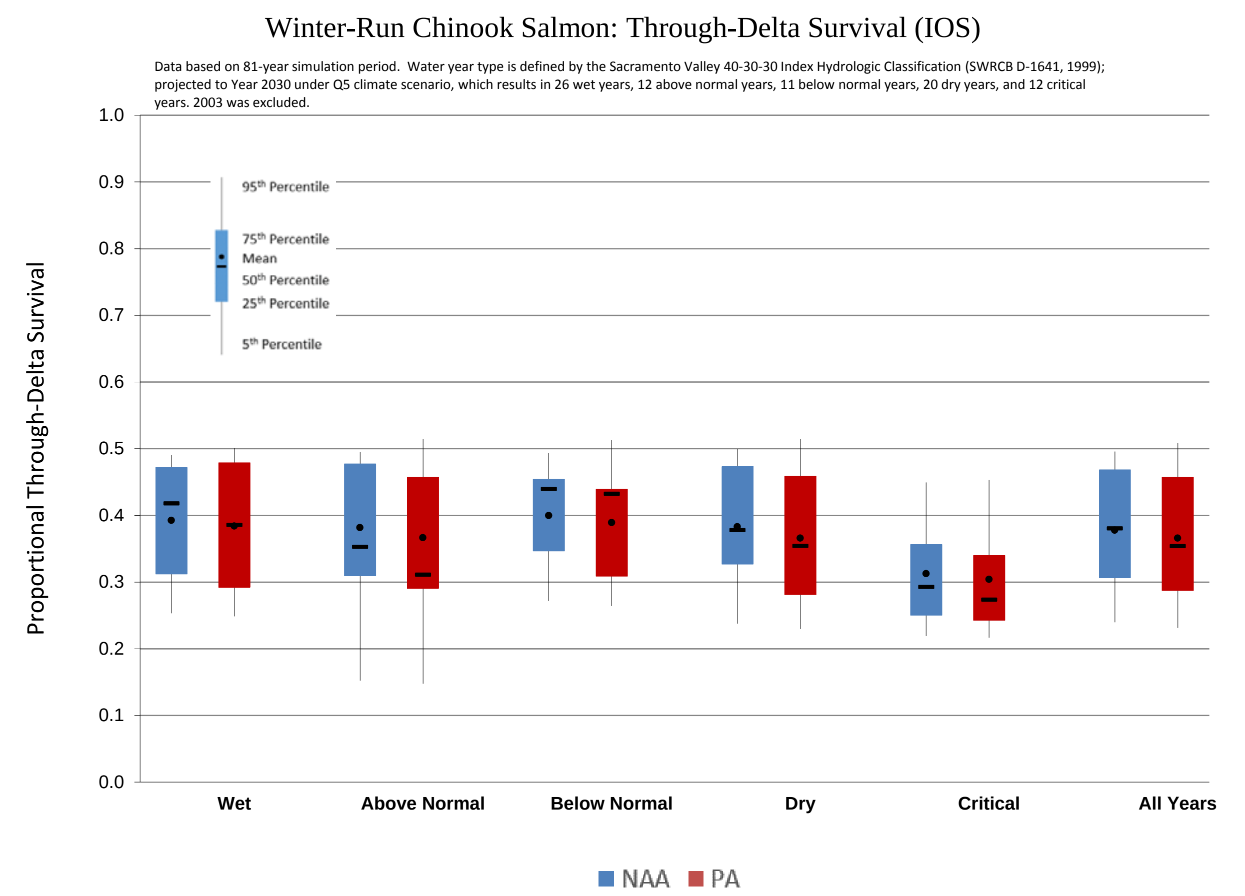
5.D.3.1.8.3 Through-Delta Survival

Across all water years, the IOS model's median predicted through-Delta survival was 0.380 for the NAA and 0.354 for the PA (Figure 5.D-146 and Figure 5.D-147), a difference of 7%. Across all years, the 25th percentile value of survival for the NAA was 0.306 and 0.287 for the PA while the 75th percentile value was 0.469 for the NAA and 0.457 for the PA. The minimum value for survival for the NAA was 0.200 and 0.200 for the PA and the maximum survival for the NAA was 0.504 and 0.527 for the PA. There was only one year in which the 95% confidence intervals of the annual through-Delta survival estimates did not overlap (2001); during this year, PA (95% CI: 0.265-0.318) was less than NAA (95% CI: 0.398-0.466) (Figure 5.D-148).



Note: Data are sorted by mean estimate, with only 95% confidence intervals shown.

Figure 5.D-146. Exceedance Plots of Annual Through-Delta Survival for Winter-Run Chinook Salmon across all 81 water years estimated by the IOS Model for the comparison between the NAA (NAA) and the PA (PA).



Note: Plot only includes annual mean responses and does not consider model uncertainty.

Figure 5.D-147. Box Plots of Annual Through-Delta Survival for Winter-Run Chinook Salmon across all 81 water years estimated by the IOS Model for the comparison between the NAA (NAA) and the PA (PA).

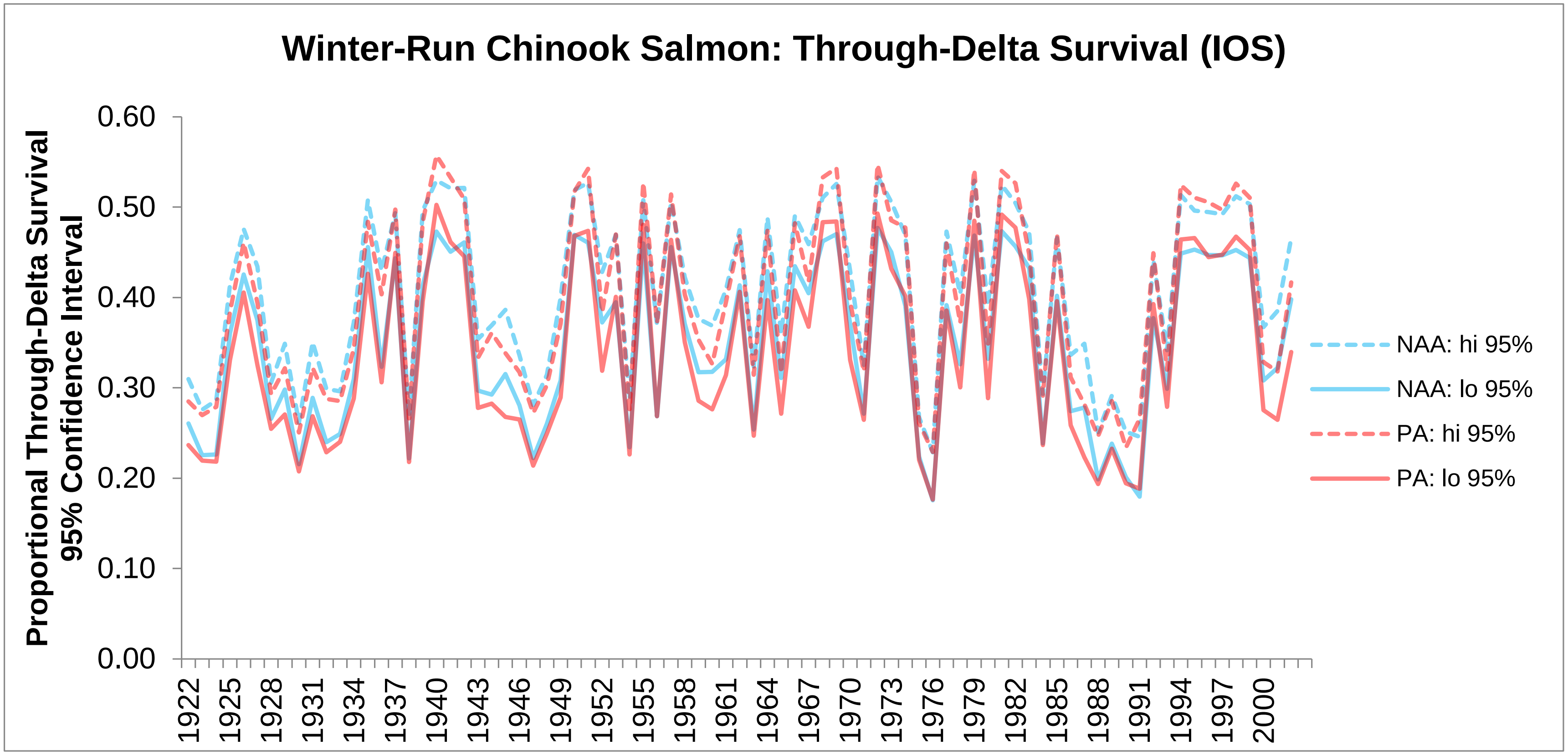
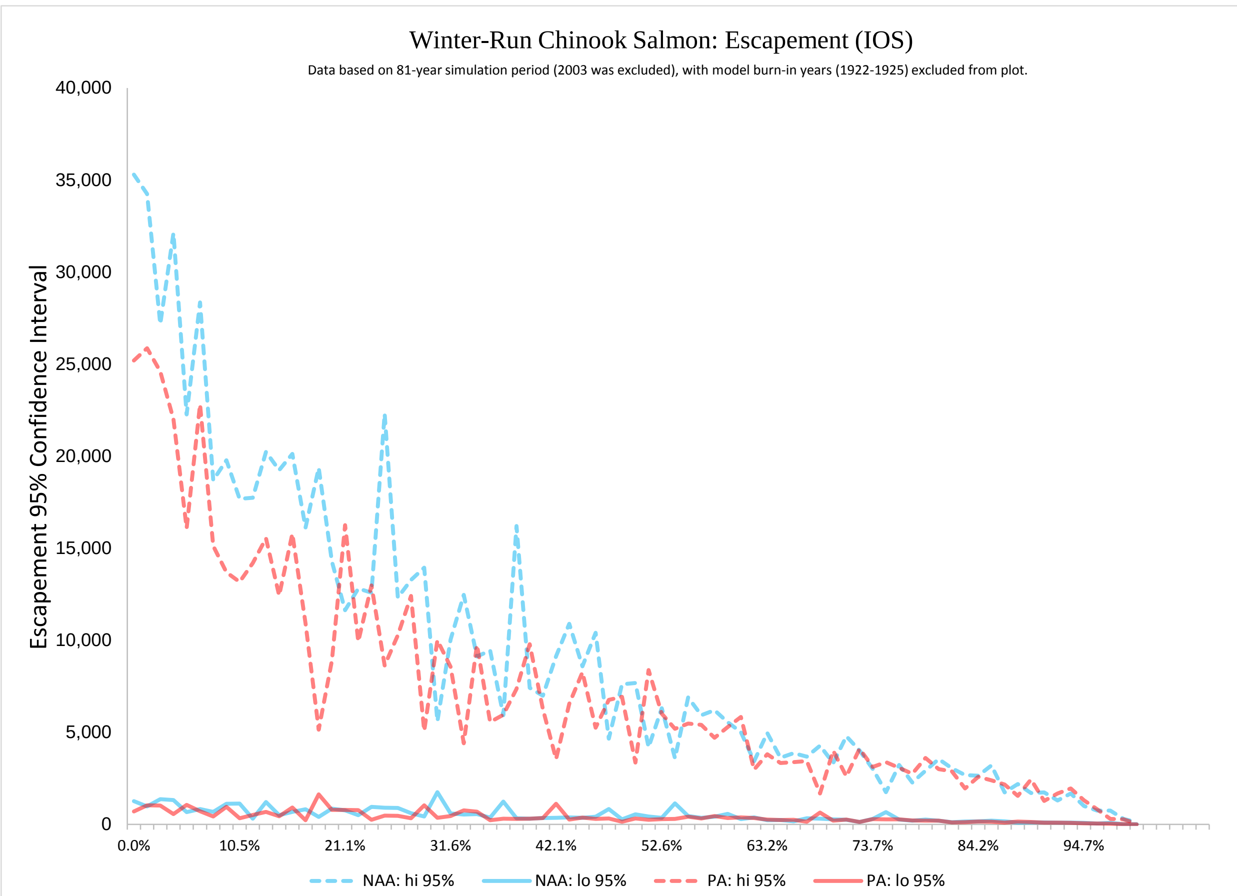


Figure 5.D-148. Time Series of 95% Confidence Interval IOS Annual Winter-Run Chinook Salmon Through-Delta Survival Estimates.

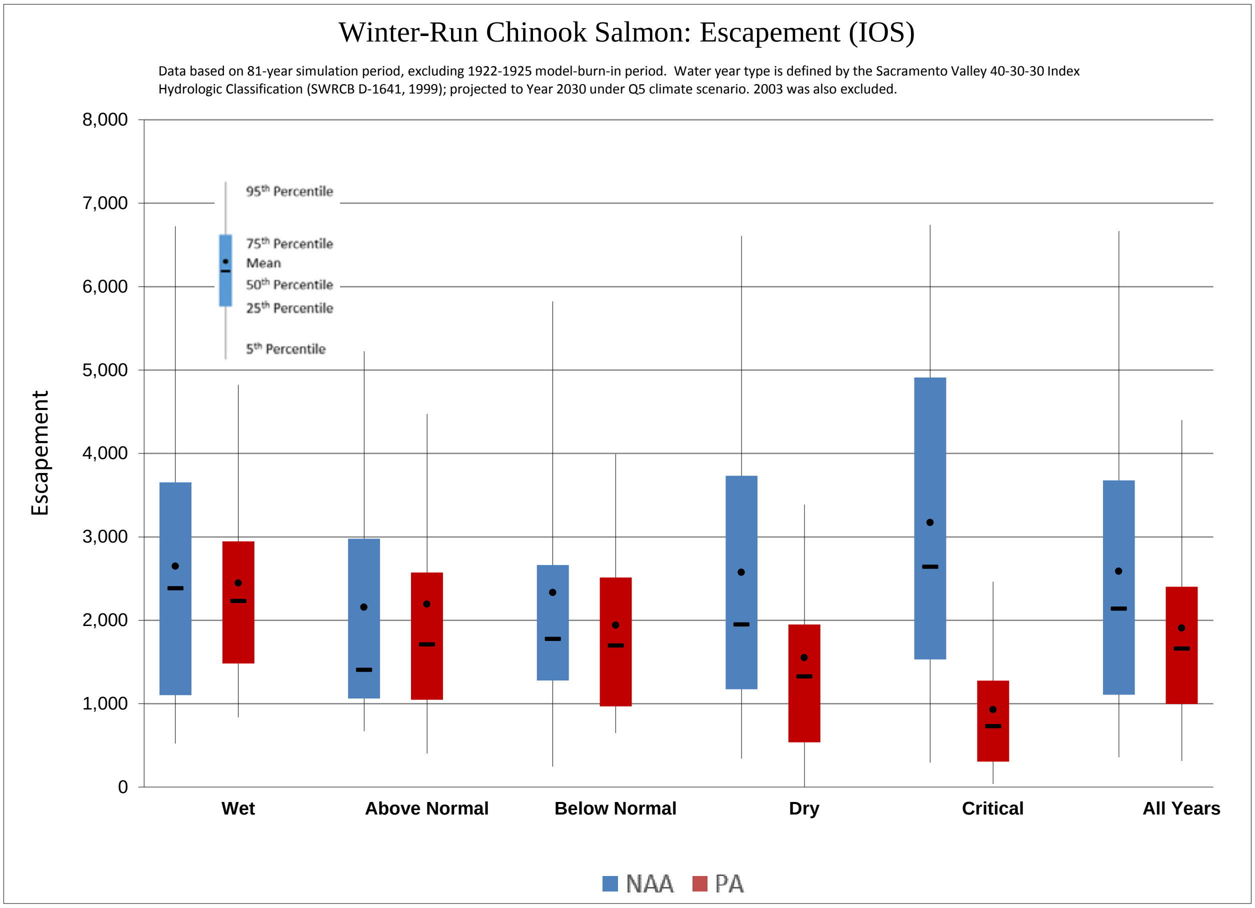
5.D.3.1.8.4 Escapement

The IOS model predicted NAA median adult escapement of 2,274 and PA median escapement of 1,699, a difference of 25% (Figure 5.D-149 and Figure 5.D-150). The 25th percentile escapement for the NAA was 1,119 and 1,007 for the PA while the 75th percentile value was 3,651 for the NAA and 2,858 for the PA. The minimum value for escapement for the NAA was 45 and 18 for the PA and the maximum escapement for the NAA was 7,868 and 5,501 for the PA. The 95% confidence intervals for escapement under the NAA and PA overlapped in all years (Figure 5.D-151). The time series of escapement under PA and NAA increasingly diverged from each other from the early years of the simulation to the 1970s-1990s, before the differences decreased again and escapement was comparable from the mid-1990s onward. The relatively large differences in escapement in the 1970s-1990s were driven by the cumulative effect of differences in Delta survival over time; however, as the mean estimates grew larger, so did the confidence intervals, which were very wide in these years, e.g., in 1985: 838-28,350 for NAA, and 717-22,814 for PA (Figure 5.D-151).



Note: Data are sorted by mean estimate, with only 95% confidence intervals shown.

Figure 5.D-149. Exceedance Plots of Annual Escapement for Winter-Run Chinook Salmon across all 81 water years estimated by the IOS Model for the comparison between the NAA (NAA) and the PA (PA).



Note: Plot only includes annual mean responses and does not consider model uncertainty.

Figure 5.D-150. Box Plots of Annual Escapement for Winter-Run Chinook Salmon by the IOS Model for the comparison between the NAA (NAA) and the PA (PA).

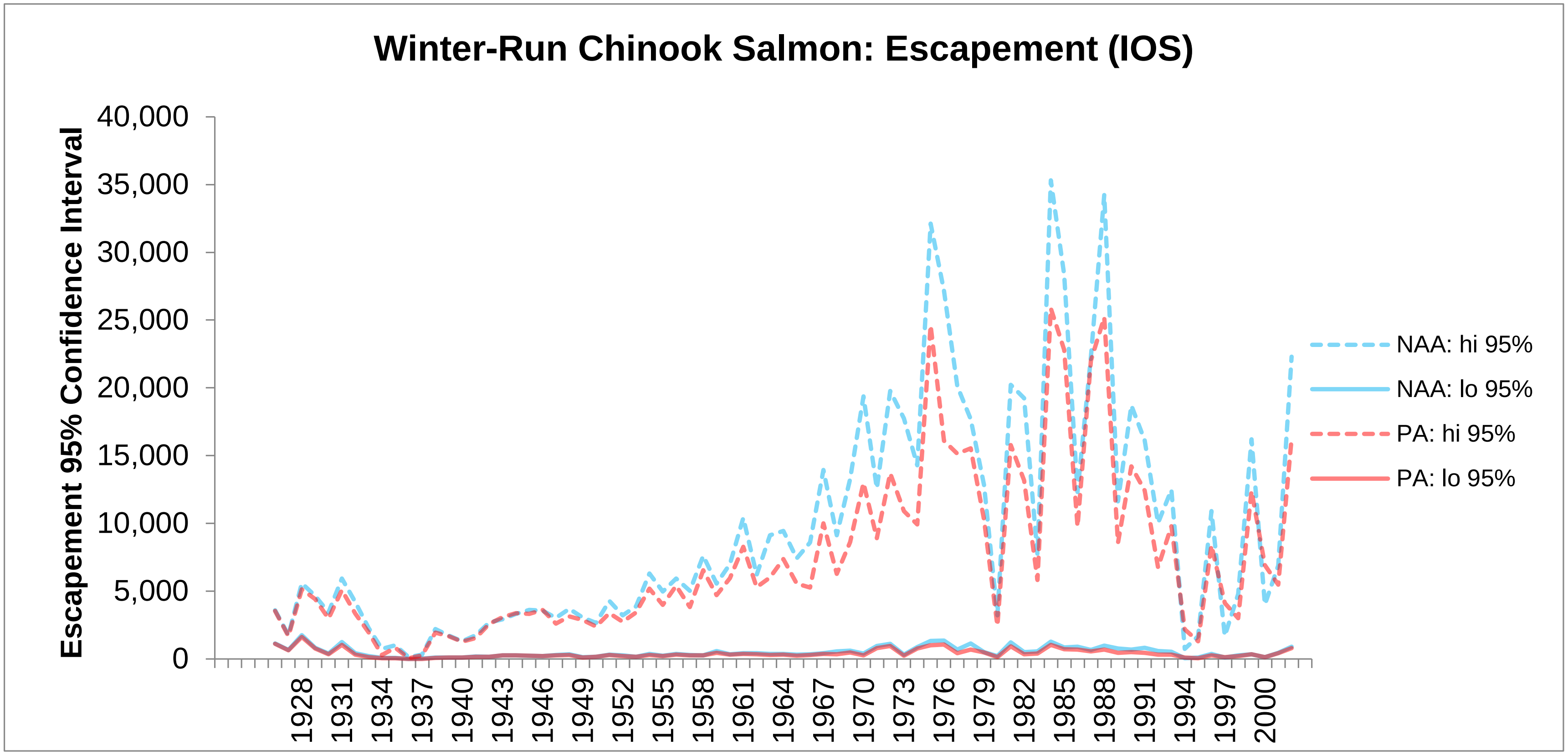


Figure 5.D-151. Time Series of 95% Confidence Interval IOS Annual Winter-Run Chinook Salmon Escapement Estimates.

5.D.3.2 OBAN (Oncorhynchus Bayesian Analysis)

5.D.3.2.1 Model Structure

The winter-run Chinook salmon OBAN model has been developed from the conceptual life cycle model of winter-run and coded into Windows-based software with graphic output capability. The Bayesian estimation of model coefficients was coded into WinBUGS. The software finds a statistical “best fit” to empirical trends by matching model predictions to empirically observed juvenile and adult abundances. The model is capable of fitting any number of abundance data sources and estimating any number of coefficient values to find the best statistical prediction.

The winter-run Chinook salmon OBAN model is composed of several life history stages (Figure 5.D-162).

- Alevin—incubation in the gravel below Keswick Dam.
- Fry—rearing above Red Bluff Diversion Dam (RBDD).
- Delta—from RBDD to Chipps Island.
- Bay—from Chipps Island to the Golden Gate.
- Gulf of Farallones
- Ocean 1—first year in the ocean, returning to spawn as 2-year-olds.
- Ocean 2—second year in the ocean, returning to spawn as 3-year-olds.
- Ocean 3—third and final year in the ocean, returning to spawn as 4-year-olds.
- Escapement—composed of all spawners on the spawning ground.

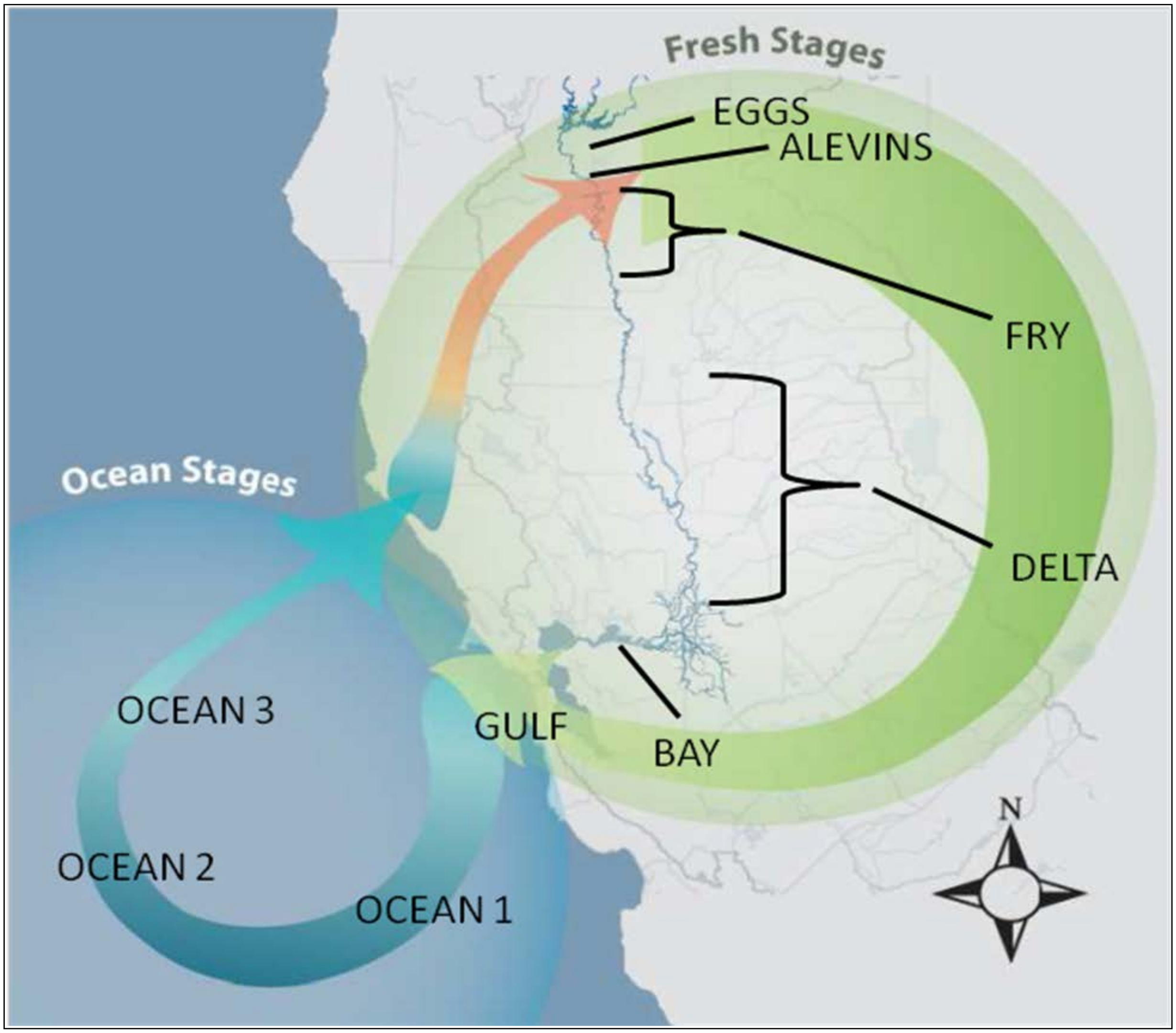


Figure 5.D-152. Winter-Run Chinook Salmon Life History Stages Used in the OBAN Model

The transition between life history stages occurs with a Beverton-Holt (1957) recruitment function:

$$N_{i,j+1} = N_{i,j} \times \frac{p_{i,j}}{1 + \frac{p_{i,j} N_{i,j}}{K_{i,j}}}$$

where $N_{i,j}$ is the abundance at stage j for stock i, $p_{i,j}$ is the productivity in the absence of density dependence for spawning stock i at stage j, $K_{i,j}$ is the capacity at stock i at stage j.

Only one spawning stock is assumed for the winter-run model. The two parameters of the Beverton-Holt transition equation are $p_{i,j}$ and $K_{i,j}$, and they can be user-defined constants, estimated parameters fixed across all years, or dynamic, i.e., $p_{i,j,t}$ and $K_{i,j,t}$ can be modeled as changing in each year t. Note that density dependence can be effectively removed from the formulation by setting $K_{i,j}$ to a very large value.

In the case of dynamic productivity ($p_{i,j,t}$) and capacity ($K_{i,j,t}$), parameter values, the values of the productivities and capacities in a given year, are modeled from a set of time-varying covariates. By using this formulation, the influence of anthropogenic and environmental factors on specific life history stages was evaluated. Each productivity parameter can be influenced by independent covariates acting simultaneously on the life history stage to drive demographic rates. The $X_{j,t}$ are environmental variables that represent water conditions such as temperature or flow, biotic factors such as predator abundance and food abundance, or anthropogenic factors such as water export levels or harvest rates.

The dynamic productivities used a logit transformation, which caused the productivities to remain between 0 and 1. This interval is the sample space for the survival of all stages from alevin to spawner.

$$\text{logit}(p_{i,j,t}) = \beta_{0,i,j} + \beta_{1,i,j}X_{1,i,t} + \beta_{2,i,j}X_{2,i,t} + \cdots + \beta_{5,i,j}X_{5,i,t} \qquad (1)$$

$$p_{i,j,t} = \frac{\exp(\beta_{0,i,j} + \beta_{1,i,j}X_{1,i,t} + \beta_{2,i,j}X_{2,i,t} + \cdots + \beta_{5,i,j}X_{5,i,t})}{1 + \exp(\beta_{0,i,j} + \beta_{1,i,j}X_{1,i,t} + \beta_{2,i,j}X_{2,i,t} + \cdots + \beta_{5,i,j}X_{5,i,t})} \qquad (2)$$

The dynamic capacities used a log transformation, which caused the capacities to remain between 0 and infinity. This interval is the sample space for the abundance for all stages from alevin to spawner.

$$\ln(K_{i,j,t}) = \gamma_{0,i,j} + \gamma_{1,i,j}X_{1,i,t} + \gamma_{2,i,j}X_{2,i,t} + \cdots + \gamma_{5,i,j}X_{5,i,t} \qquad (3)$$

The estimation of $p_{i,j,t}$ and $K_{i,j,t}$ involves estimating the β parameters. If no environmental effect is being estimated, only β_0 is estimated and the remaining βs are set to 0. If $p_{i,j}$ and $K_{i,j}$ are not estimated, but rather set as constants, then β_0 is selected such that p or K equates to the desired rate, i.e., $\beta_0 = \ln(p/(1-p))$ or $\gamma_0 = \ln(K)$.

The model has the ability to estimate as few or as many of the parameters as desired. AIC_c (Burnham and Anderson 2002) was used to evaluate the utility of adding additional parameters evaluating model complexity in a maximum likelihood framework. Estimating a fixed rate involves one additional parameter (β_0), and estimating relationships to a covariate involves adding a β parameter for each additional covariate.

5.D.3.2.2 Time Step

OBAN operates at an annual time step. Model inputs (covariates) are composed of daily, weekly, or monthly values. To fit within the annual time step for OBAN model outputs, some manipulation of the CalSim outputs (for YOLO, FLMIN, and EXPT [see explanation under *Covariates*]) and SRWQM output (for STEMP) is required. These metrics are effectively converted from daily, weekly, or monthly covariates into annual covariates that then are used in the model at the annual time step. Although the extreme values of some covariates (e.g., flow, water temperature, and exports) are lost by averaging the data at a larger time step, the relationships between these covariates and population size were developed using this time step during model development and, therefore, should still reflect the biological significance.

5.D.3.2.3 Model Inputs

Data on the distribution of winter-run spawners are available through carcass surveys that have been conducted since 1996 (Snider et al. 1997; Snider et al. 1998; Snider et al. 1999; Snider et al. 2000; Snider et al. 2001; Snider et al. 2002; U.S. Fish and Wildlife Service 2007). Age and gender of spawning winter-run Chinook salmon are provided by carcass surveys for fish that spawn above River Mile (RM) 275 (California Department of Fish and Game 2004). In addition, aerial redd surveys have been conducted that provide an assessment of the distribution of redds below RBDD (California Department of Fish and Game 2004). Finally, counts at RBDD have been used to estimate the winter-run escapement since 1967; however, since 2001 the annual escapement estimates have been calculated using a Jolly-Seber estimator derived from the carcass count data (California Department of Fish and Game 2004). Despite some changes in the operations of RBDD that affect the precision of the spawner escapement estimates (Botsford and Brittnacher 1998), the RBDD counts provide a continuous time series of winter-run estimates. Prior to 1987, all returning spawners passed via a counting ladder at RBDD, but from 1987 onward, the gates of the diversion dam have been opened to enhance upstream survival of winter-run Chinook salmon, but also likely improved access to areas above RBDD. The current operation of RBDD makes counts of winter-run Chinook salmon based on passage by May 15. On average, 15% of the winter-run passed RBDD by May 15, but the specific percentage in a given year was as low as 3% or as high as 48% (Snider et al. 2000). Egg abundance is calculated by assuming that each adult spawner produces 2,000 eggs (Williams 2006).

Juvenile production indices taken from Poytress (2007) were used for 1995 through 1999 and 2002 through 2007. Maturation rates were taken from an analysis of 1998, 1999, and 2000 coded wire tag data (Grover et al. 2004).

5.D.3.2.4 Covariates

Through maximum likelihood and Bayesian estimation to minimize deviations between predicted and observed winter-run Chinook salmon abundance estimates, the following covariates were retained in the original OBAN model and their coefficients were estimated.

- **STEMP:** July through September mean daily water temperature (degrees Fahrenheit [°F]) in the Sacramento River at Bend Bridge. This covariate affects survival of the alevin life history stage.

- **FLMIN:** August through November minimum monthly flow (cubic feet per second [cfs]) in the Sacramento River at Bend Bridge (U.S. Geological Survey [USGS] Gage 11377100 data). This covariate affects survival of the fry life history stage.

- **EXPT:** Total water exports in the south Delta (CVP and SWP) during December through June, derived by taking average daily export rate (cubic feet per second), multiplying by the number of days in the month, and then summing over December–June (Interagency Ecological Program [IEP] Dayflow data). This covariate affects survival in the Delta life history stage.

- **YOLO:** Number of days during December through March with minimum flows of 100 cfs over the Fremont Weir, which is enough for positive flows onto the Yolo Bypass (December of the brood year and January–March of the year following) (Bureau of Reclamation data). The 100 cfs minimum flow threshold was chosen to distinguish days with an actual inundation event from the rest of the days with year-round 100 cfs flows into the bypass to maintain positive flows for adult fish passage under the preliminary proposal. Although this flow is much lower than the suggested flows needed for juveniles salmonids to gain survival benefits in the Yolo Bypass (~4,000 cfs) (Sommer pers. comm.), the parameter used to fit the data is number of days of flooding, and not flow rate during flooding. This covariate affects survival in the Delta life history stage.

- **DCC:** Proportion of time that the Delta Cross Channel (DCC) gates were open between December and March (December of the brood year and January–March of the year following) (Bureau of Reclamation data). This covariate affects survival in the Delta life history stage.

- **CURL:** a wind stress curl index that is correlated with coastal productivity off California (Pascals per meter) (Chelton 1982) (Kessler 2006). Persistent longshore equatorward wind stress during spring and summer forces surface waters offshore via Eckman transport drawing nutrient-rich water to the euphotic zone to replace surface waters pushed offshore (Rykaczewski and Checkley 2008). Once nutrient-rich water reaches the euphotic zone, primary productivity increases. Positive effects of the CURL index on Chinook salmon growth and maturation have been observed (Wells et al. 2007). This covariate affects survival in the Gulf life history stage.

- **Harvest:** Ocean harvest of Ocean 2 and Ocean 3 individuals (Ocean 1 are assumed to be too small to be vulnerable to the fishery) as the proportion of the total Ocean 2 and Ocean 3 individuals available for harvest. The harvest rate index was constructed by using the DFG ocean and recreational fishing regulations. Until 1987, there was little regulation of the Central Valley Chinook salmon fishery and estimates of the mortality rate on winter-run Chinook salmon in the ocean fishery were approximately 0.7 of the mortality rate experienced by fall-run Chinook salmon. The harvest rate of fall-run Chinook salmon is calculated annually as the Central Valley Index (CVI) by calculating the proportion of the fall run that were captured in the fishery (harvested/(harvested + escaped)). In 1989, winter-run Chinook salmon were listed as threatened, and the following year the ocean fishery regulations were shifted to open 2 weeks later (National Marine Fisheries Service 1997). It was assumed that this had an effect on the winter harvest mortality and reduced the impact to 0.5 of the CVI. In 1994, winter-run were listed as endangered, and in 1997, a biological opinion (BiOp) was released by NMFS (1997) initiating a delayed opening of the ocean fishery from mid-March to mid-April and eventually to late April in 2001. Using coded wire tagged winter-run Chinook salmon from 1998 through 2000 cohorts, Grover and coauthors (2004) estimated ocean harvest rates of 0.22. The effect of the fishery is not the same for Ocean 2 and Ocean 3 stages, however. The rates described above were generated for the Ocean 2 stage.

  Ocean 2 and Ocean 3 fish are not captured at the same rate. Most winter-run Chinook salmon return to spawn as 3-year-olds (after the Ocean 2 phase); however, the Ocean 3 stages are more likely to be captured in the commercial fishery because of their larger size. Grover and coauthors (2004) found that the harvest-related mortality of Ocean 3 winter-run Chinook salmon was 2.5 to 3.7 times the rate of Ocean 2 winter-run. For OBAN, it assumed that the harvest rates experienced by Ocean 3 stage winter-run were 2.7 times the harvest rates experienced by Ocean 2 stage. In order to make sure that the harvest rate could not surpass 1, a logistic regression approach was used to incorporate the harvest rates.

Harvest also occurs in the Sacramento River, and the best available published rates were used. Between 1967 and 1975, estimates of winter-run harvest in the recreational river fishery varied from 0.04 to 0.14 (Hallock and Fisher 1985). For OBAN, it was assumed that the in-river fishery harvest rates were 0.09 from 1975 to 1982, which was the average of the Hallock and Fisher (1985) estimates. NMFS (1997) published in-river harvest rates from 1983 to 1990 that varied between 0.013 and 0.087. For OBAN, it was assumed that the in-river harvest was constant at 0.05 from 1991 to 2007. The 0.05 river harvest rate was used in combination with the 0.22 ocean harvest rate to equal the average harvest impact rate identified by Grover and coauthors (2004) for the 1998, 1999, and 2000 cohorts.

Additional covariates that were analyzed but not used in the full model because of weak relationships with winter-run population size include those following.

- **FLMAX:** Maximum monthly average flow (cubic feet per second) during August through November in the Sacramento River at Bend Bridge (USGS Gage 11377100 data).
- **BASS:** Bass catch per unit vessel in the Delta (DFG data).
- **SLH:** Average April to June sea level height (meters [m]) at Presidio (University of Hawaii Sea Level Center, San Francisco data).
- **UPW:** Upwelling at the Gulf of Farallones from April to June (Pacific Fisheries Environmental Laboratory, Pacific Grove data).
- **PDO:** Pacific Decadal Oscillation index from October to March of the following year (University of Washington, Joint Institute for the Study of the Atmosphere and Ocean data).
- **SST:** Sea surface temperature from July to February of the following year (°C) (Scripps Institute of Oceanography data).

5.D.3.2.5 Updates to the OBAN Model in 2015

There were multiple modifications to the winter-run OBAN model in 2015 to reflect improvements in the covariates, and in the methods of estimation.

5.D.3.2.5.1 Covariate Updates

Several covariates were updated since the initial OBAN winter-run model was constructed in 2010 largely due to conducting retrospective analyses that improved the covariate values in earlier periods of the 1967 to 2010 data set.

5.D.3.2.5.1.1 Temperature Reconstruction at Bend Bridge (STEMP)

The initial winter-run OBAN model used a temperature reconstruction that was based on a series of regressions between existing water quality monitoring stations over the period 1967 to 2000 (W. Kimmerer pers. comm.2011) and using CDEC BND gage data for 2001 to 2010. In contrast, the updated temperature data at Bend Bridge includes a temperature reconstruction on the Sacramento River for the 1970 to 2000 period (Deas 2002). Comparisons of the water quality covariate (July to Sept average) from the previous (STEMP) and the current data set incorporating the Deas reconstruction for 1990 to 2000 (TEMP 2015) indicate generally similar patterns, although the average temperature is slightly higher under the TEMP 2015 (14.27 C) relative to the STEMP data set (13.73 C) (Figure 5.D-164).

5.D.3.2.5.1.2 Ocean Productivity Covariates

Evaluation of additional factors affecting ocean productivity has indicated that winter run may be sensitive to upwelling and temperature in the Farallon Islands. These factors likely do not affect winter-run Chinook directly, but instead affect the conditions that promote a strong prey base, thus leading to better feeding conditions. Previous efforts used wind-stress curl (CURL) to reflect these early ocean conditions. The ocean conditions now are a function of upwelling during spring south of the Golden Gate Bridge (UPW) and temperatures during spring in the Gulf of Farallones (FARA). The time series of indicators of wind-stress curl, upwelling, and Farallon temperatures are presented in Figure 5.D-165 in a standardized format; that is, each year’s value has had the mean subtracted and is divided by the standard deviation of the time series.

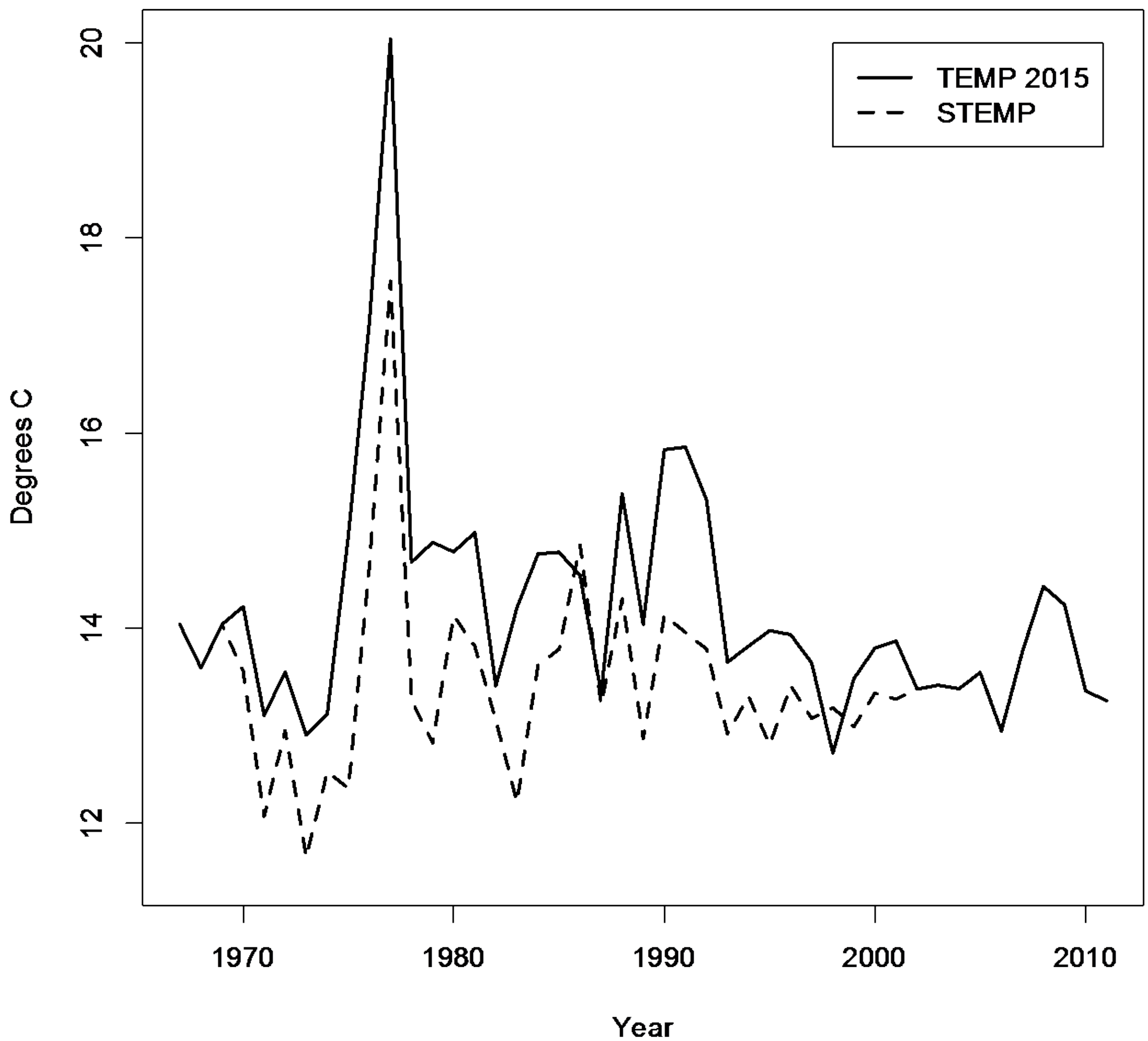


Figure 5.D-153. Comparison of average temperature at Bend Bridge from July to September based on a regression approach (TEMP) and a temperature reconstruction (Deas 2002) for the years 1970 – 2000 (TEMP 2015). Data for 1967 – 1969 used regression with air temperature and data for 2001 – 2010 used Bend Bridge gage data.

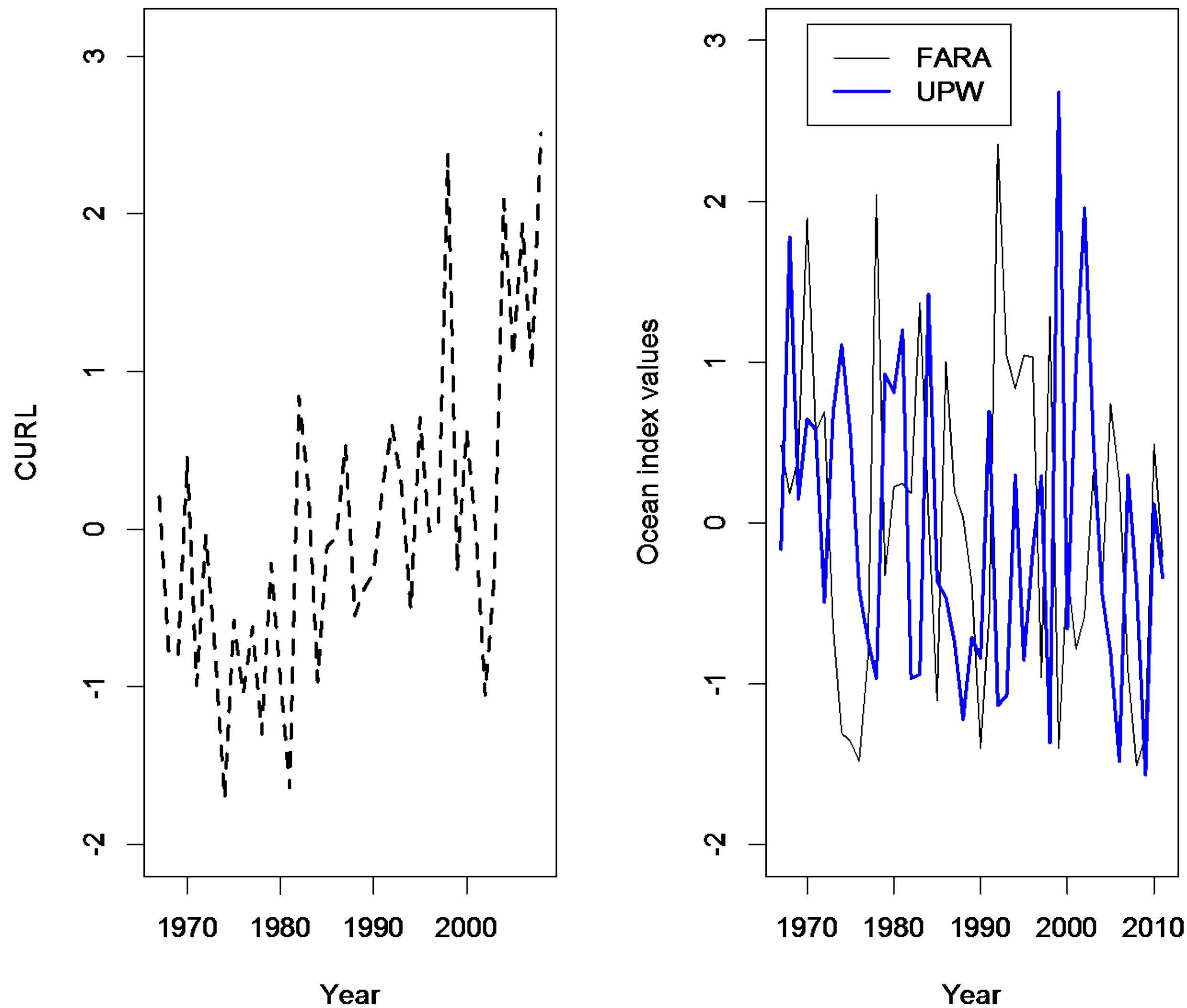


Figure 5.D-154. Wind stress Curl (CURL) (left) and Gulf of Farallones temperatures in spring (FARA) and upwelling index south of Golden Gate in spring (UPW) (right).

5.D.3.2.5.1.3 Harvest Rates

The ocean stages were modeled as a function of maturation rates and age-3 impact rates. Information for the maturation rates were taken from an analysis of 1998, 1999, and 2000 coded wire tag (CWT) data (Grover et al. 2004) and more recent analyses of maturation rates (O'Farrell et al. 2012). Age-3 impact rates for winter-run were calculated for 1978 - 2011 from a combination of estimated impact rates from CWT returns (1998 - 2008) and from a hindcast of impact rates given spatial allocation of fishing effort (Michael O'Farrell pers. comm.). Until 1987, there was little regulation of the Central Valley Chinook salmon fishery and estimates of the mortality rate on winter-run Chinook salmon in the ocean fishery were approximately 0.7 of the mortality rate experienced by fall-run Chinook salmon. Most winter-run Chinook salmon return to spawn as 3-year-olds; however, the winter-run age-4 ocean stages are more likely to be captured in the commercial fishery because of their larger size. Grover et al. (2004) found that the harvest-related mortality of age-4 winter-run Chinook salmon was 2.5 to 3.7 times the rate of age-3. The age-4 impact rate in a calendar year y was assumed to be double the instantaneous rate of age-3 (h_4,y = exp(log(h_3,y /2))).

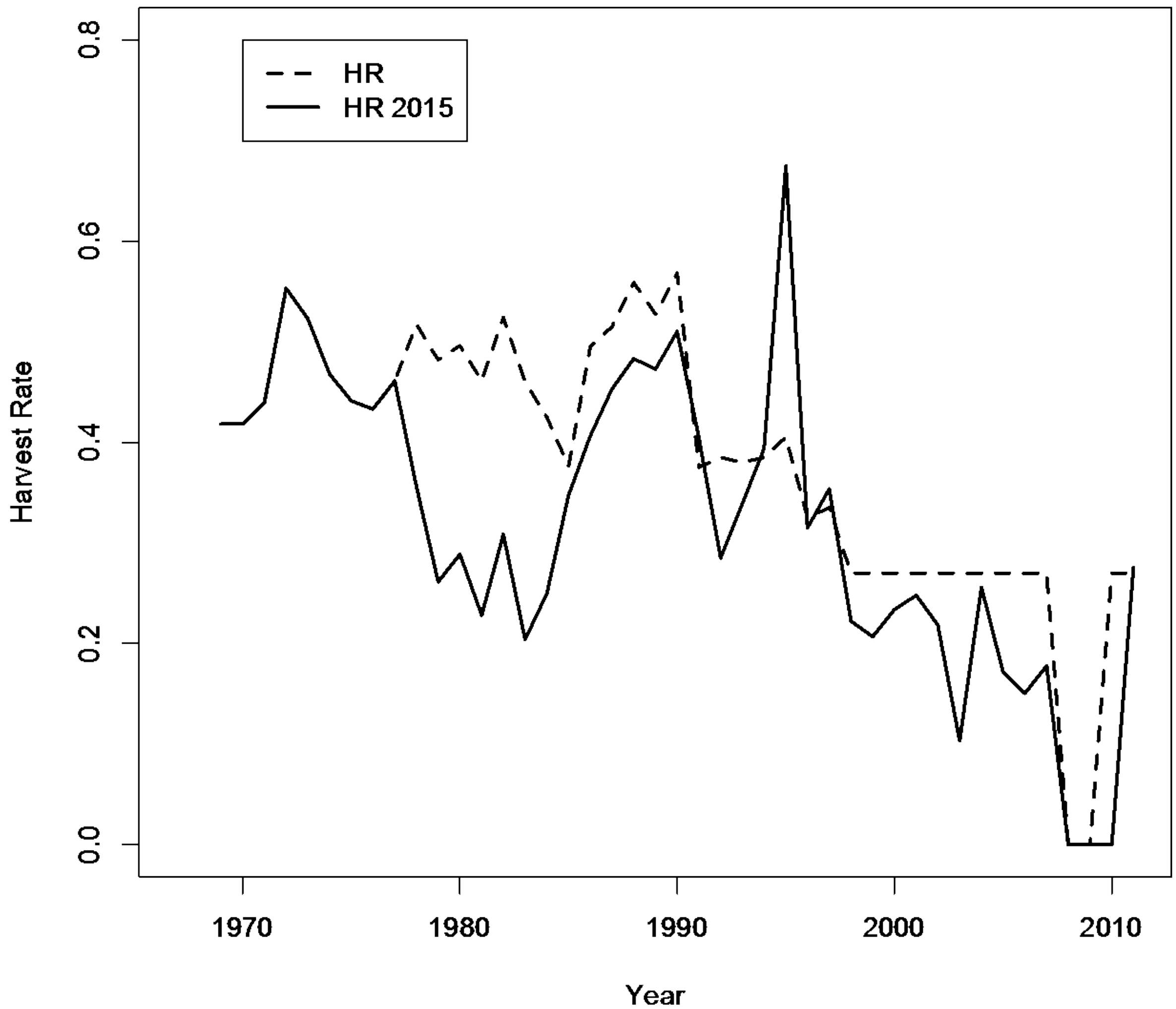


Figure 5.D-155. Estimated harvest rate (HR) using fishing regulations prior to 2015, and the harvest rate in 2015 using the hindcast of O'Farrell et al. (2012).

5.D.3.2.5.2 Estimation Approaches

5.D.3.2.5.2.1 Prior distributions on parameters in the logistic regression for stage-specific survival

Prior probability distributions are required for all model coefficients that are estimated within the modeling framework. For example, the coefficients of the logistic regression to define stage-specific survival rates (β 's) and coefficients of the log-linear model (γ 's) to define stage-specific capacities will require prior probability distributions; normal distributions can be used to define the prior probabilities for both of these coefficients due to the transformations used in equations (1) and (3). Care should be taken in specifying the priors for the β coefficients given their inclusion into a logit() transformation, and N(0,2.5) priors may be used in the coefficients of logistic regression to ensure that excessive mass is not placed in the values near 0 and 1 (King et al. 2010). The previous OBAN implementation used more diffuse priors for the β coefficients, but updated the 2015 OBAN to include the N(0, 2.5) priors.

5.D.3.2.5.2.2 Estimates of measurement error among survey types

Estimation of the model parameters occurs by comparing model predictions to observed data across multiple competing "states of nature" or parameter values. This is achieved through Bayesian estimation of the likelihood of observing the data times the prior probability of the model parameter values (Gelman et al. 2004). The general framework described above is used to compute predicted abundances that are then compared with observed abundances obtained through some sampling method. As a result, a sampling model is defined for each observation. The stage abundances are related to the observed indices of abundance through a sampling model Multiple types of abundance indices can be included in the modeling framework by defining the observation process as a function of the sampling model and observation error σ_k^2 for abundance index *k*. For example, the observation process could be defined as a lognormal for abundances or biomass, Poisson or negative binomial for counts, or Binomial for capture-recapture studies. The relationship of measurements to average counts can be described by the coefficient of variation (CV = standard deviation/ mean). Note that if the observation process is modeled with lognormal errors, the variance can be defined in terms of the coefficient of variation (CV = standard deviation/mean) as $\sigma_k^2 = log(CV_k^2 + 1)$.

There were three periods in which the measurements of winter-run Chinook differed: 1) an initial period of abundance estimates using Red Bluff Diversion Dam ladder counts (1967 – 1987); 2) expansion of counts of winter-run adults assuming 15% passage by May 15th (1988 – 2000); and 3) estimates of male and female abundance based on Jolly-Seber carcass capture recapture data (2001 – 2010). It was assumed that each of these periods had different measurement errors associated with them. Given the different measurement types, it was assumed that the errors in measurement were structured as follows: $CV_1 < CV_3 < CV_2$.

Juvenile abundance estimates at RBDD (e.g., Poytress and Carillo 2010) were also fit with their own assumed measurement error expressed as a coefficient of variation CV_J.

5.D.3.2.5.3 Evaluating density dependence in the fry rearing stage

With the new model structure incorporating the updated covariates and measurement error structure, the role of minimum flows on fry rearing was evaluated. The effect of minimum flows in the fry rearing stage was evaluated under two competing hypotheses: 1) minimum flows affected the capacity of rearing fry and 2) minimum flows affected the survival of rearing fry. A model was fit that was consistent with each of the two hypotheses and its fit was evaluated relative to the model complexity (i.e., number of parameters in the model). Because both models incorporated random effects in the cohort production equation, the number of parameters is not the exact number of parameters being estimated in the model. Instead, the number of effective degrees of freedom (pD) is estimated from the model structure. Deviance information criterion (DIC), which is a function of pD and the amount of variability explained (deviance) (Spiegelhalter et al. 2002), was used to compare the two hypotheses regarding the role of minimum flow. Lower DIC values indicate a model with better explanatory ability given the model complexity, similar to Akaike Information Criterion (Burnham and Anderson 2002).

The model with minimum flow affecting survival had a lower DIC value of approximately 5 units (460 units of DIC) compared to the model with flow affecting capacity (465 units of DIC). This result supports using minimum flow to affect survival in the rearing stage.

5.D.3.2.6 Model Fitting Results for the OBAN 2015 Model

The juvenile survival prior to reaching RBDD was negatively affected by average temperature at Bend Bridge (negative $\beta_{TEMP\ 2015}$ coefficient value, Table 5.D-189) between July and September; thus higher temperatures lead to lower survival. Juvenile survival was positively affected by minimum flows from August to December (positive β_{FLMIN} coefficient value, Table 5.D-189); therefore, higher minimum flows lead to higher survival. In both cases, confidence in the direction of effect of the environmental driver variable was relatively high, i.e., 95% probability interval end points of 2.5% and 97.5% indicated the majority of the distribution was negative for TEMP 2015 and positive for FLMIN.

In the delta, exports decreased survival (negative β_{EXPT} coefficient value, Table 5.D-189), whereas access to the Yolo bypass and DCC gate position increased survival (positive β_{YOLO} coefficient and β_{DCC} coefficient values, Table 5.D-189). Confidence in the effect of exports and Yolo bypass were less certain as both covariates' 95% probability intervals included both positive and negative values, whereas confidence in the effect of DCC position was high (95% probability interval was positive). Given the existing literature suggesting that entry in to the interior delta may be disadvantageous to the survival rate of Chinook salmon (e.g., Perry et al. 2010), the estimated effect of DCC may be a function of the escapement time series. The DCC gates were open a greater proportion of the December to March period from 1967 to 1980, when adult escapement of winter-run were generally higher, whereas the DCC gates were open for shorter periods later in the time series when escapements were low.

Table 5.D-189. Posterior coefficient values obtained from fitting the winter run OBAN 2015 model to observed escapement and observed Red Bluff Diversion Dam juvenile abundance. Note that all *β* coefficients are in logit space, thus their sign is directly interpretable, but their magnitude requires transformation.

Coefficient	Mean	Standard Deviation	2.5%	50%	97.5%
β0, Alevin	-1.282	0.610	-2.400	-1.311	0.005
β0,Delta	-4.357	0.471	-5.179	-4.386	-3.347
βTEMP 2015	-1.61	0.497	-2.606	-1.585	-0.672
βFLMIN	1.021	0.586	-0.060	0.990	2.290
βEXPT	-0.097	0.374	-0.812	-0.105	0.650
βYOLO	0.169	0.300	-0.370	0.154	0.753
βDCC	0.620	0.316	0.015	0.615	1.245
βFARA	-0.430	0.563	-1.558	-0.411	0.636
βUPW	0.534	0.895	-0.973	0.455	2.516
CV1	0.573	0.191	0.306	0.537	1.069
CV2	1.516	0.305	0.917	1.514	1.986
CV3	1.092	0.341	0.59	1.041	1.912
CVJ	1.271	0.408	0.473	1.268	1.956

The winter-run OBAN 2015 model fit the trends in the log escapement data well (Figure 5.D-166). Due to the differences in measurement error among the three escapement data collection methods (ladder counts, expansion, and carcass survey), the model fit the data with the lowest measurement error better. For example, the model was sensitive to the period of ladder counts prior to 1987, which was assumed to have the lowest measurement error (i.e., large variation in the mean predictions to match the observed data), whereas it was least sensitive to the intermediate period of expansion counts (1987 – 2000), which was assumed to have the highest measurement error.

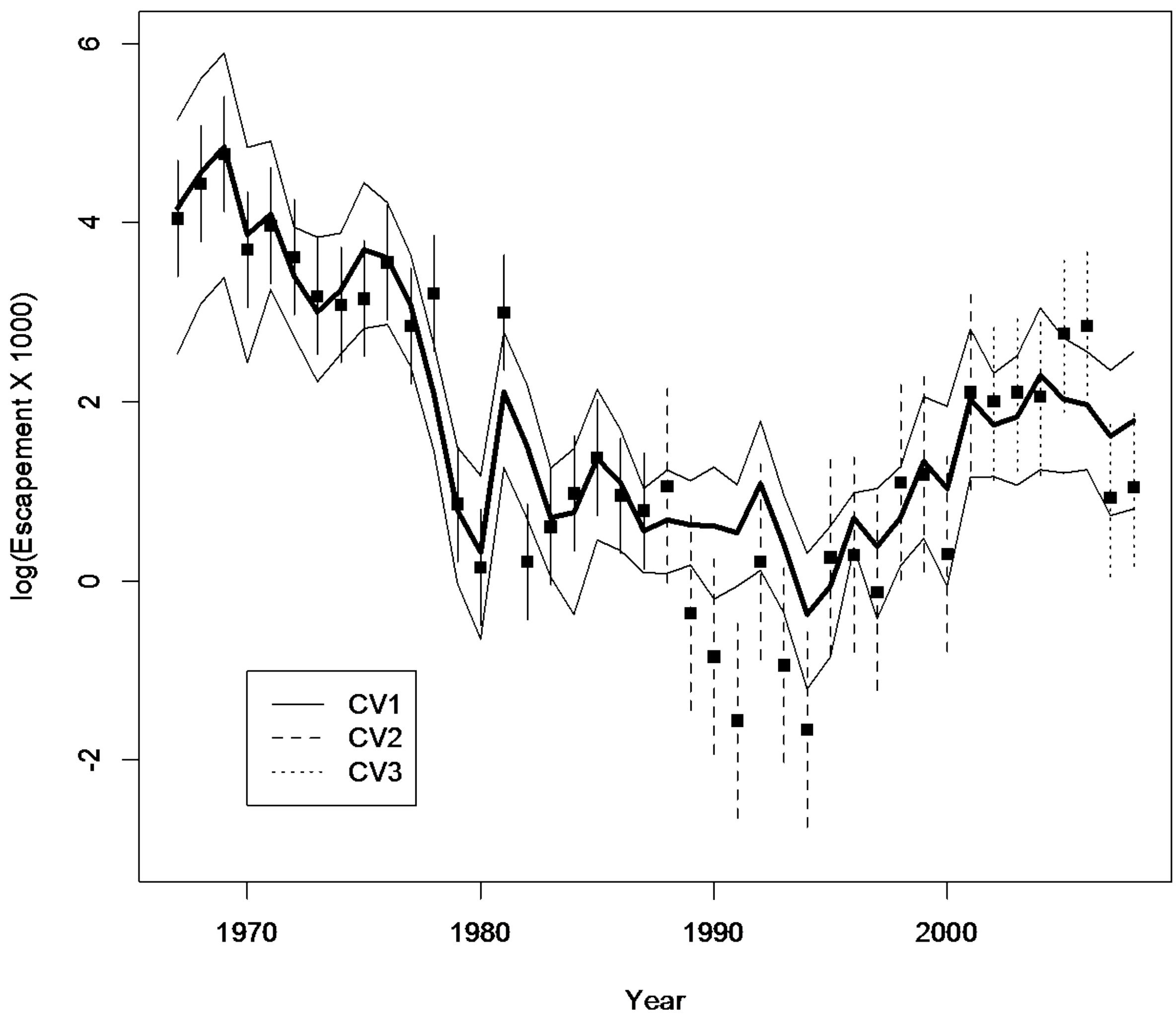


Figure 5.D-156. Mean Prediction (thick line) and 95% probability interval (thin line) of winter-run OBAN 2015 model to winter-run log escapement data (black squares) that were collected via ladder counts (CV1), expansion counts (CV2), and carcass surveys (CV3). Vertical bars represent 1 standard deviation for each of the survey methods.

The winter-run OBAN 2015 model also captured the dynamics of the juvenile abundance estimates at RBDD (Figure 5.D-167), including estimates of the unobserved juvenile abundances in 2000 and 2001, when the RBDD trap was not operational.

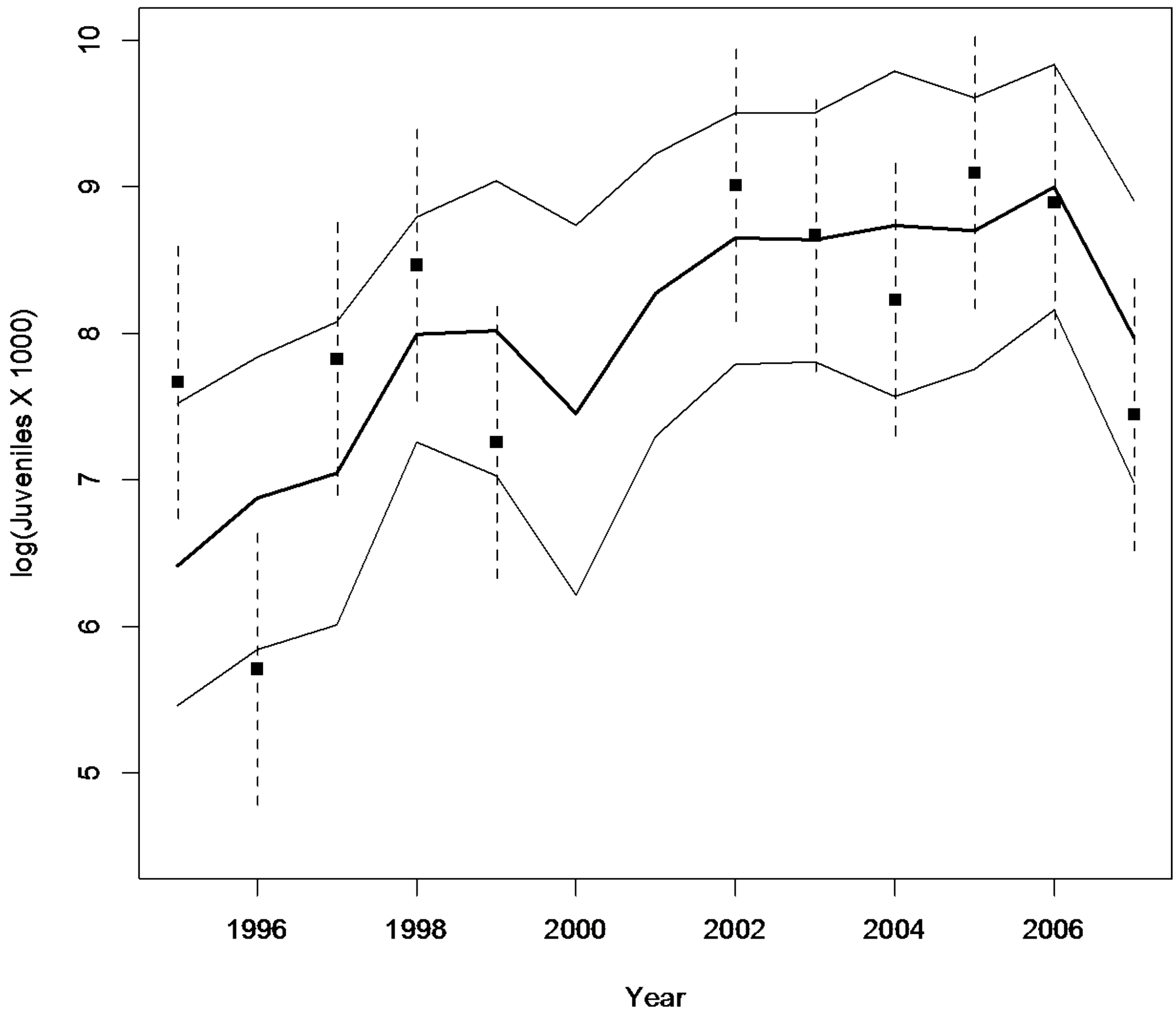


Figure 5.D-157. Mean Prediction (thick line) and 95% probability interval (thin line) of winter-run OBAN 2015 model to winter-run log juvenile count data at Red Bluff Diversion Dam (black squares). Vertical bars represent 1 standard deviation.

5.D.3.2.7 Implementation for Effects Analysis

Modeling of potential effects was undertaken for the NAA and PA scenarios. The required OBAN input data were obtained from physical modeling of the NAA and PA scenarios: number of days with Yolo Bypass flow >100 cfs (YOLO, from disaggregated CalSim data[15]; Figure 5.D-158); mean water temperature at Bend Bridge (STEMP, from SRWQM; Figure 5.D-159); mean flow at Bend Bridge (FLMIN, from CalSim; Figure 5.D-160); and mean south Delta exports (EXPT, from CalSim; Figure Expt1). Data averaging was as described in Section 5.D.3.2.5.2, *Estimation Approaches*. Other covariates (UPW, FARA, and Harvest) were given historic values and did not vary between scenarios (Figure 5.D-154 and Figure 5.D-155 in

[15] The annual pattern of the PA data was used for both scenarios, so the Yolo Bypass covariate did not differ between NAA and PA.

Section 5.D.3.2.5.1, *Covatiate Updates*), whereas DCC was assumed to be closed all the time under both scenarios[16].

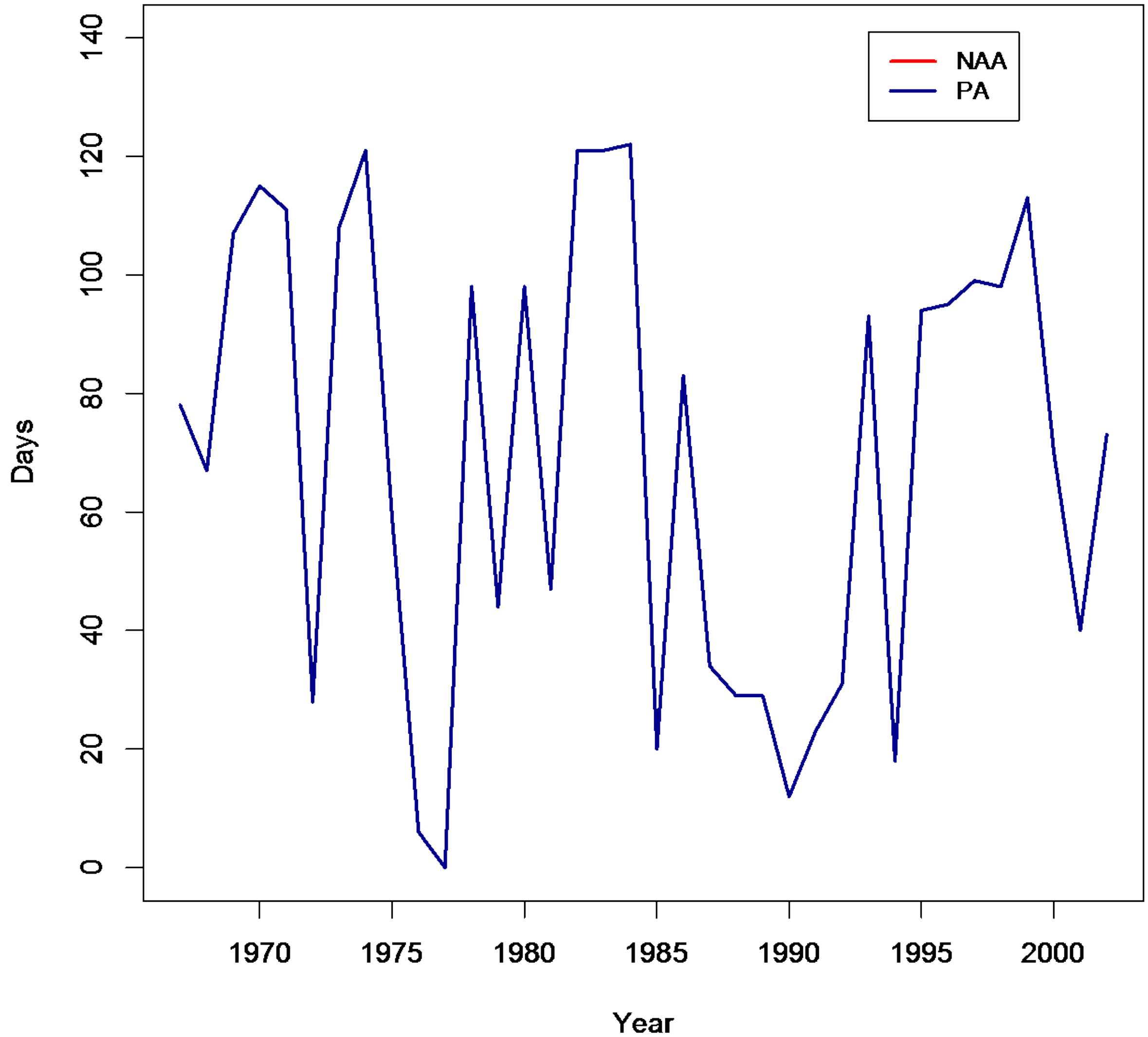


Figure 5.D-158. OBAN Inputs for the Yolo Covariate: Number of days where flow over the Fremont Weir into the Yolo bypass is greater than 100.1 cfs from December thru March.

[16] As described in Section 5.D.3.2.6, the DCC covariate has a positive influence on Delta survival (survival is greater with a greater proportion of days of DCC open).

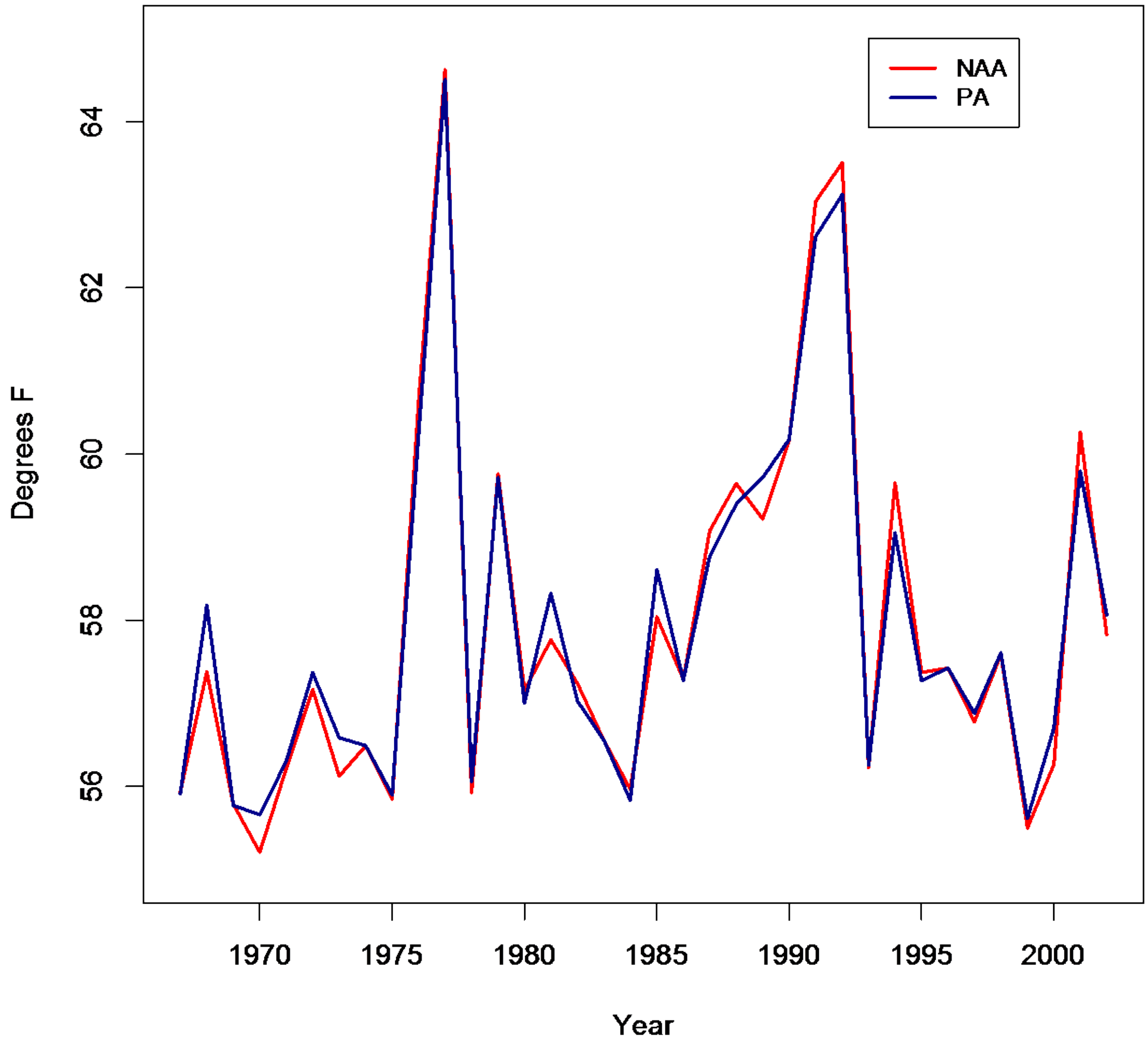


Figure 5.D-159. OBAN STEMP Covariate: Mean temperature from July to September at Bend Bridge.

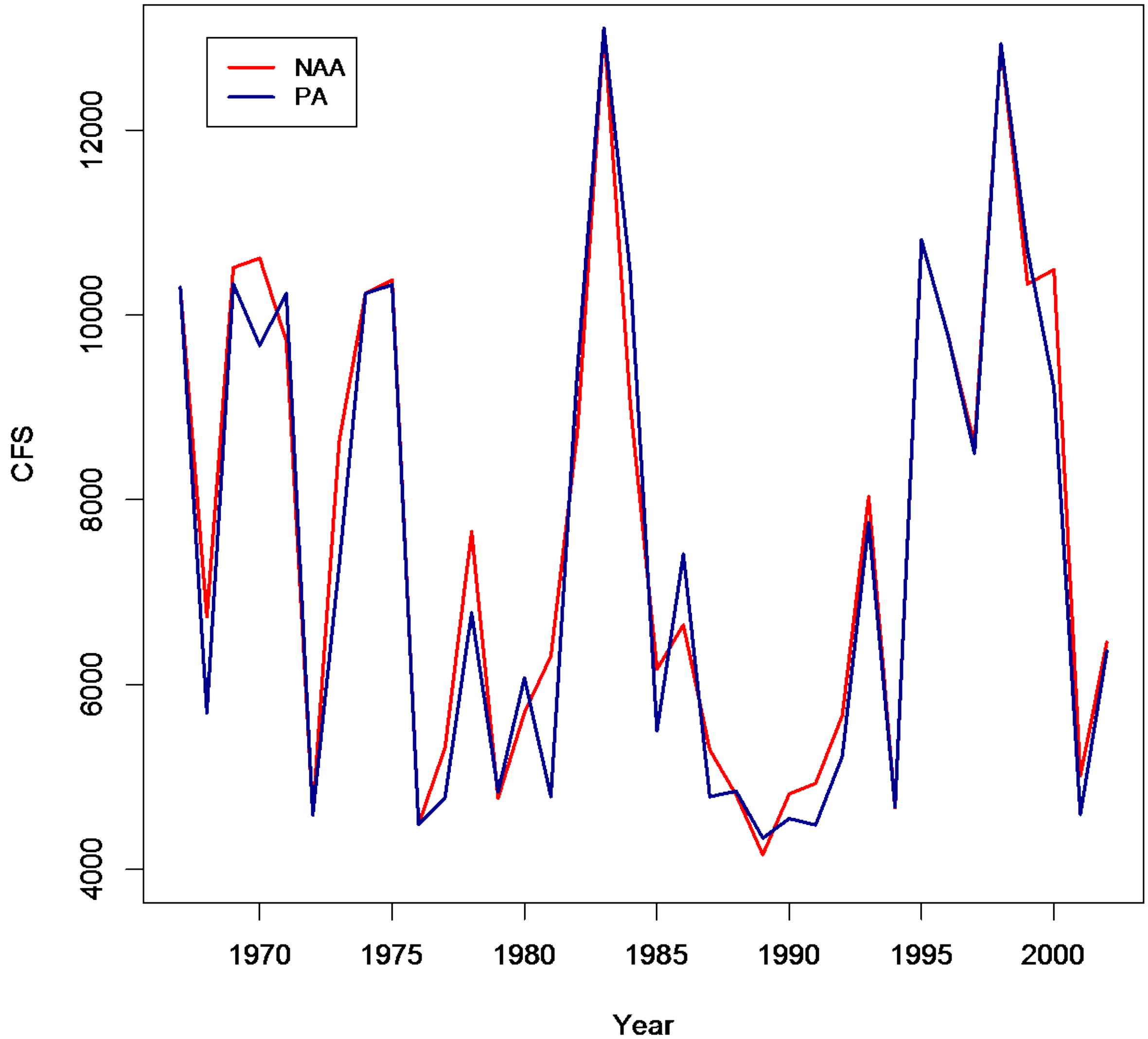


Figure 5.D-160. OBAN FLMIN Covariate: Minimum of monthly mean flow between August and November at Bend Bridge in cubic feet per second (CFS).

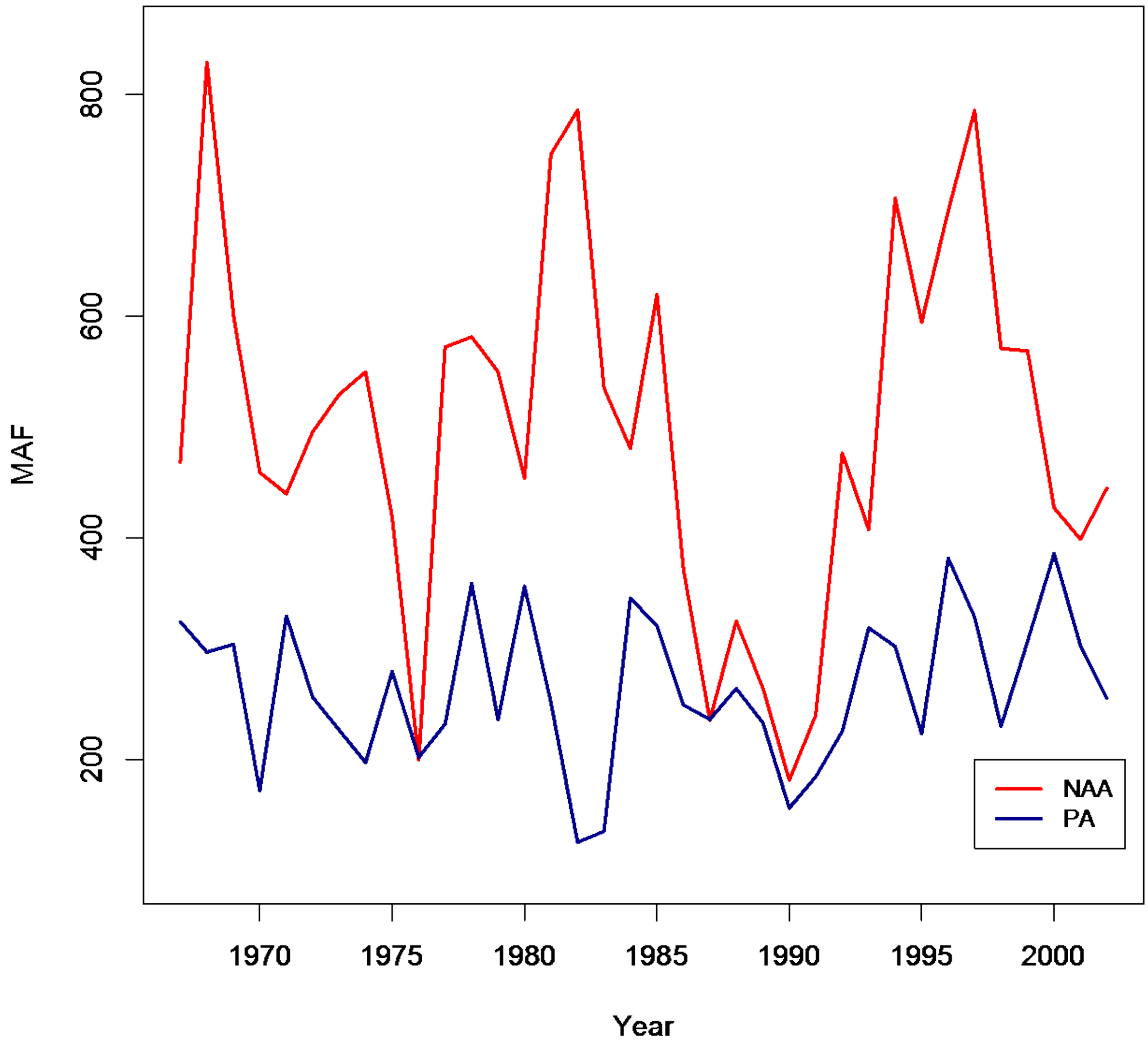


Figure 5.D-161. OBAN EXPT Covariate: Total South Delta exports from December to June in million acre feet (MAF).

In order to assess the potential effects of NDD mortality (e.g., near-field effects from predatory fish associated with the intakes structures; far-field effects from less river flow leading to longer travel times and reduced survival probability), four additional PA scenarios were included that multiplied estimated PA survival in the Delta reach of the OBAN model by a constant to reflect this mortality:

- PA 1.0% : (PA Delta survival)*0.99 (i.e., 1% lower Delta survival)
- PA 5.0%: (PA Delta survival)*0.95 (i.e., 5% lower Delta survival)
- PA 10.0%: (PA Delta survival)*0.90 (i.e., 10% lower Delta survival)

Note that these are relative survival values. Thus, if PA Delta survival was 0.01, then PA 5.0% Delt survival would be 0.01*0.95 = 0.0095. Preliminary results suggested the need to examine an even higher level of additional Delta mortality in order gauge model response, so an additional scenario with very high additional mortality also was run:

- PA 50.0%: (PA Delta survival)*0.50 (i.e., 50% lower Delta survival)

In order to evaluate the probability of higher escapement under the PA scenarios relative to the NAA scenario, the OBAN model was used to provide 1000 ‘states of nature’ or parameter sets to evaluate the scenarios via Monte Carlo simulation. For each parameter set, an annual escapement was calculated under each scenario. The probability of higher escapement under the PA scenarios equates to the proportion of parameter sets in which the PA scenarios were greater than NAA. Calculations of probability of higher escapement under the PA were made for all years of the simulation (1967-2002).

As with other quantitative analyses conducted for the effects analysis (e.g., IOS), it is important to bear in mind that OBAN provides inference for future conditions on a relative basis: the forecasts are not accurate in an absolute sense but are important in evaluating scenarios relative to each other. In considering the results, the following important points should be borne in mind:

- For the evaluation of the scenarios, all sources of mortality after the Delta were exactly the same to focus on the river and Delta portions of the life cycle.

- OBAN is sensitive to water temperature in the incubation stage (July – Sept) and minimum flows in the fry rearing stage (Aug – Nov).

- OBAN is less sensitive to DCC position, exports, and Yolo operations in the Delta.

5.D.3.2.8 Results

The OBAN results reflected the impacts of temperature and flow in the spawning reaches on annual patterns in escapement; high temperatures led to high cohort mortality. Factors affecting survival in the Delta were important when the population was recovering from low escapement levels, and reductions in south Delta exports showed potential to improve this recovery.

Patterns in escapement showed temporal variability that was similar across scenarios (Figure 5.D-162, Figure 5.D-163). These patterns were driven largely by dynamics in the spawning reaches in which high temperatures (> 60 °F mean at Bend Bridge from July to September) and low flow led to high cohort mortality, and lower temperatures facilitated cohort recovery (Figure 5.D-164). Two periods within the simulation period led to moderate declines in 3-year lagged escapement: 1976-1977 and 1990– 1992. Under all scenarios, the probability of quasi-extinction in 1994 and 1995 was > 0.5 as a result of the second period of high temperatures (Figure 5.D-165). Under all scenarios, the winter run escapement recovered in 1996, largely due to lower temperatures in the spawning reaches for the 1993 cohort. Recovery was uneven due to the population dynamics, however. Escapement was low in 1994 and 1995 (as a result of previous temperature induced mortality) and despite low temperatures, there was low spawning abundance. The recovery was driven by the 1996-1999-2002 component of the spawning population, yet this imbalance in the dominant 3-year component became less apparent as the population recovered from 1996 to 2002.

Median escapement differed as a result of different assumptions in NDD mortality rates over the simulation period (Figure 5.D-162), and the effects were most apparent with the PA 50.0% scenario. The NDD mortality effects were multiplicative: therefore, in years where juvenile abundance was low, the absolute effect of the NDD mortality was small compared to years in which juvenile abundance was high. Plotting the log escapement (Figure 5.D-163) provided a better view of the effect of NDD mortality at low escapement levels. Still, differences among NDD mortality levels were most pronounced during periods of high escapement early in the simulation time series and during 1996-2002. The effects of NDD mortality may also compound over time as was indicated by the 1996-2002 period, in which the escapement under the PA 50.0% scenario failed to recover to the degree of the other scenarios (Figure 5.D-162).

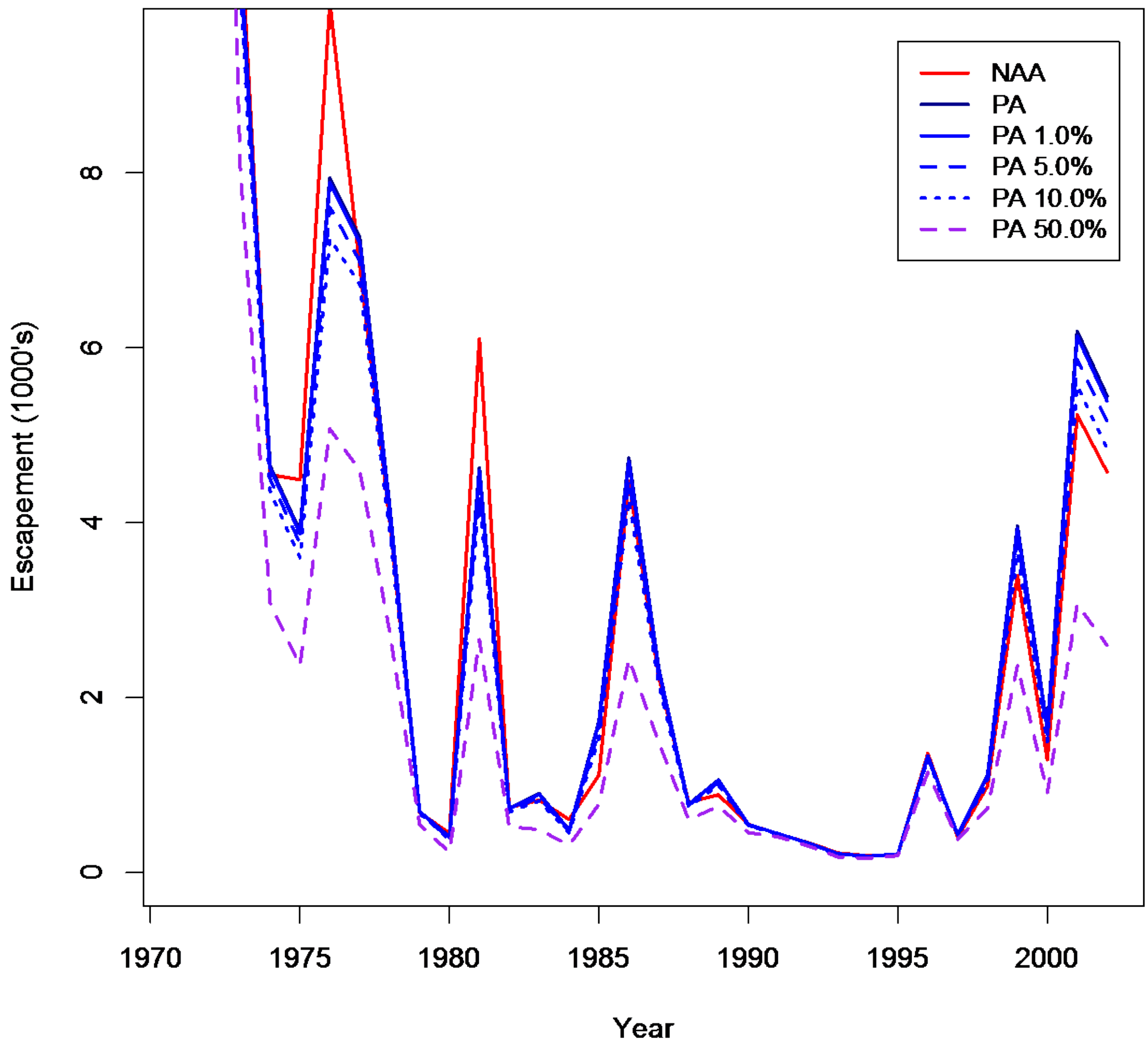


Figure 5.D-162. OBAN: Median escapement for each of the scenarios.

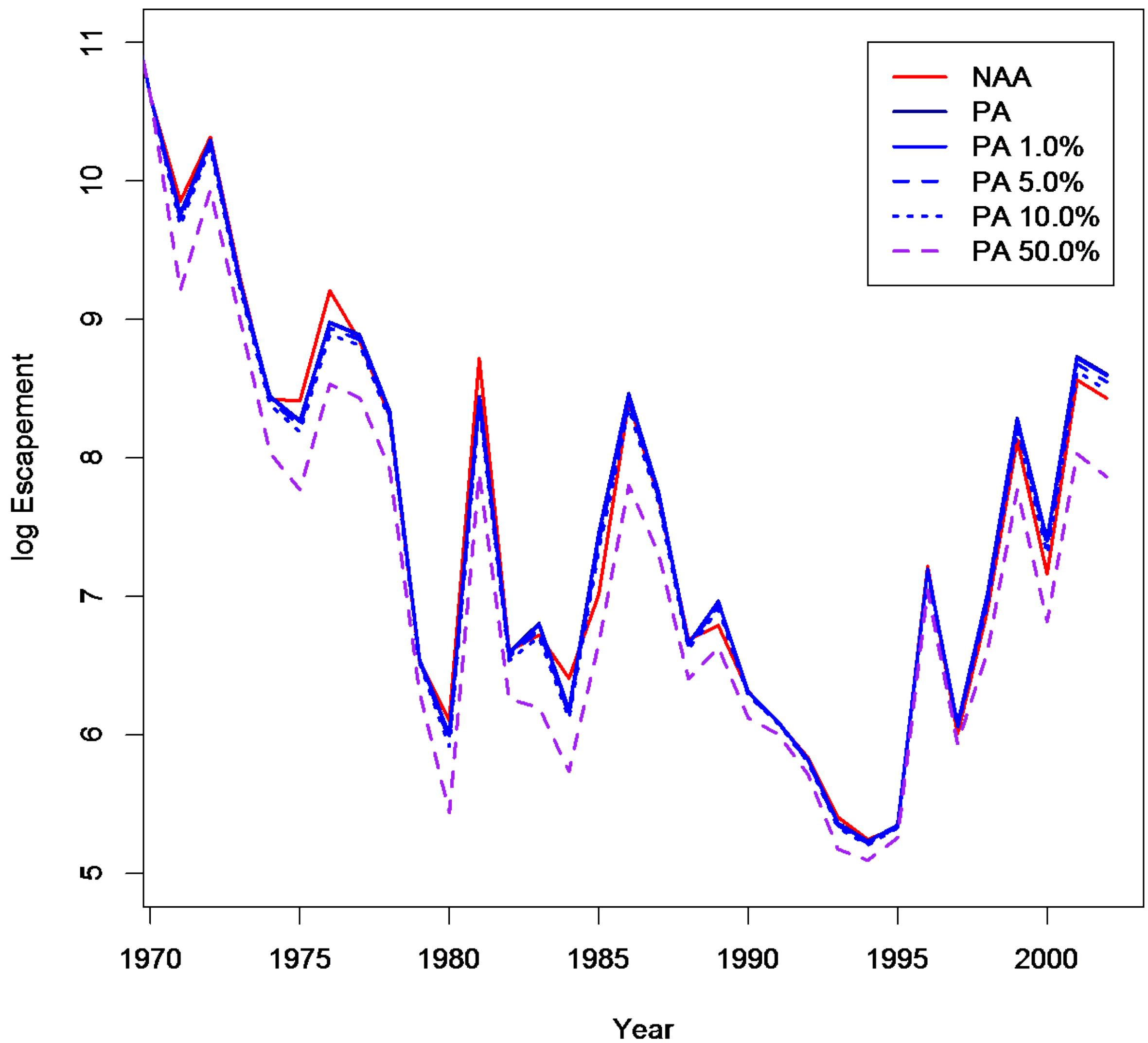
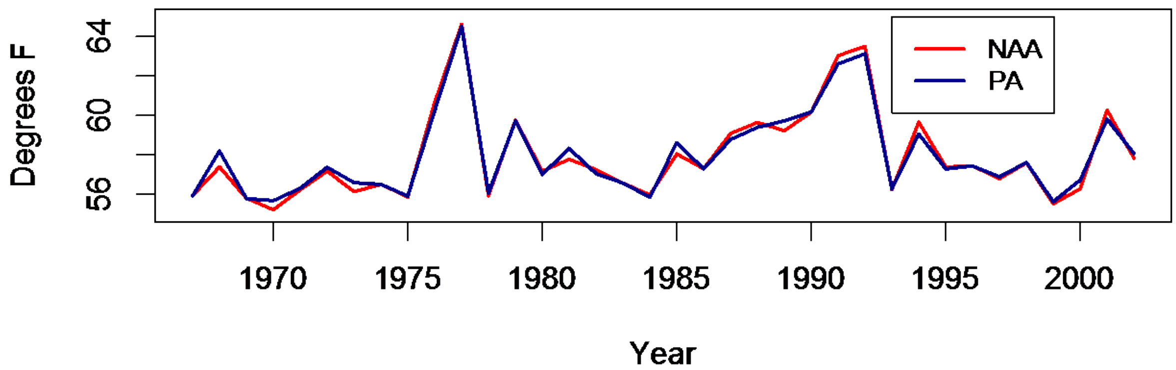


Figure 5.D-163. OBAN: Median log escapement for each of the scenarios.



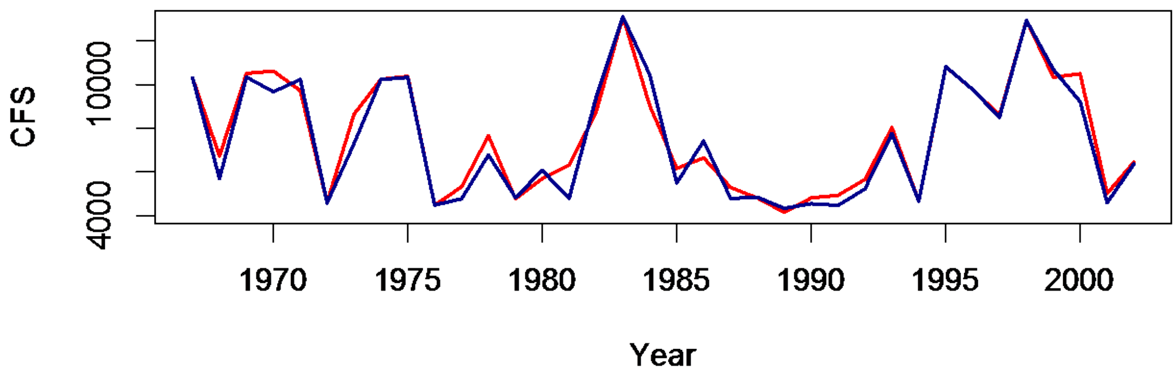


Figure 5.D-164. OBAN: Mean temperature from July to September at Bend Bridge (top) and minimum of monthly average flow between August and November at Bend Bridge in cubic feet per second (CFS) (bottom).

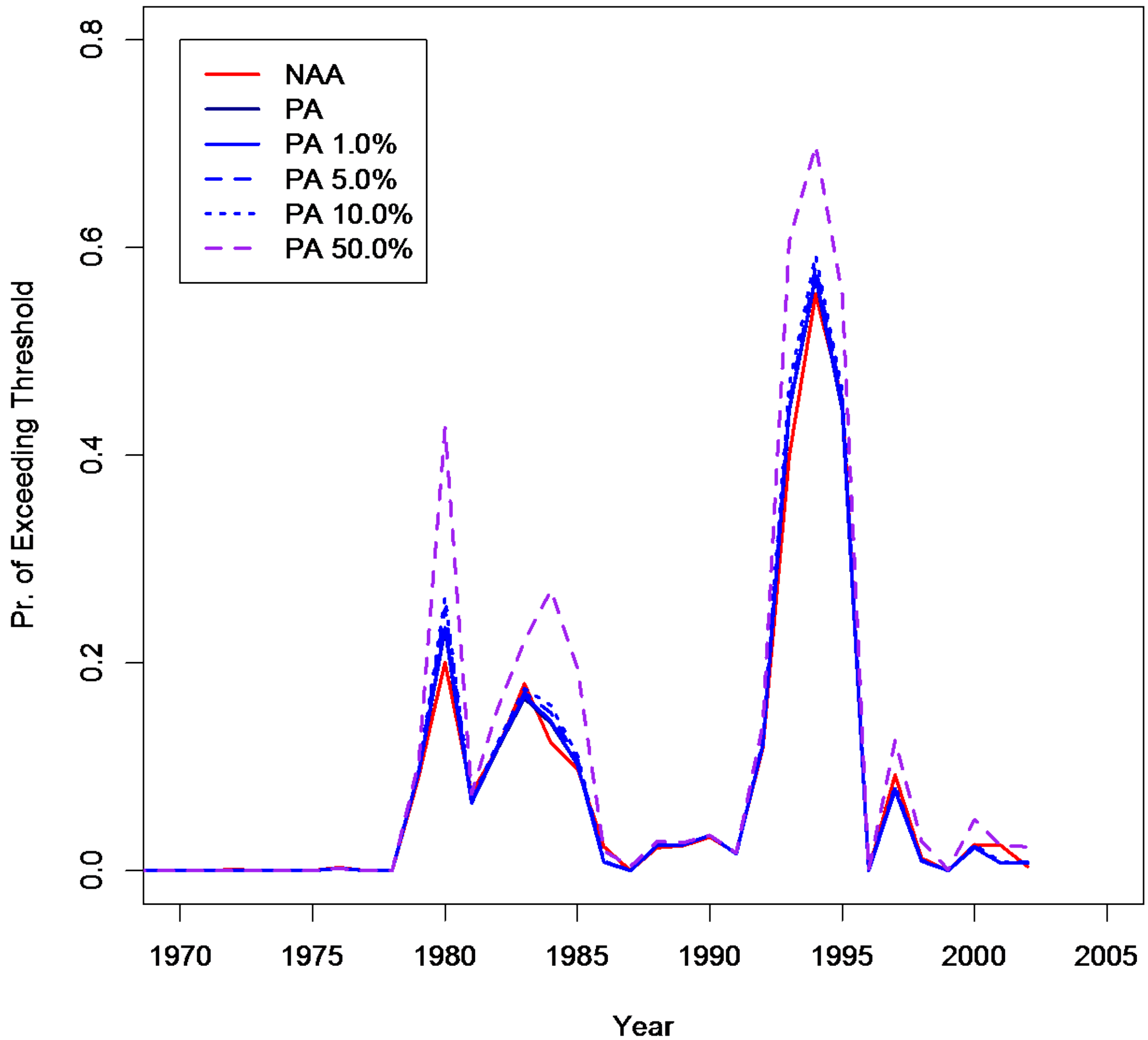


Figure 5.D-165. OBAN: Probability of exceeding quasi-extinction threshold of 200 spawners for each scenario.

The differences between PA and NAA scenarios in the Delta are largely a function of south Delta exports (Figure 5.D-161). The other factor affecting Delta survival is access to Yolo bypass, which was equal for the PA and NAA scenarios. Relative to the historical ranges, the range of south Delta exports under PA was somewhat lower and the range of Yolo access was higher than has been observed historically for some of the simulation years (Figure 5.D-166). Because the OBAN model uses probability distributions to describe the relationship between south Delta exports and Delta survival, the predicted survival values are less certain as the export levels move outside of their historical range (Figure 5.D-167).

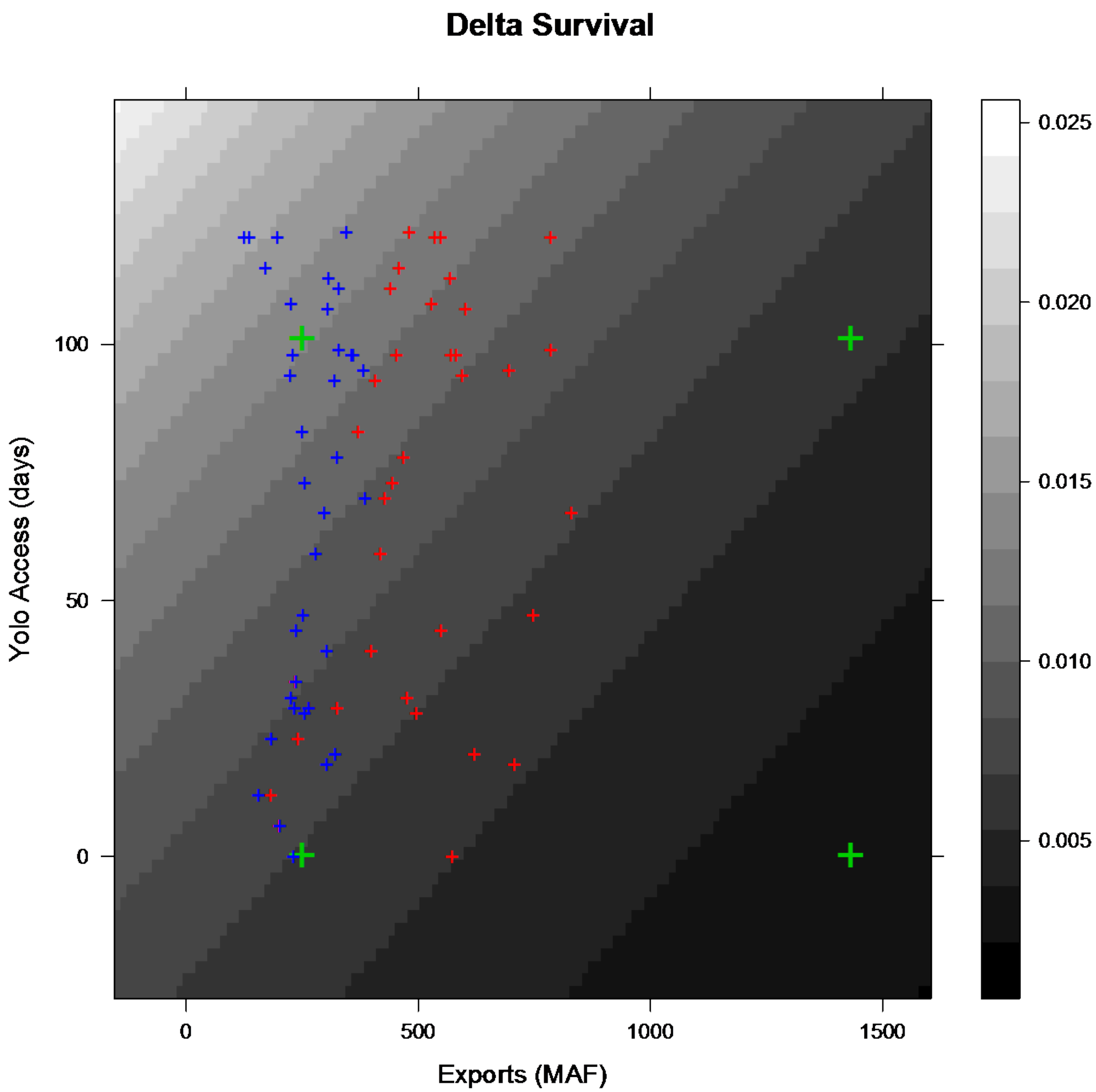


Figure 5.D-166. OBAN: Median survival estimates (surface) in the Delta as a function of Yolo access and south Delta exports. Green crosses indicate bounds of historical data from 1967 to 2010. Annual values of Yolo access and south Delta exports under the NAA (red crosses) and PA (blue crosses).

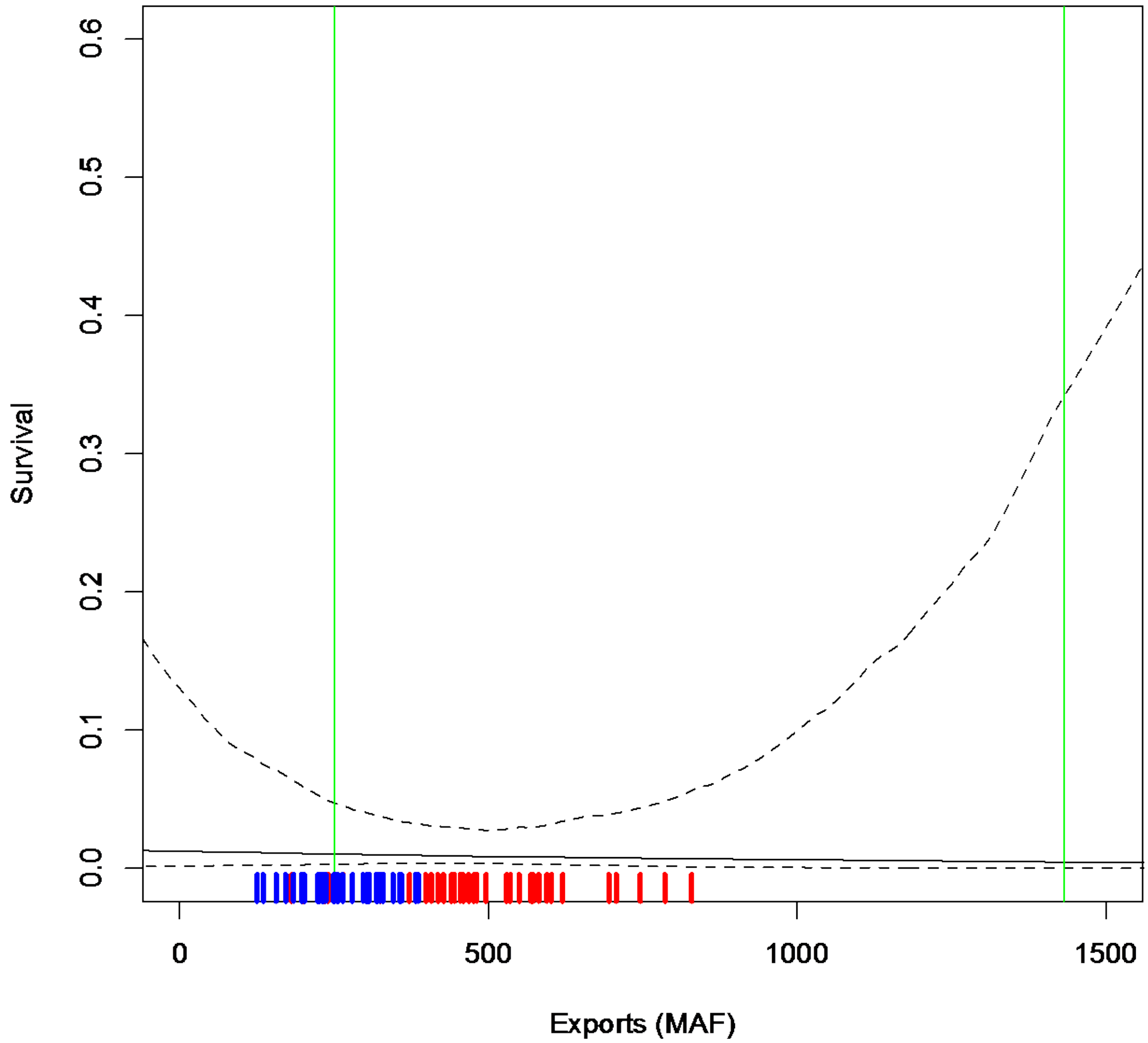


Figure 5.D-167. OBAN: Median relationship (solid black line) and 90% credible intervals (dashed black line) between south Delta exports and survival under 70 days of Yolo access (mean Yolo access under PA). Historical range of export data (vertical green lines) and the export levels under the NAA (red ticks) and PA (blue ticks).

Patterns in relative escapement in PA scenarios versus NAA (Figure 5.D-168 – Figure 5.D-172) were driven by: 1) low escapement levels in 1990 – 1995 in which the relative differences between NAA and PA scenarios were small, and 2) differences in south Delta export levels between PA and NAA. In 1982 and 1983 exports were at their minimum in the PA and maximum in the NAA, thus the relative escapement of PA relative to NAA in 1985 was large. Similar levels of relative escapement occurred in the 1996 to 2002 period. In addition, the 90% credible intervals were broader during these periods due to export levels in the PA scenarios being lower than the historical minimum. This reflects considerable uncertainty in the potential effects of very low south Delta exports that will occur in some years under the PA.

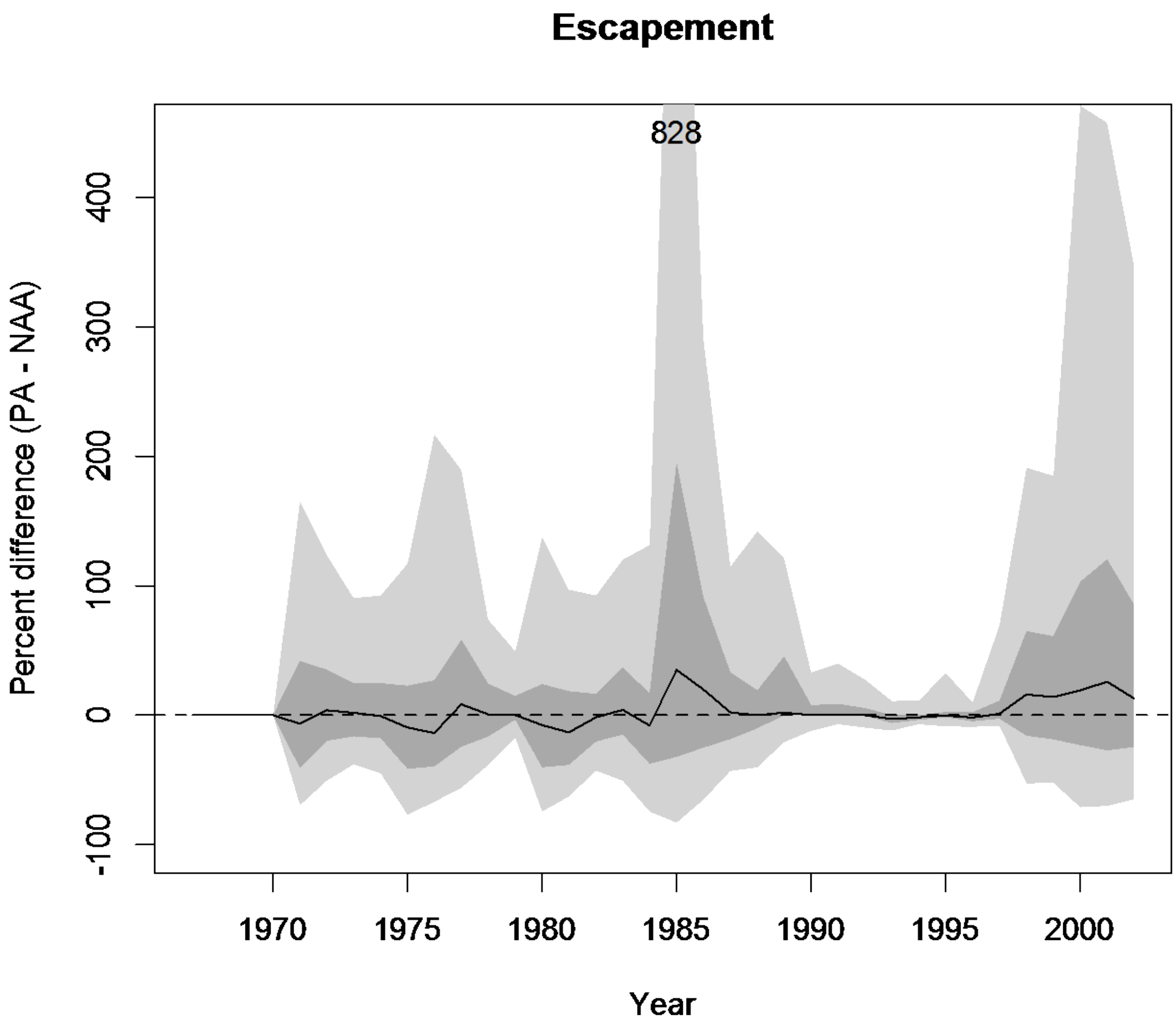


Figure 5.D-168. OBAN: Percent relative difference in escapement of PA compared to NAA (PA – NAA)/NAA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

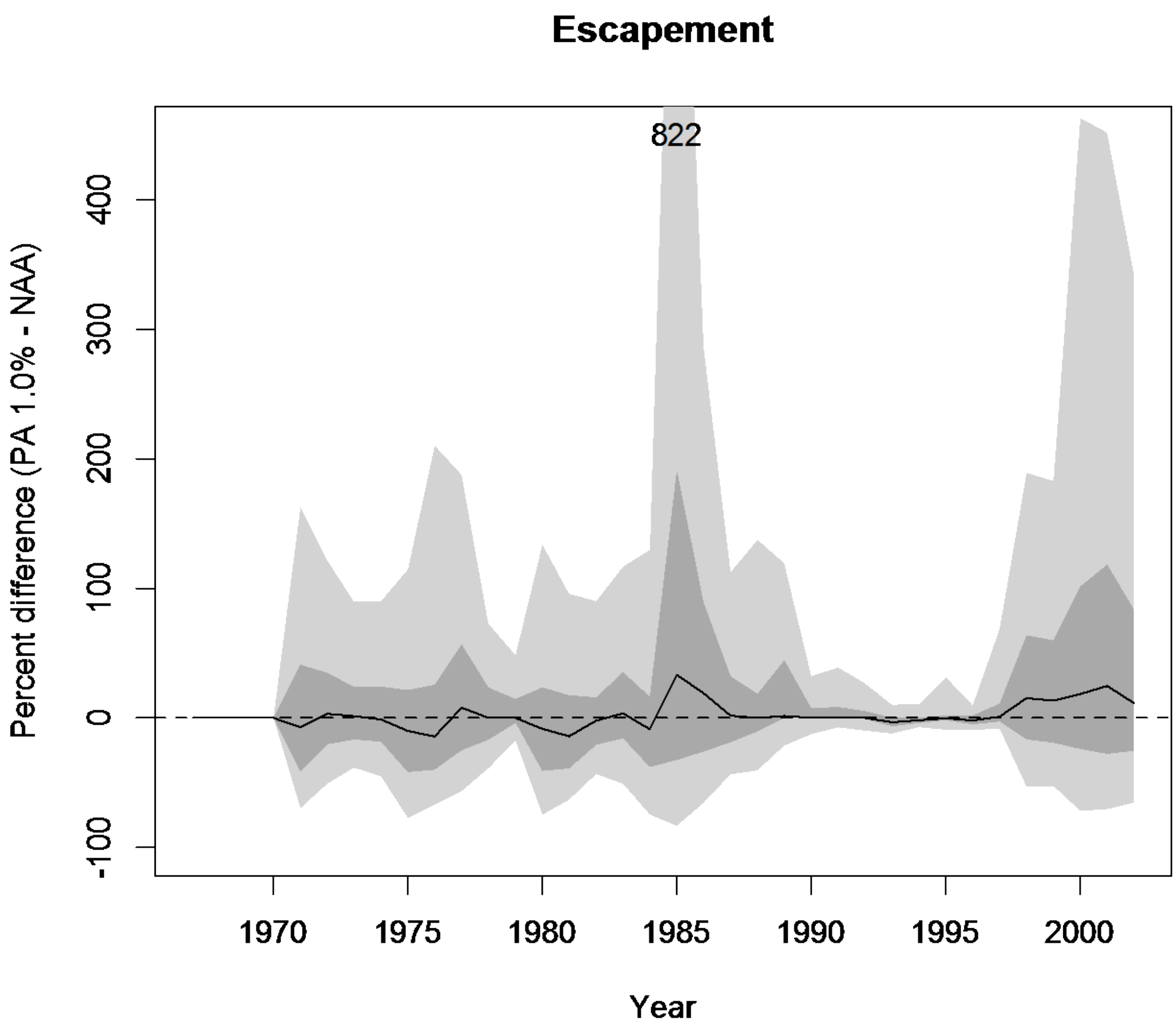


Figure 5.D-169. OBAN: Percent relative difference in escapement of PA 1.0% compared to NAA (PA 1.0% – NAA)/NAA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

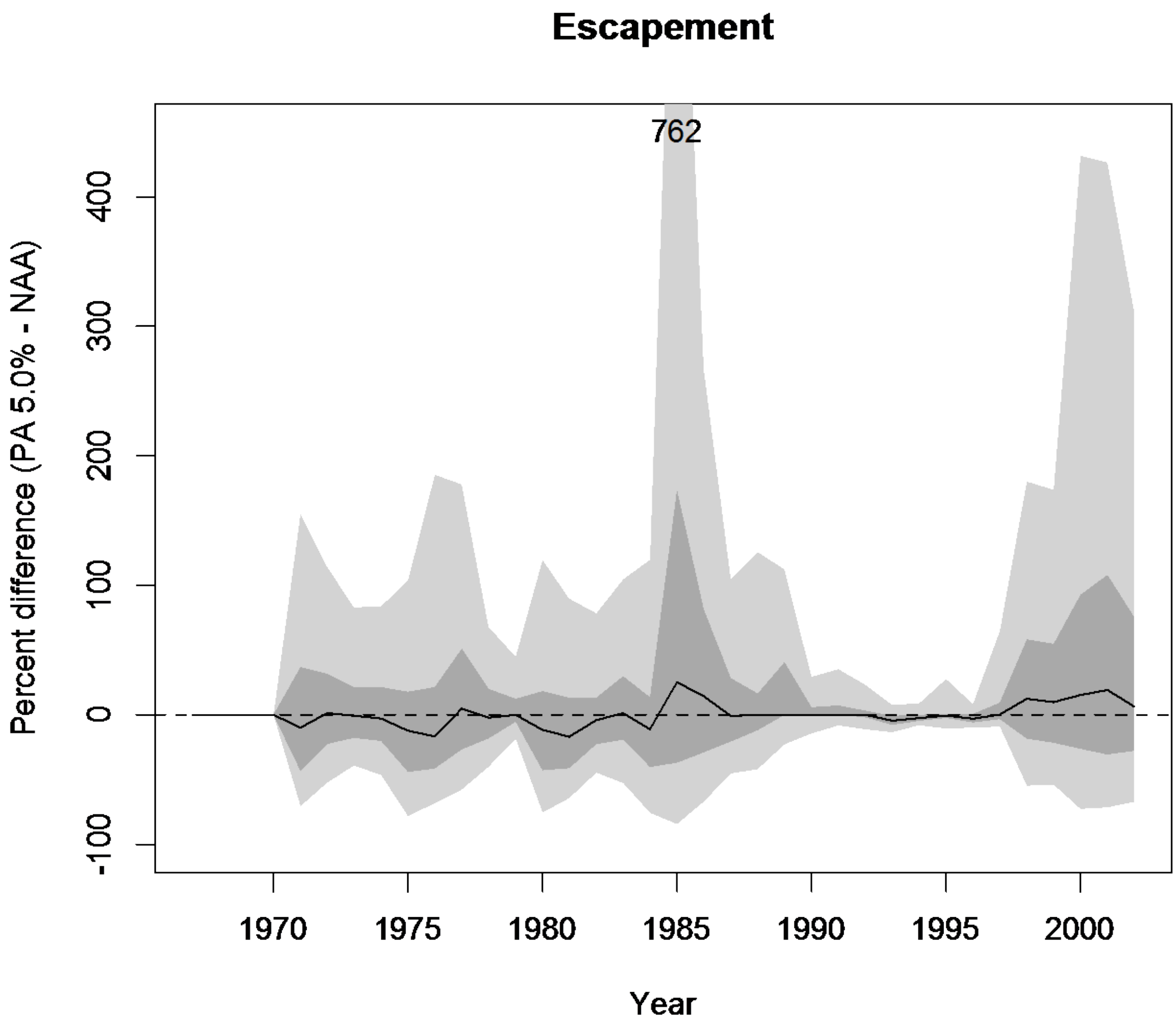


Figure 5.D-170. OBAN: Percent relative difference in escapement of PA 5.0% compared to NAA (PA 5.0% – NAA)/NAA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

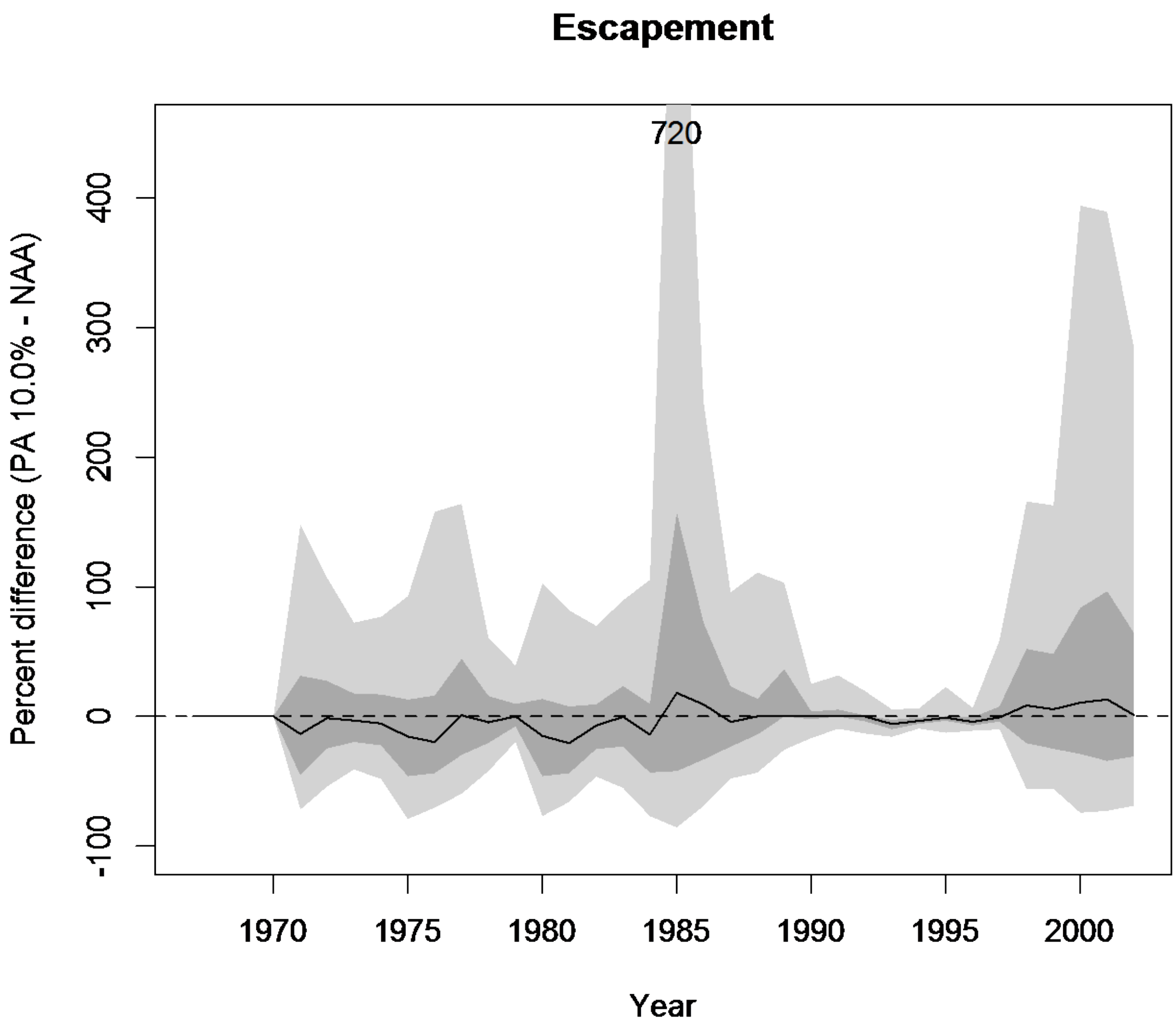


Figure 5.D-171. OBAN: Percent relative difference in escapement of PA 10.0% compared to NAA (PA 10.0% – NAA)/NAA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

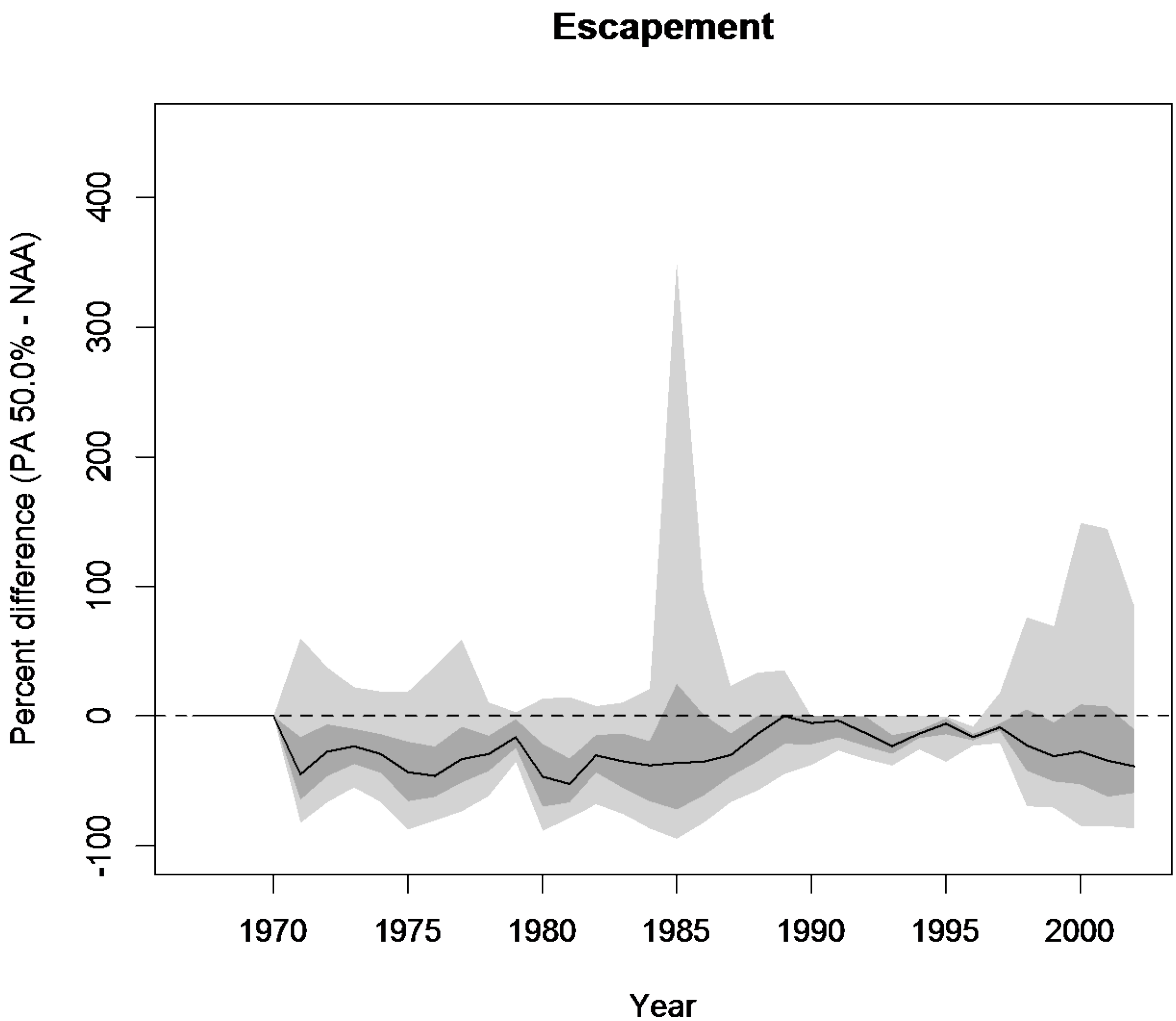


Figure 5.D-172. OBAN: Percent relative difference in escapement of PA 50.0% compared to NAA (PA 50.0% – NAA)/NAA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

Patterns in the relative escapement among NDD mortality scenarios (Figure 5.D-173-Figure 5.D-176) reflected small differences among scenarios during periods of low escapement (1990 – 1995). Yet, during periods of high *absolute* escapement, the effect of NDD mortality became more apparent. These patterns were due to the multiplicative effect of the NDD mortality and thus small absolute effects at low juvenile abundances. The patterns became more pronounced as the assumed NDD mortality rate increased.

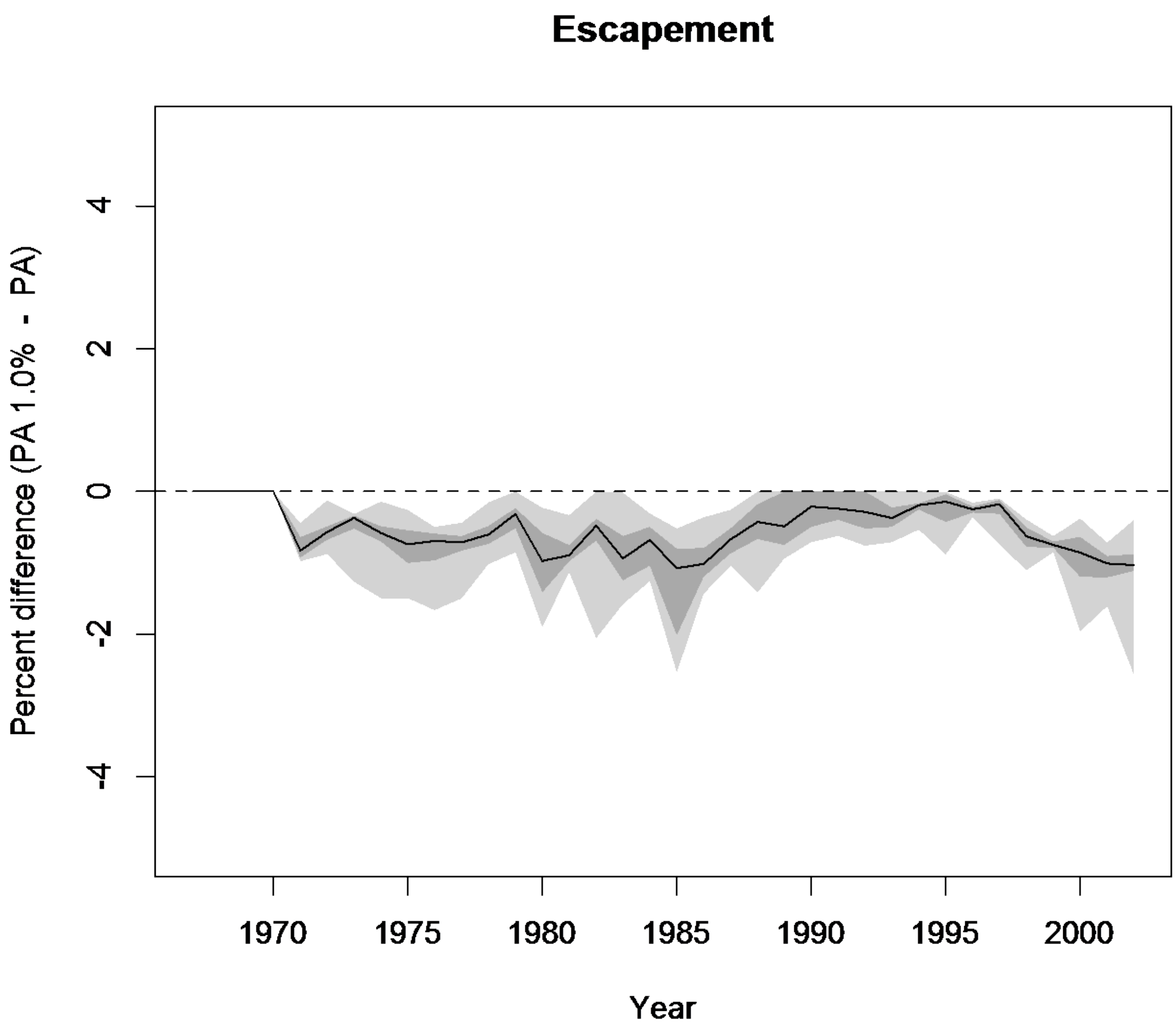


Figure 5.D-173. OBAN: Percent relative difference in escapement of PA 1.0% compared to PA (PA 1.0% – PA)/PA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

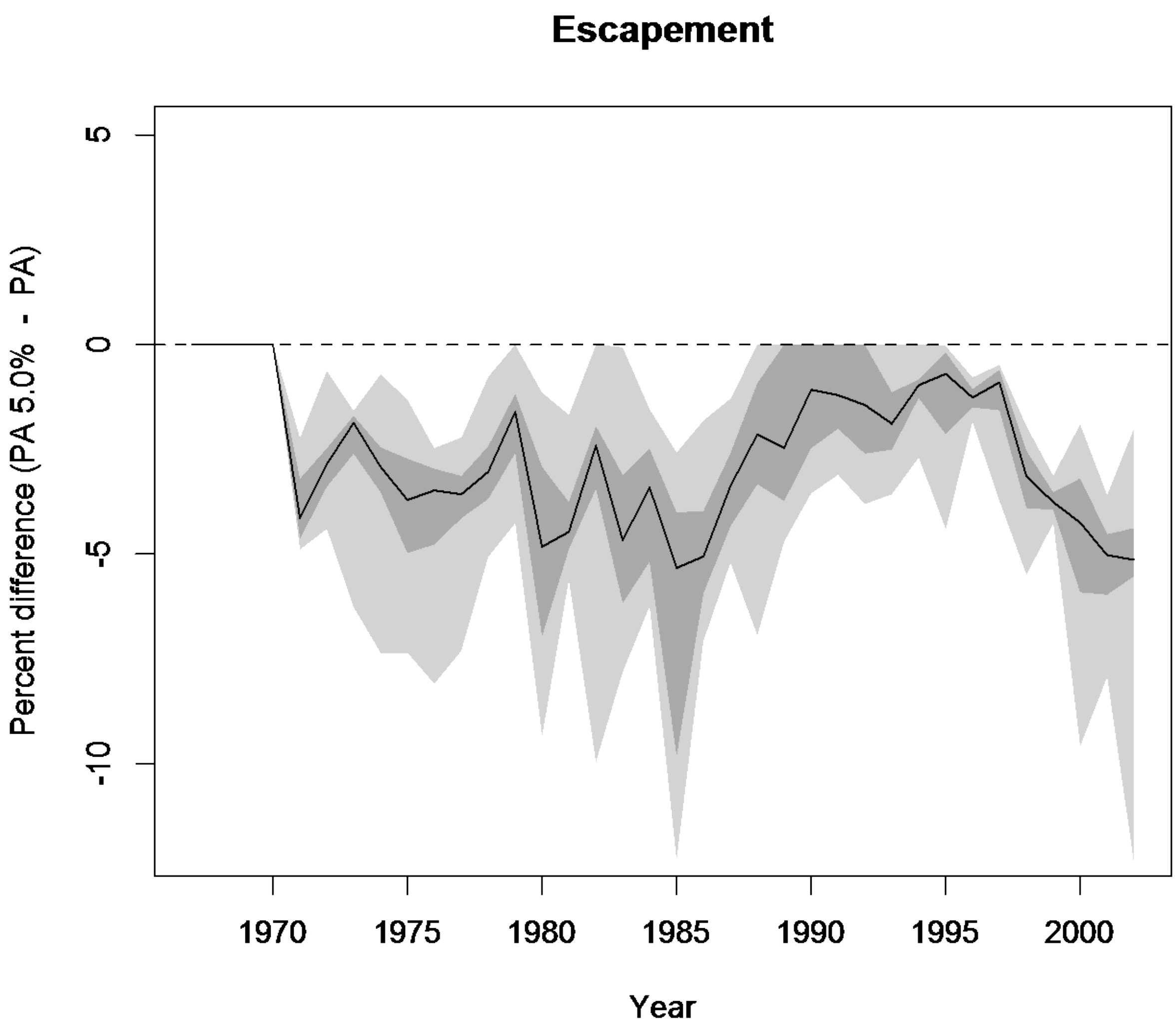


Figure 5.D-174. OBAN: Percent relative difference in escapement of PA 5.0% compared to PA (PA 5.0% – PA)/PA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

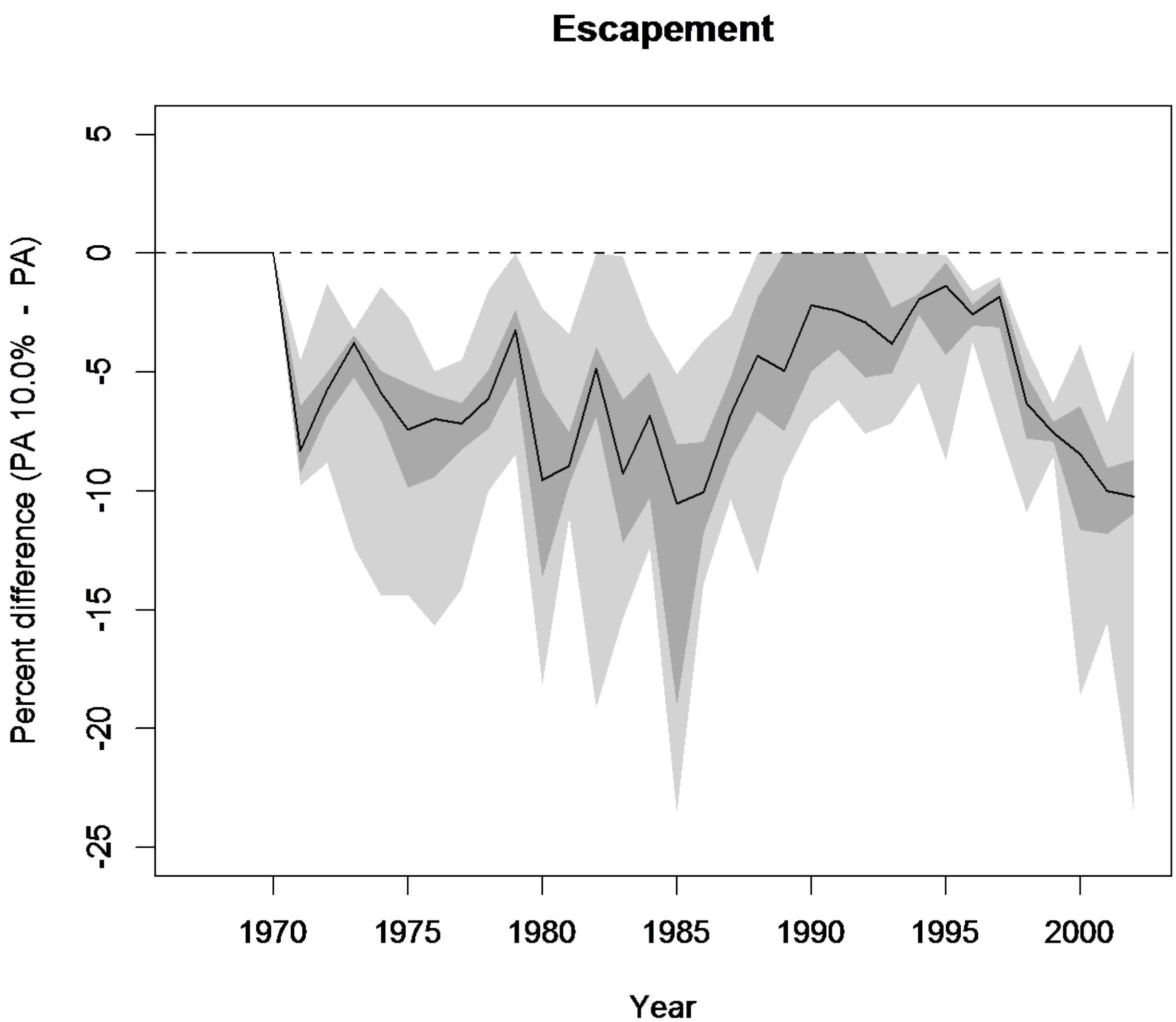


Figure 5.D-175. OBAN: Percent relative difference in escapement of PA 10.0% compared to PA (PA 10.0% – PA)/PA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

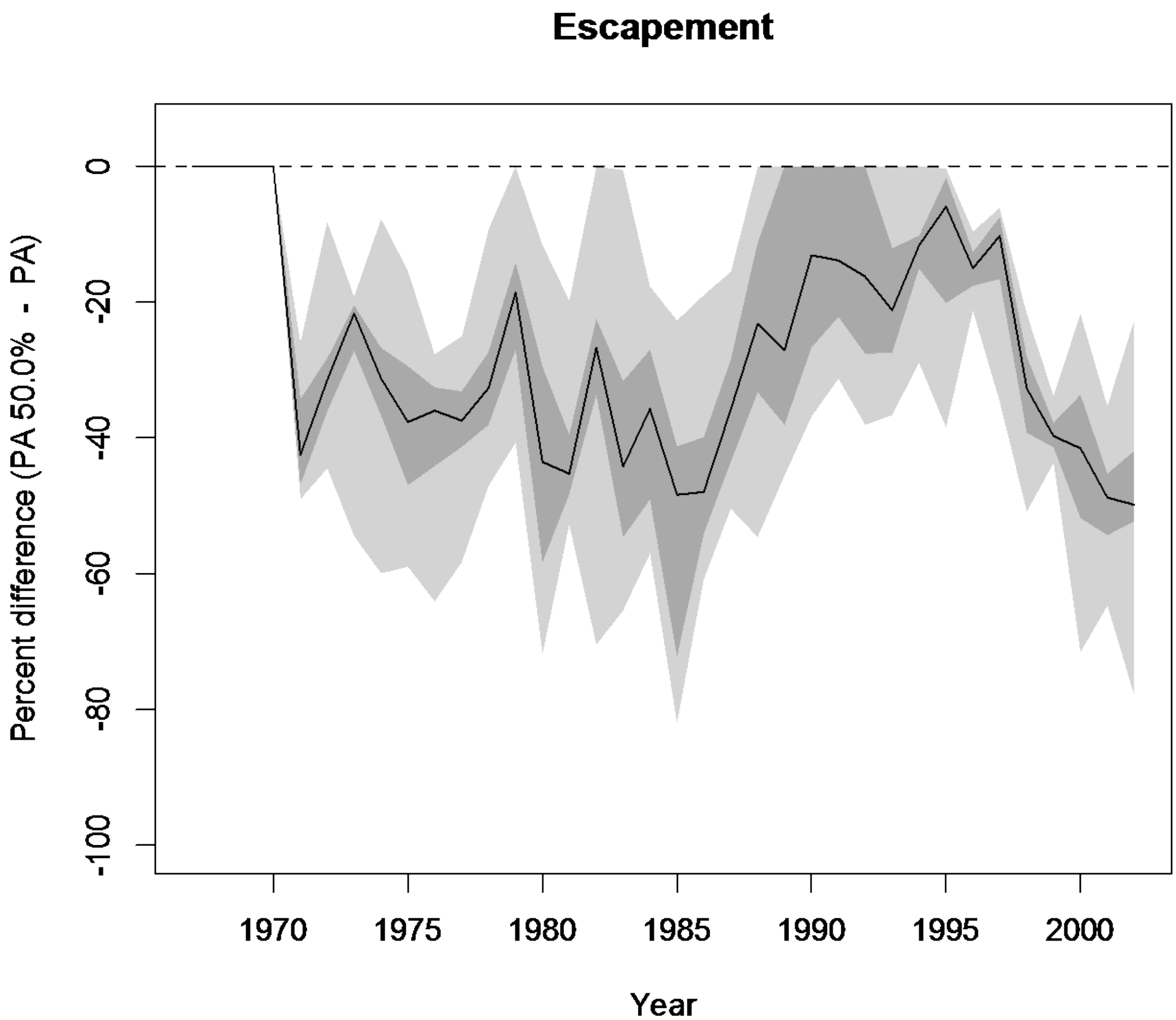


Figure 5.D-176. OBAN: Percent relative difference in escapement of PA 50.0% compared to PA (PA 50.0% – PA)/PA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

Median survival through the Delta varied by scenario as a function of south Delta exports, access to Yolo bypass (which was the same for PA and NAA alternatives), and NDD mortality levels (Figure 5.D-177). The PA 50.0% was consistently the lowest survival through the Delta, with the NAA being second lowest in most years except the late 1980s, late 1990s, and early 2000s.

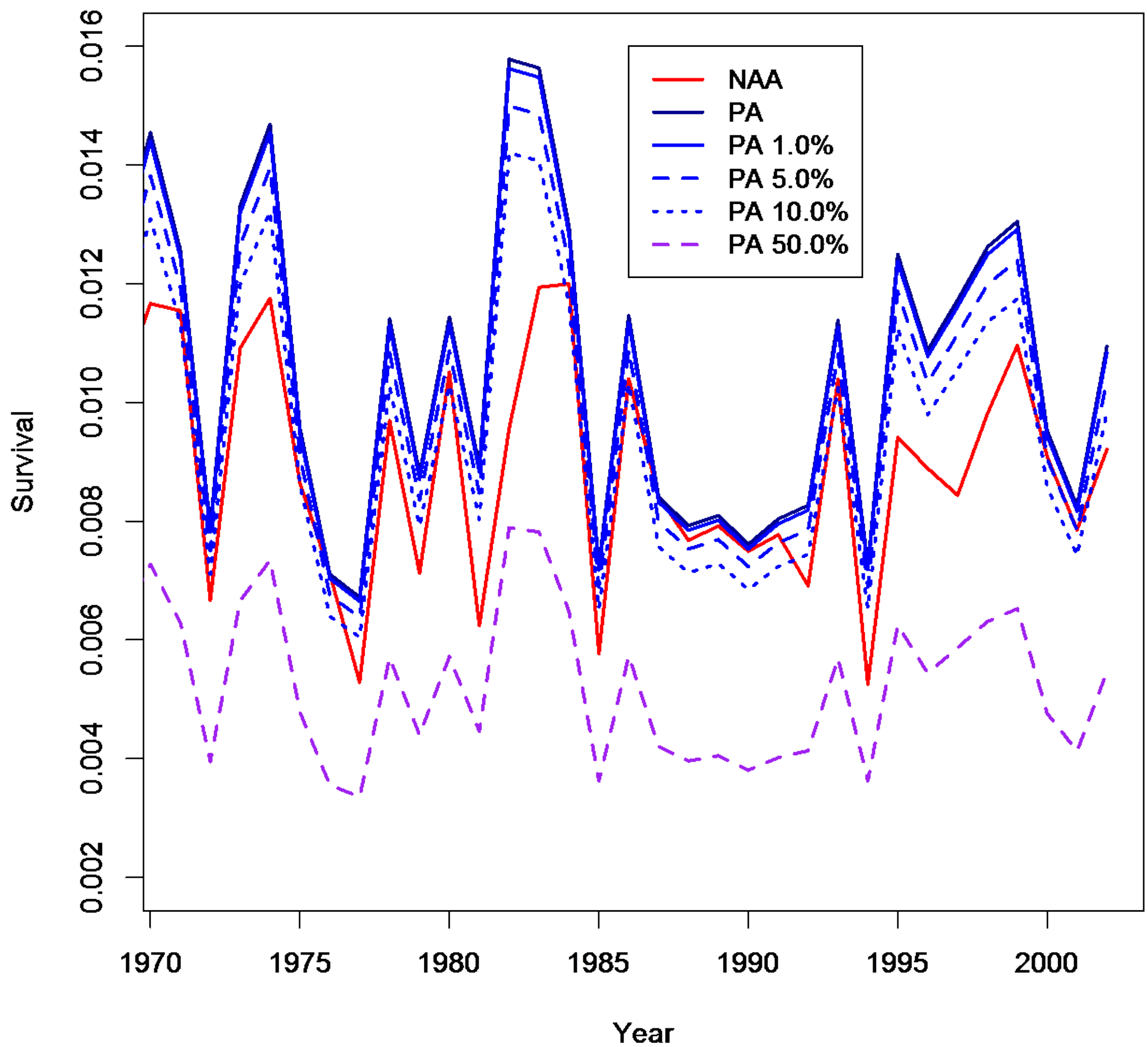


Figure 5.D-177. OBAN: Median Delta survival for each of the scenarios.

Patterns in relative Delta survival between NAA and PA scenarios with different assumptions of NDD mortalities were driven by differences in south Delta export levels (Figure 5.D-178– Figure 5.D-182). South Delta exports during simulation years 1987 – 1990 were similar; therefore, differences in relative survival were small. Yet periods when south delta exports were substantially smaller under PA than NAA (e.g., 1976-1985) led to higher survival rates under PA than NAA. The 90% credible intervals were magnified when differences in export levels were large (e.g., 1985), as a result of south Delta exports being in a range that were outside of historical bounds in those years under the PA scenarios. As previously noted for escapement, this reflects the considerably uncertainty in the potential effects of the very low south Delta exports that will occur in some years under the PA.

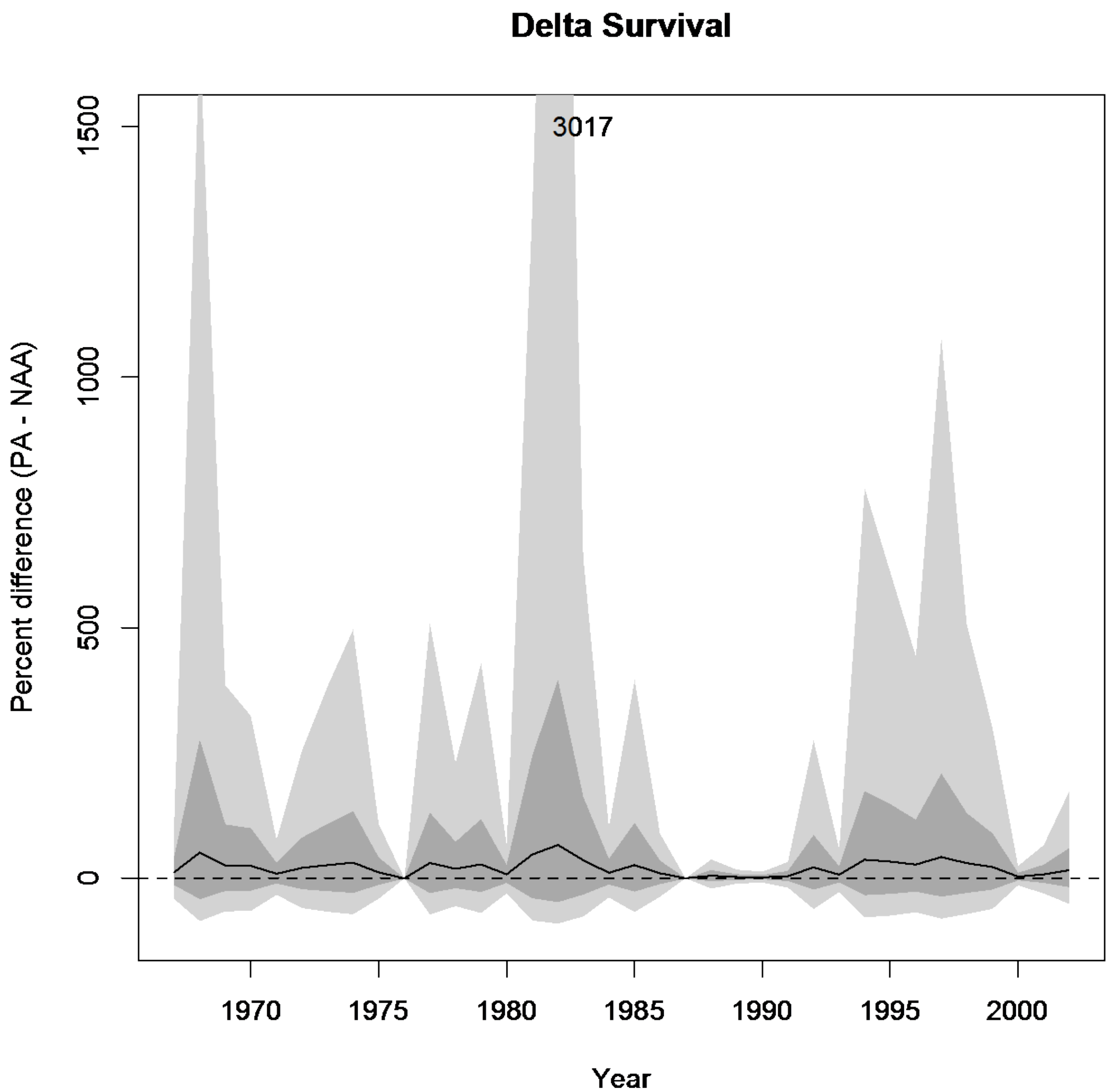


Figure 5.D-178. OBAN: Percent difference in Delta survival of PA compared to NAA (PA – NAA)/NAA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

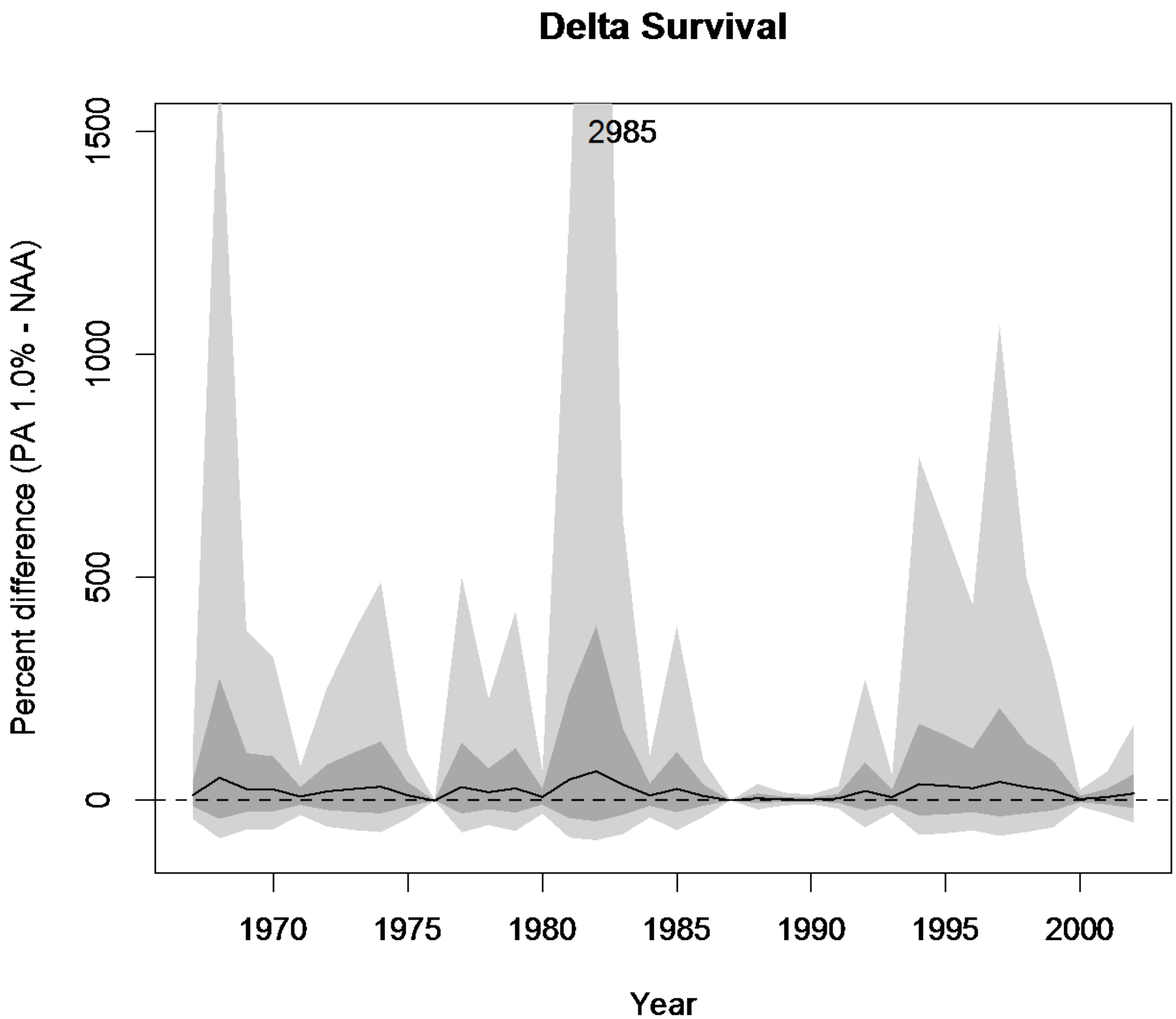


Figure 5.D-179. OBAN: Percent difference in Delta survival of PA 1.0% compared to NAA (PA 1.0% – NAA)/NAA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

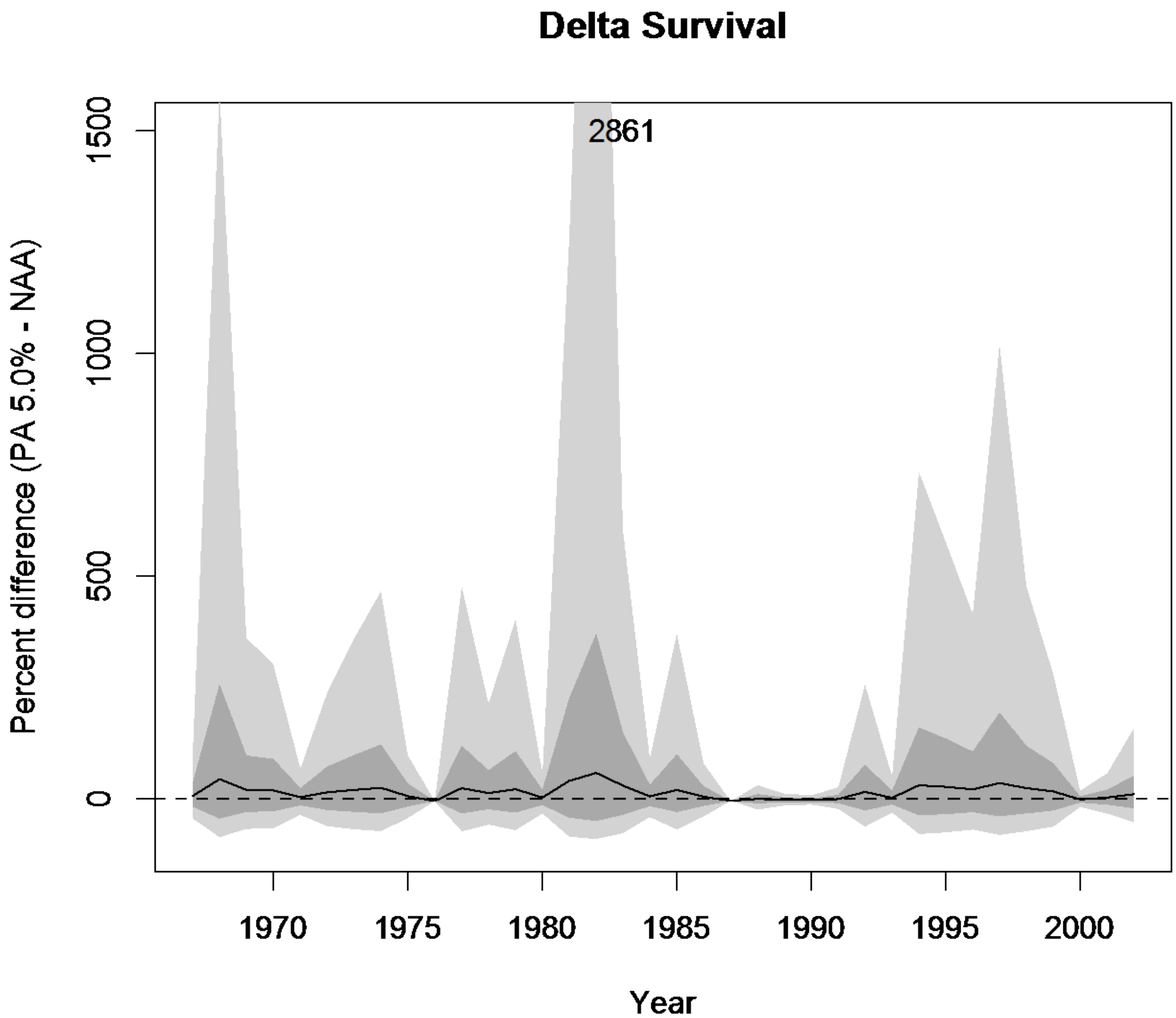


Figure 5.D-180. OBAN: Percent difference in Delta survival of PA 1.0% compared to NAA (PA 5.0% – NAA)/NAA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

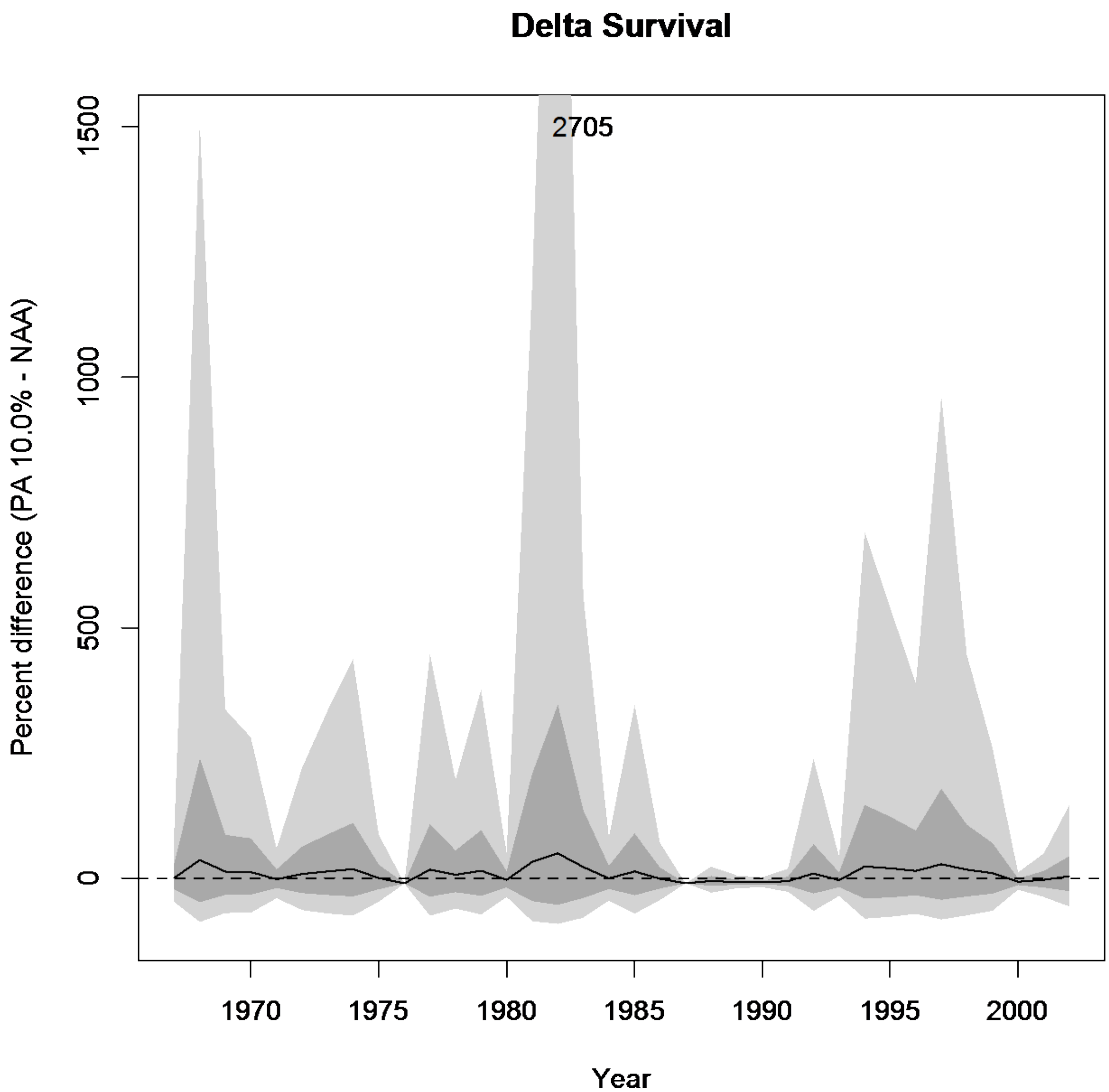


Figure 5.D-181. OBAN: Percent difference in Delta survival of PA 10.0% compared to NAA (PA 10.0% – NAA)/NAA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

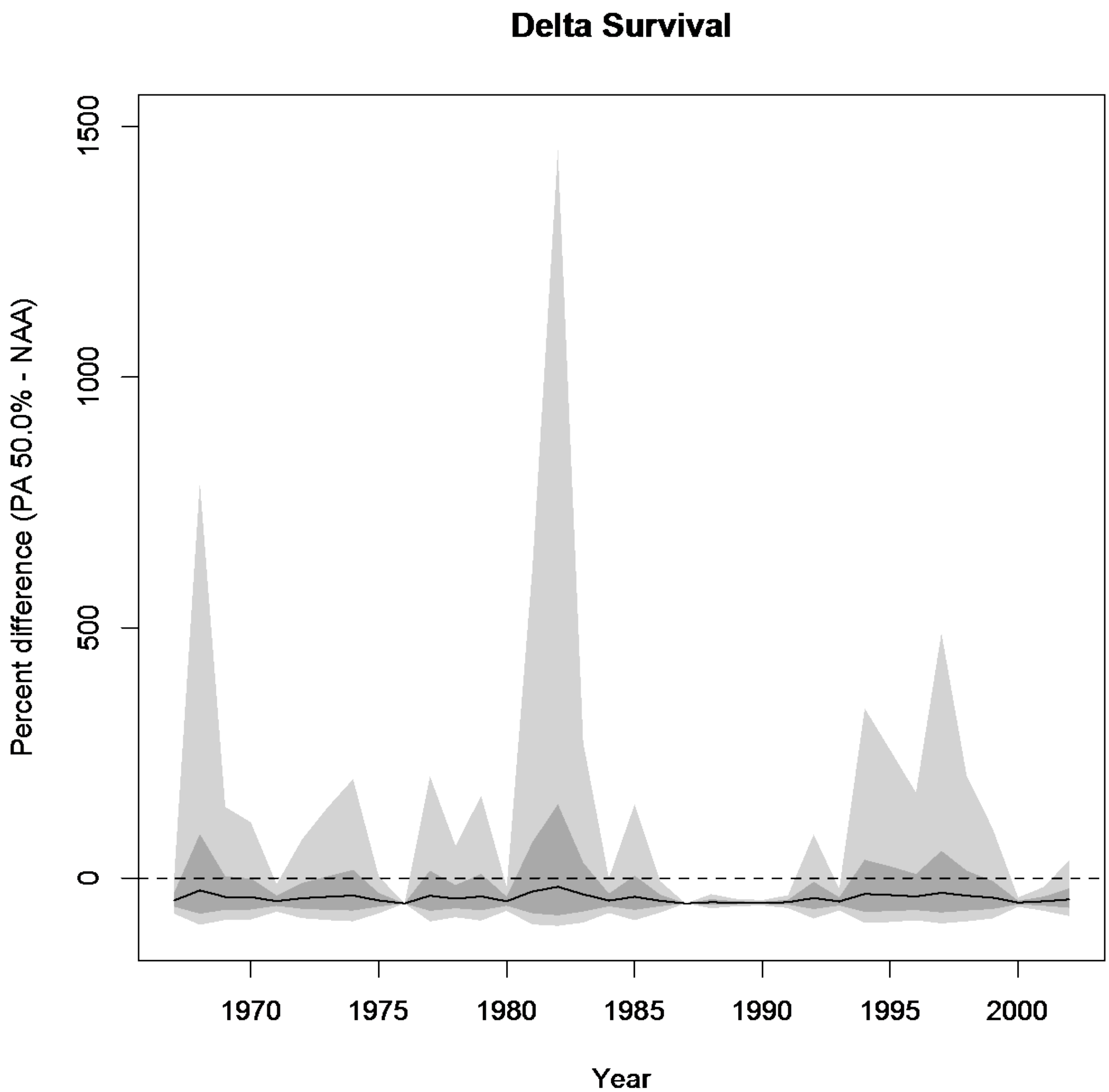


Figure 5.D-182. OBAN: Percent difference in Delta survival of PA 50.0% compared to NAA (PA 50.0% – NAA)/NAA*100%. Median (black line) 50% interval (dark grey) and 90% intervals (light gray) are plotted.

Several key points should be considered when assessing the results of the OBAN analysis:

- The OBAN model uses Monte Carlo simulation to translate uncertainty in the model coefficients to uncertainty in the outcomes. For the present effects analysis, buffering of the NDD mortality effects may have arisen from factors affecting the dynamics 1) among iterations of the simulation that affected the median escapement levels and 2) within an iteration of the simulation that affected the median escapement and the relative percentage difference in escapement.

- Early ocean survival buffered the effects of the NDD mortality among simulations (i.e., across the 1,000 parameter sets) because the coefficients are drawn from probability distributions. Some draws improve survival relative to the NDD mortality effect, whereas others decreased survival. This effect can cancel out if the distributions are symmetric; however, there is asymmetry in both of the ocean productivity marginal distributions that may be influencing this process. The magnitude of this effect varies among years as the ocean productivity covariates are also changing year to year.

- More importantly, the maturity schedule buffers the effects of delta mortality within an iteration (i.e., a specific parameter set) by spreading the effect between age-3 and age-4 spawners. Buffering is maximized as the age-3 maturation rate approaches 0.5. The mean age-3 maturation rate is 0.918, but the 95% credible interval spans (0.681, 0.999); thus, there were many iterations of the Monte Carlo simulation in which substantial buffering between age-3 and age-4 spawners was occurring.

- Finally, the OBAN model operates in log abundance, and 0 abundance causes an undefined mathematical result; therefore, there is a lower bound on the abundances of life stages for numerical stability. Thus, it is possible for scenarios to have the same abundance if they have effectively run against this lower bound. This process occurred in the scenario evaluations, and it was apparent in the sensitivities where there was a 0% difference between scenarios despite having higher NDD mortality.

The analyses assessing the probability of escapement under the PA scenarios being greater than or equal to escapement under the NAA yielded useful information. During the first 4 years of the simulations, all scenarios have the same escapement, as this is the period in which the model is being initiated. As a result, the probability of the PA scenarios equaling the NAA scenario was 1 (Figure 5.D-183). After 1970, the escapements differed, largely as a function of south Delta exports and NDD mortality assumptions, and the probability of higher escapement varied throughout the remainder of the simulation period. The PA had the highest probability of having escapement greater than or equal to the NAA scenario: the probability was greater than 0.5 in 19 of 32 years from 1971 to 2002. There were several years where the probability was less than 0.50 of having higher escapement under PA relative to NAA, in particular 1991 to 1995 during which the modeled escapement was at its lowest levels in the simulation period. Likewise, there were periods in which the probability of higher escapement under the PA scenarios (PA, PA 1.0%, PA 5.0%, PA 10.0%) relative to NAA was greater than 0.5, such as 1985- 1991 and 1996 – 2003. Both of these periods had moderate levels of escapement, with the 1996 – 2003 period being a recovery period from the 1995 low. With assumptions of increasing NDD mortality, the number of years under the PA scenarios having a probability of greater or equal escapement as under the NAA decreased: for PA 5.0%, 16 of 32 years had probability greater than 0.5; for PA 10.0%, 12 of 32 years had probability greater than 0.5; and for PA 50.0%, only one year had probability (marginally) greater than 0.5 (Figure 5.D-183).

As would be expected, there was a trade-off between the level of NDD mortality and the reduction in south delta exports. Based on a 0.5 probability of having escapement greater than or equal to the NAA, the OBAN results suggested that NDD mortality of 5% would result in half of years being above this threshold and half below. Higher levels of NDD-associated mortality would increase the probability of lower escapement under the PA relative to the NAA, whereas lower levels of NDD-associated mortality would increase the probability of higher escapement under the PA relative to the NAA. Note, however, that the probability of having greater escapement under the PA scenarios relative to NAA was essentially never at high or low levels of probability (i.e., >0.9 or <0.1), except for the comparison of PA 50.0% to NAA in 1996 (Figure 5.D-183). This reflects the fact there was considerable variability in escapement estimates for each year, based on the 1,000 randomly drawn parameter sets; as previously shown, the 90% probability intervals for escapement overlapped in nearly all years when comparing the PA scenarios to NAA (Figure 5.D-168–Figure 5.D-172).

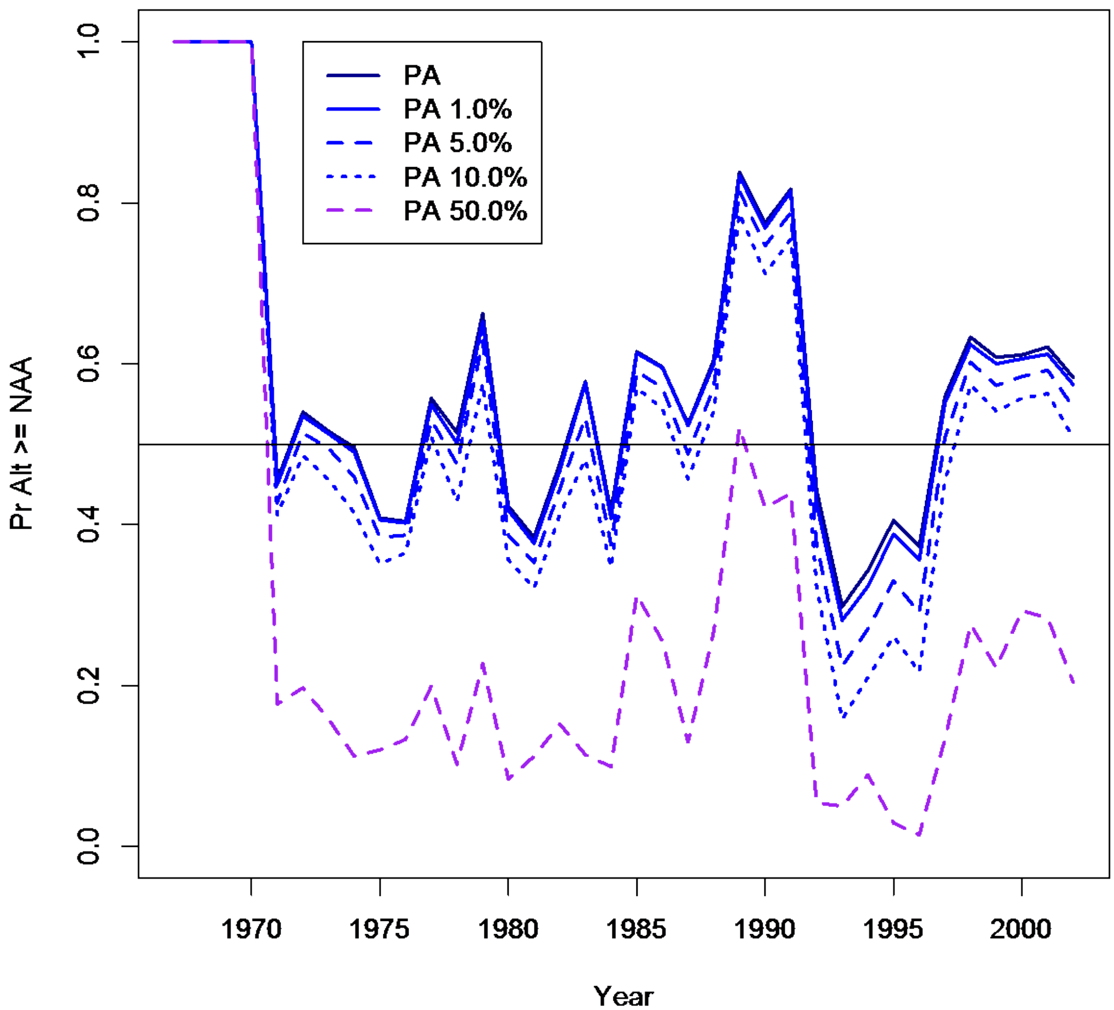


Figure 5.D-183. OBAN: Probability of higher annual abundance in a PA scenario relative to the NAA scenario. The horizontal black line at 0.5 indicates an equal probability that escapement is higher in a PA scenario relative to the NAA scenario.

5.D.4 References

5.D.4.1 Written References

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