Appendix 8M
Selenium in Sturgeon

Project-related changes in waterborne concentrations of selenium in the Sacramento–San Joaquin River Delta (Delta) may result in increased selenium bioaccumulation and/or toxicity to aquatic and semi-aquatic receptors using the Delta. Historical fish tissue data and measured (at Vernalis) or DSM2-modeled (other locations) waterborne selenium concentrations for selected locations in 2000, 2005, and 2007 were used to calibrate a model for water-to-tissue relationships in largemouth bass (*Micropterus salmoides*; see Appendix M). That model was used to compare project alternatives to Existing Conditions and the No Action Alternative for impact assessment. It, as well as the one presented in this Addendum, generally follow procedures described by Presser and Luoma (2010) for selenium modeling. Additional information from the recently published ecosystem-scale selenium model for the San Francisco Bay-Delta Regional Ecosystem Restoration Implementation Plan (Presser and Luoma 2013) also was used in this Addendum.

Comments from the United States Fish and Wildlife Service (USFWS) and discussions with Dr. Sam Luoma indicated that selenium bioaccumulation in largemouth bass is not representative of the greater bioaccumulation rates observed for sturgeon (green sturgeon, *Acipenser medirostris,* and white sturgeon, *A. transmontanus*) that feed, in part, on overbite clams (*Corbula* [*Potamocorbula*] *amurensis*) in Suisun Bay and may do so in the western portion of the Delta under future conditions. Therefore, DSM2-modeled waterborne selenium concentrations from the two western-most locations in the Delta (Sacramento River at Mallard Island and San Joaquin River at Antioch Ship Channel) were used to model selenium bioaccumulation for sturgeon at those two locations to supplement the modeling done for largemouth bass for the BDCP EIR/EIS.

The data and processes used to estimate this selenium bioaccumulation in sturgeon in the western Delta are described in the following sections.

8M.1 Selenium Concentrations in Water

Dissolved selenium concentrations in water were estimated for the Sacramento River at Mallard Island and San Joaquin River at Antioch Ship Channel locations as described in Appendix M and presented in Table M-10A and M-10B of the BDCP EIR/EIS. Selenium concentrations were estimated under existing conditions, and 13 late long-term (LLT) scenarios (i.e., No Action plus nine alternatives, with four scenarios under Alternative 4) for each location for "All" and "Drought" conditions.

DSM2-modeled selenium concentrations for the Sacramento River at Mallard Island and the San Joaquin River at Antioch Ship Channel are presented in Table 8M-1.

8M.2 Methodology for Bioaccumulation of Selenium into Whole-body Sturgeon

Selenium concentrations in whole-body surgeon were calculated using ecosystem-scale models developed by Presser and Luoma (2013). The models were developed using biogeochemical and physiological factors from laboratory and field studies; information on loading, speciation, and transformation to particulate material; bioavailability; bioaccumulation in invertebrates; and trophic transfer to predators. Important components of the methodology included (1) empirically determined environmental partitioning factors between water and particulate material that quantify the effects of dissolved speciation and phase transformation; (2) concentrations of selenium in living and nonliving particulates at the base of the foodweb that determine selenium bioavailability to invertebrates; and (3) selenium biodynamic foodweb transfer factors that quantify the physiological potential for bioaccumulation from particulate matter to consumer organisms and prey to their predators.

8M.2.1 Methodology for Estimation of Selenium Concentration in Particulates

Phase transformation reactions from dissolved to particulate selenium are the primary form by which selenium enters the food web. Presser and Luoma (2013) used field observations to quantify the relationship between particulate material and dissolved selenium as provided below.

$$C_{particulate} = K_d \bullet C_{watercolumn} \qquad \text{[Eq. 1]}$$

Where:

$C_{particulate}$ = selenium concentration in particulate material (micrograms/kilogram, dry weight [µg/kg dw])

$C_{water\ column}$ = selenium concentration in water column (µg/L)

K_d = particulate/water ratio

The K_d describes the particulate/water ratio at the moment the sample was taken and should not be interpreted as an equilibrium constant (as it sometimes is). It can vary widely among hydrologic environments and potentially among seasons (Presser and Luoma 2010). In addition, other factors such as speciation, residence time, and particle type affect K_d. Residence time of selenium is usually the most influential factor on the conditions in the receiving water environment. Short water residence times (e.g., streams and rivers) limit partitioning of selenium into particulate material. Conversely, longer residence times (e.g., sloughs, lakes, and estuaries) allow greater uptake by plants, algae, and microorganisms. Furthermore, environments in downstream portions of a watershed can receive cumulative contributions of upstream recycling in a hydrologic system. Due to its high variability, K_d is a large source of uncertainty in the model, especially if translation of selenium concentration in the water column is necessary.

Presser and Luoma (2013) determined K_d values for San Francisco Bay (including Carquinez Strait – Suisun Bay) during “low flow” conditions (5,986) and “average” conditions (3,317). These values were used to model selenium concentrations in particulates for “Drought” and “All” conditions at the two locations in the western Delta.

8M.2.2 Methodology for Estimation of Selenium Concentrations in Invertebrates

Species-specific trophic transfer factors (TTFs) for transfer of selenium from particulates to prey and to predators were developed using data from laboratory experiments and field studies (Presser and Luoma 2013).

TTFs for estimating selenium concentrations in invertebrate prey were calculated using the following equation:

$$TTF_{invertebrate} = \frac{C_{invertebrate}}{C_{particulate}} \qquad \text{(Eq. 2)}$$

Where:

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate prey

$C_{invertebrate}$ = concentration of selenium in invertebrate prey (μg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (μg/g dw)

Sturgeon in the western Delta, Carquinez Strait, and Suisun Bay typically prey on a mix of clams (including *Corbicula amurensis*, which is known to be an efficient bioaccumulator of selenium) and crustaceans. Presser and Luoma (2013) assumed a diet of 50 percent clams and 50 percent amphipods and other crustaceans in their model. Based on this diet, the authors reported a TTF of 9.2 (identified as TTF_{prey} in Table 1 of Presser and Luoma [2013]). This TTF was used to calculate concentrations in sturgeon invertebrate prey at the San Joaquin River at Antioch and Sacramento River at Mallard Island locations.

8M.2.3 Methodology for Estimation of Selenium Concentrations in Whole-body Sturgeon

The mechanistic equation for modeling of selenium bioaccumulation in fish tissue is similar to that for invertebrates if whole-body concentrations are the endpoint (Presser and Luoma 2013), as follows:

$$TTF_{fish} = \frac{C_{fish}}{C_{invertebrate}}$$

$$where:$$

$$C_{invertebrate} = C_{particulate} \bullet TTF_{invertebrate}$$

$$therefore:$$

$$C_{fish} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \qquad \text{(Eq. 3)}$$

Where:

C_{fish} = concentration of selenium in fish (μg/g dw)

$C_{invertebrate}$ = concentration of selenium in invertebrate (μg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (μg/g dw)

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

TTF_{fish} = trophic transfer factor from invertebrate to fish

A TTF of 1.3 (identified as $TTF_{predator}$ in the paper) was reported for sturgeon in Table 1 of Presser and Luoma (2013) and was used to calculate concentrations of selenium in sturgeon for the two western Delta locations according to the following model:

$$C_{sturgeon} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \quad \text{(Eq. 4)}$$

Where:

$C_{sturgeon}$ = concentration of selenium in whole-body sturgeon (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

$TTF_{invertebrate}$ = Trophic transfer factor from particulate material to invertebrate prey (9.2)

TTF_{fish} = Trophic transfer factor from invertebrate to fish predator (1.3)

In this model, the particulate selenium concentration was estimated using Equation 1 and a K_d of 5,986 (for Drought conditions) or 3,317 (for All).

8M.3 Results of Estimation of Selenium Concentrations in Whole-body Sturgeon

8M.3.1 Selenium Concentrations in Sturgeon

The outputs of estimated selenium concentrations in sturgeon at the two western Delta locations under each scenario are presented in Table 8M-2.

Modeled selenium concentrations for sturgeon under Existing Conditions, No Action Alternative Late Long Term (NAA-LLT), and Alternatives 1 through 9 for the BDCP EIR/EIS are lowest during "All" conditions compared to "Drought" conditions within both of the western Delta locations evaluated (Table 8M-2). For the San Joaquin River at Antioch, modeled selenium concentrations for sturgeon ranged from 12.3 to 15.1 mg/kg (dw) during All conditions for Existing Conditions, NAA-LLT, and across the alternatives, and from 19.3 to 22.9 mg/kg (dw) during Drought conditions. The lowest values (12.3 mg/kg, dw for All and 19.3 mg/kg, dw for Drought) were estimated for Existing Conditions and NAA-LLT, whereas Alternative 9-LLT had the highest concentrations under both All and Drought conditions (15.1 and 22.9 mg/kg, dw, respectively). Whole-body sturgeon selenium concentrations for All conditions under Alternative 6-LLT also had the highest value of 15.1 mg/kg, dw, but concentrations for Drought conditions for this alternative as well as Alternatives 7-LLT and 8-LLT were slightly less than those for Alternative 9-LLT (22.2 mg/kg, dw compared to 22.9 mg/kg, dw).

Existing Conditions, NAA-LLT, and Alternative 3-LLT had the lowest concentrations (9.92 mg/kg, dw for All and 15.0 mg/kg, dw for Drought [and Alternatives 1-LLT, 4 H1, 4 H2, and 5-LLT also were similar for Drought conditions]) among the alternatives modeled for the Sacramento River at Mallard Island (Table 8M-2). The highest whole-body selenium concentrations were estimated for Alternative 6-LLT (11.9 mg/kg, dw for All and 17.2 mg/kg, dw for Drought). Alternatives 6-LLT, 7-LLT and 8-LLT were predicted to have the same concentration under Drought conditions, but Alternatives 7-LLT and 8-LLT had a slightly lower estimated concentration under All conditions compared to Alternative 6-LLT (11.5 mg/kg, dw compared to 11.9 mg/kg, dw).

Presser and Luoma (2013) present low and high benchmark values for whole-body fish tissue that they developed from the available toxicity data. The low benchmark is 5 mg/kg (dw) and the high value is 8 mg/kg (dw) in whole-body fish. Modeled selenium concentrations in whole-body sturgeon exceeded these benchmarks under Existing Conditions, NAA-LLT, and each alternative for both All and Drought conditions at both western Delta locations (Table 8M-3).

The increases in selenium concentrations in sturgeon modeled to occur under Alternatives 1-5, relative to Existing Conditions and the No Action Alternative, are 3-10%, whereas the increases modeled for Alternatives 6-9 are 20-23%. Although green sturgeon spend much of their lives in the ocean, coming into the estuary or rivers mainly to spawn, white sturgeon typically spend most of their lives in the estuary. However, they are known to move in response to salinity changes, and do migrate up the Sacramento River to spawn, and thus do not spend their entire lives in one localized area (Moyle 2002). Thus, given that the modeled estimates of selenium bioaccumulation in sturgeon at the two westernmost Delta locations represent long term, worst-case conditions for a fish spending most of its life in this vicinity, it is likely that actual selenium levels in sturgeon would be highly variable. This is due to the variety in prey concentrations experienced by a sturgeon that moves from one part of the estuary to another, and up into the Sacramento River to spawn, the variety in diets between individuals, and the range in TTFs of sturgeon from San Francisco Bay cited in Presser and Luoma 2013 (0.6 to 1.7). Because the scenario modeled represents long-term, worst-case conditions, the actual increases in selenium concentrations in sturgeon would likely be less than modeled herein.

Furthermore, the estimates of selenium concentrations in sturgeon are based in part on estimates of water concentrations of selenium in the western Delta. Discharges from point sources in North San Francisco Bay (i.e., refineries) that contribute selenium to Suisun Bay and the western Delta are expected to be reduced through a TMDL under development by the San Francisco Bay Water Board that is expected to result in decreasing discharges of selenium. Nonpoint sources of selenium in the San Joaquin Valley that contribute selenium to the San Joaquin River, and thus the Delta and Suisun Bay, will be controlled through a TMDL developed by the Central Valley Water Board (2001) for the lower San Joaquin River, established limits for the Grassland Bypass Project, and Basin Plan objectives (Central Valley Water Board 2010) that are expected to result in decreasing discharges of selenium from the San Joaquin River to the Delta.

Given the variability of concentrations expected at the individual level, decreasing concentrations in source waters to the Delta and Suisun Bay expected as described above, and the uncertainties in the water concentration modeling and subsequent bioaccumulation modeling presented above, it is unlikely that the increases in whole-body selenium for sturgeon modeled for Alternatives 1-5 would be measurable in the environment. Conversely, the increases modeled for Alternatives 6-9 are high enough that they may represent measurable increases in the environment. However, there is also uncertainty about the biological significance of these increases, given the uncertainty of the actual threshold for biological effects in sturgeon.

8M.3.2 Comparisons of Selenium Concentrations in Sturgeon and Bass

Modeled whole-body selenium concentrations in sturgeon were about 8 to 10 times greater than those modeled for largemouth bass at the two western Delta locations (see Table 8M-2 compared to largemouth bass concentrations in Table 8M-4, which are extracted from Tables M-11 through M-20 in Appendix M). This difference in modeled whole-body fish was the combined result of using higher K_d and TTF values for the sturgeon (assuming a benthic food web) than those used for bass (assuming primarily a water-column-based food web), and higher whole-body selenium concentrations consequently are expected to occur in sturgeon. Concentrations in largemouth bass for the Sacramento River at Mallard Island ranged from 1.13 mg/kg (dw) during All conditions for Existing Conditions to 1.73 mg/kg (dw) during Drought conditions for Alternative 8-LLT. The lowest concentrations for the San Joaquin River at Antioch were also predicted for Existing Conditions (and for NAA-LLT) under All conditions (1.39 mg/kg, dw) compared to the high value estimated for Alternative 9-LLT under Drought conditions (2.33 mg/kg, dw). The lowest modeled concentrations at both western Delta locations were predicted under Existing Conditions for both water year types, though the differences among alternatives within location and water year type are small (i.e., the largest difference was only 0.37 mg/kg, dw for Sacramento River at Antioch under Drought).

In contrast to sturgeon, for which modeled whole-body selenium concentrations exceeded toxicity benchmarks under each alternative and water year type, all modeled selenium concentrations in largemouth bass at the two locations were less than the more conservative low toxicity threshold of 4 mg/kg (dw) that was used in the toxicity evaluation of alternatives in Appendix M of the BDCP EIR/EIS (Table 8M-5; comparisons to the low toxicity threshold are from Tables M-21 to M-30 in Appendix M). However, the differences among scenarios/alternatives were consistent despite the different K_d and TTF values used for bass and sturgeon because both were based on the DSM2-modeled waterborne selenium concentrations, which did not differ markedly among scenarios within location and water year type.

8M.4 References

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ABBREVIATIONS

μg/kg dw	micrograms/kilogram, dry weight
μg/L	micrograms/liter
BDCP EIR/EIS	Bay Delta Conservation Plan Environmental Impact Report/Environmental Impact Statement
Delta	Sacramento–San Joaquin River Delta
K_d	particulate/water ratio
mg/kg dw	milligram/kilogram, dry weight
TTFs	trophic transfer factors
USFWS	United States Fish and Wildlife Service

Table 8M-1. Modeled Selenium Concentrations in Water for Existing Conditions, No Action Alternative, and Alternatives 1-9.

Location	Period [a]	Period Average Concentration (µg/L)													
		Existing Conditions	No Action Alternative-LLT	Alternative 1-LLT	Alternative 2-LLT	Alternative 3-LLT	Alternative 4H1	Alternative 4H2	Alternative 4H3	Alternative 4H4	Alternative 5-LLT	Alternative 6-LLT	Alternative 7-LLT	Alternative 8-LLT	Alternative 9-LLT
San Joaquin River at Antioch	ALL	0.31	0.31	0.33	0.34	0.32	0.33	0.33	0.34	0.34	0.32	0.38	0.37	0.37	0.38
	DROUGHT	0.27	0.27	0.27	0.28	0.27	0.28	0.28	0.28	0.28	0.28	0.31	0.31	0.31	0.32
Sacramento River at Mallard Island	ALL	0.25	0.25	0.26	0.27	0.25	0.26	0.26	0.27	0.27	0.26	0.3	0.29	0.29	0.28
	DROUGHT	0.21	0.21	0.21	0.22	0.21	0.21	0.21	0.22	0.22	0.21	0.24	0.24	0.24	0.23

Notes:
LLT - late long term
µg/L - microgram per liter
[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2.
Drought: Represents a 5-consecutive-year (Water Years 1987-1991) drought period consisting of dry and critical water-year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

Table 8M-2. Summary of Annual Average Selenium Concentrations in Whole-Body Sturgeon.

Location	Period [a]	Estimated Concentrations of Selenium in Whole-body Sturgeon (mg/kg, dw)													
		Existing Conditions	No Action Alternative-LLT	Alternative 1-LLT	Alternative 2-LLT	Alternative 3-LLT	Alternative 4H1	Alternative 4H2	Alternative 4H3	Alternative 4H4	Alternative 5-LLT	Alternative 6-LLT	Alternative 7-LLT	Alternative 8-LLT	Alternative 9-LLT
San Joaquin River at Antioch	ALL	12.3	12.3	13.1	13.5	12.7	13.1	13.1	13.5	13.5	12.7	15.1	14.7	14.7	15.1
	DROUGHT	19.3	19.3	19.3	20	19.3	20	20	20	20	20	22.2	22.2	22.2	22.9
Sacramento River at Mallard Island	ALL	9.92	9.92	10.3	10.7	9.92	10.3	10.3	10.7	10.7	10.3	11.9	11.5	11.5	11.1
	DROUGHT	15	15	15	15.8	15	15	15	15.8	15.8	15	17.2	17.2	17.2	16.5

Notes:
LLT - late long term
dw - dry weight
mg/kg - milligram per kilogram
[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2.
Drought: Represents a 5-consecutive-year (Water Years 1987-1991) drought period consisting of dry and critical water-year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

Table 8M-3. Ratio of Period Average Selenium Concentrations in Whole-Body Sturgeon to Toxicity Thresholds.[a]

Location	Period [b]	Ratio of Period Average Selenium Concentrations in Whole-body Sturgeon to Toxicity Thresholds																											
		Existing Conditions		No Action Alternative-LLT		Alternative 1-LLT		Alternative 2-LLT		Alternative 3-LLT		Alternative 4-LLT (H1)		Alternative 4-LLT (H2)		Alternative 4-LLT (H3)		Alternative 4-LLT (H4)		Alternative 5-LLT		Alternative 6-LLT		Alternative 7-LLT		Alternative 8-LLT		Alternative 9-LLT	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
San Joaquin River at Antioch	ALL	2.5	1.5	2.5	1.5	2.6	1.6	2.7	1.7	2.5	1.6	2.6	1.6	2.6	1.6	2.7	1.7	2.7	1.7	2.5	1.6	3.0	1.9	2.9	1.8	2.9	1.8	3.0	1.9
	DROUGHT	3.9	2.4	3.9	2.4	3.9	2.4	4.0	2.5	3.9	2.4	4.0	2.5	4.0	2.5	4.0	2.5	4.0	2.5	4.0	2.5	4.4	2.8	4.4	2.8	4.4	2.8	4.6	2.9
Sacramento River at Mallard Island	ALL	2.0	1.2	2.0	1.2	2.1	1.3	2.1	1.3	2.0	1.2	2.1	1.3	2.1	1.3	2.1	1.3	2.1	1.3	2.1	1.3	2.4	1.5	2.3	1.4	2.3	1.4	2.2	1.4
	DROUGHT	3.0	1.9	3.0	1.9	3.0	1.9	3.2	2.0	3.0	1.9	3.0	1.9	3.0	1.9	3.2	2.0	3.2	2.0	3.0	1.9	3.4	2.2	3.4	2.2	3.4	2.2	3.3	2.1

Notes:
LLT - late long term
dw - dry weight
mg/kg - milligram per kilogram
[a] Toxicity thresholds are those reported in Presser and Luoma (2013): Low = 5 mg/kg, dw and High = 8 mg/kg, dw
[b] All: Water years 1975-1991 represent the 16-year period modeled using DSM2.
Drought: Represents a 5-consecutive-year (Water Years 1987-1991) drought period consisting of dry and critical water-year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

Table 8M-4. Summary of Annual Average Selenium Concentrations in Whole-Body Largemouth Bass.

Location	Period [a]	Estimated Concentrations of Selenium in Whole-body Largemouth Bass (mg/kg, dw)													
		Existing Conditions	No Action Alternative-LLT	Alternative 1-LLT	Alternative 2-LLT	Alternative 3-LLT	Alternative 4H1	Alternative 4H2	Alternative 4H3	Alternative 4H4	Alternative 5-LLT	Alternative 6-LLT	Alternative 7-LLT	Alternative 8-LLT	Alternative 9-LLT
San Joaquin River at Antioch	ALL	1.39	1.39	1.46	1.53	1.42	1.49	1.5	1.52	1.53	1.44	1.72	1.63	1.63	1.68
	DROUGHT	1.96	1.97	1.97	2.04	1.98	2	2.01	2.04	2.05	2.01	2.27	2.23	2.23	2.33
Sacramento River at Mallard Island	ALL	1.13	1.14	1.15	1.2	1.13	1.17	1.17	1.2	1.2	1.15	1.33	1.28	1.28	1.24
	DROUGHT	1.52	1.54	1.52	1.57	1.53	1.54	1.55	1.57	1.57	1.55	1.72	1.71	1.73	1.67

Notes:
LLT - late long term
dw - dry weight
mg/kg - milligram per kilogram
[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2.
Drought: Represents a 5-consecutive-year (Water Years 1987-1991) drought period consisting of dry and critical water-year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).
Source of whole-body selenium concentrations in largemouth bass: Tables M-11 through M-20 in Appendix M of the BDCP EIR/EIS

Table 8M-5. Ratio of Period Average Selenium Concentrations in Whole-body Largemouth Bass to Toxicity Thresholds.[a]

Location	Period [b]	Ratio of Period Average Selenium Concentrations in Whole-body Largemouth Bass to Toxicity Thresholds																											
		Existing Conditions		No Action Alternative-LLT		Alternative 1-LLT		Alternative 2-LLT		Alternative 3-LLT		Alternative 4-LLT (H1)		Alternative 4-LLT (H2)		Alternative 4-LLT (H3)		Alternative 4-LLT (H4)		Alternative 5-LLT		Alternative 6-LLT		Alternative 7-LLT		Alternative 8-LLT		Alternative 9-LLT	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
San Joaquin River at Antioch	ALL	0.3	0.2	0.3	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2
	DROUGHT	0.5	0.2	0.5	0.2	0.5	0.2	0.5	0.3	0.5	0.2	0.5	0.2	0.5	0.2	0.5	0.2	0.5	0.2	0.5	0.2	0.6	0.3	0.6	0.2	0.6	0.2	0.6	0.3
Sacramento River at Mallard Island	ALL	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.2	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1
	DROUGHT	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2

Notes:
LLT - late long term
dw - dry weight
mg/kg - milligram per kilogram
[a] Toxicity thresholds are those reported in Bekon et al. (2008) and were used to evaluate alternatives using largemouth bass in the BDCP EIR/EIS: Low = 4 mg/kg, dw and High = 9 mg/kg, dw
[b] All: Water years 1975-1991 represent the 16-year period modeled using DSM2.
Drought: Represents a 5-consecutive-year (Water Years 1987-1991) drought period consisting of dry and critical water-year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).