Table 1. Bioaccumulation monitoring assessment framework for the fishing beneficial use.

D.1. *Determine the status of the fishing beneficial use throughout the State with respect to bioaccumulation of toxic pollutants*

D.1.1 What are the extent and location of water bodies with sufficient evidence to indicate that the fishing beneficial use is at risk due to pollutant bioaccumulation?

D.1.2 What are the extent and location of water bodies with some evidence indicating the fishing beneficial use is at risk due to pollutant bioaccumulation?

D.1.3 What are the extent and location of water bodies with no evidence indicating the fishing beneficial use is at risk due to pollutant bioaccumulation?

D.1.4 What are the proportions of water bodies in the State and each region falling within the three categories defined in questions D.1.1, D.1.2, and D.1.3?

D.2. *Assess trends in the impact of bioaccumulation on the fishing beneficial use throughout the State*

D.2.1 Are water bodies improving or deteriorating with respect to the impact of bioaccumulation on the fishing beneficial use?

D.2.1.1 Have water bodies fully supporting the fishing beneficial use become impaired?

D.2.1.2 Has full support of the fishing beneficial use been restored for previously impaired water bodies?

D.2.2 What are the trends in proportions of water bodies falling within the three categories defined in questions D.1.1, D.1.2, and D.1.3 regionally and statewide?

D.3. *Evaluate sources and pathways of bioaccumulative pollutants impacting the fishing beneficial use*

D.3.1 What are the magnitude and relative importance of pollutants that bioaccumulate and indirect causes of bioaccumulation throughout each Region and the state as a whole?

D.3.2 How is the relative importance of different sources and pathways of bioaccumulative pollutants that impact the fishing beneficial use changing over time on a regional and statewide basis?

D.4. *Provide the monitoring information needed to evaluate the effectiveness of management actions in reducing the impact of bioaccumulation on the fishing beneficial use*

D.4.1 What are the management actions that are being employed to reduce the impact of bioaccumulation on the fishing beneficial use regionally and statewide?

D.4.2 How has the impact of bioaccumulation on the fishing beneficial use been affected by management actions regionally and statewide?

Table 2.

Thresholds for concern based on an assessment of human health risk by OEHHA (Klasing and Brodberg, 2008). All values given in ng/g (ppb) wet weight. The lowest available threshold for each pollutant is in bold font. One serving is defined as 8 ounces (227 g) prior to cooking. The FCG and ATLs for mercury are for the most sensitive population (i.e., women aged 18 to 45 years and children aged 1 to 17 years).

Pollutant	Fish Contaminant Goal	Advisory Tissue Level (2 servings/week)	Advisory Tissue Level (1 serving/week)	Advisory Tissue Level (No Consumption)
Chlordanes	**5.6**	190	280	560
DDTs	**21**	520	1000	2100
Dieldrin	**0.46**	15	23	46
Mercury	220	**70**	150	440
PCBs	**3.6**	21	42	120
Selenium	7400	**2500**	4900	15000
PBDEs	310	100	210	630

Table 3. Criteria for assigning candidate lakes to tiers. Colors refer to shading in Table 4.

Tier 1 (blue)
Both indicator types sampled
Hg: Below 303(d) listing criterion (90% of samples below 0.2 ppm)
Organics: Below 303(d) listing criteria (90% of samples below FCGs)
At least some fishing activity

Tier 2 (green)
Both indicator types sampled
Hg: Below 303(d) listing criterion (90% of samples below 0.2 ppm)
Organics: means below 2 serving ATLs
At least some fishing activity

Tier 3 (purple)
Both indicator types sampled
Hg: mean below 0.2
Organics: means below 2 serving ATLs
At least some fishing activity

Tier 4 (yellow)
Both indicator types not sampled
Hg: Below 303(d) listing criterion (90% of samples below 0.2 ppm)
Organics: Below 303(d) listing criteria (90% of samples below FCGs)
The more fishing the better

Table 4. Candidates for inclusion in the Clean Lakes Study.

Candidates for the Clean Lakes Study: Region 1. See Table 3 for tier and color scheme. Letters indicate priority of the Tier 4 lakes.

Region	Lake	Species	Tier	Comments
1	Kangaroo Lake	RBT		Remote back country lake.
1	Reservoir F	LMB		Remote back country lake.
1	Lewiston Lake	RBT	4a	Popular. More heavily fished than Cleone.
1	Trinity Lake	RBT		Listed for Hg. Do not eat LMB advisory.
1	Howard Lake	RBT		Remote back country lake.
1	Plaskett Lake	Hardhead		Remote back country lake.
1	Cleone Lake	RBT	4b	Popular.

Candidates for the Clean Lakes Study: Region 2. See Table 3 for tier and color scheme. Letters indicate priority of the Tier 4 lakes.

Region	Lake	Species	Tier	Comments
2	Horseshoe Lake, Quarry Lakes	CCAT		Not impaired for Hg. One of three PCB samples above FCG. Difficult to get bass.
2	Lago Los Osos	CCAT		No fishing allowed.
2	Lake Cunningham	CARP		Not popular. PCBs, DDTs, dieldrin, chlordanes above FCGs.
2	Lake Elizabeth	CARP		Not impaired for Hg. PCBs, DDTs, dieldrin above FCGs
2	Briones Reservoir	LMB		Fishing not allowed.
2	Lake Madigan	Bluegill		Only got bluegill.

Table 4. Candidates for inclusion in the Clean Lakes Study (continued).

Candidates for the Clean Lakes Study: Region 3. See Table 3 for tier and color scheme. Letters indicate priority of the Tier 4 lakes.

Region	Lake	Species	Tier	Comments
3	Loch Lomond Reservoir	LMB, Bluegill		Impaired. Hg 0.11 at 350 mm.
3	Lopez Lake	LMB, Sucker	2	Not impaired. PCBs, dieldrin above FCGs

Table 4. Candidates for inclusion in the Clean Lakes Study (continued).

Candidates for the Clean Lakes Study: Region 4. See Table 3 for tier and color scheme. Letters indicate priority of the Tier 4 lakes.

Region	Lake	Species	Tier	Comments
4	Castaic Lagoon	LMB, CARP, RBT, Redear	3	Need repeat of low Hg, PCBs above FCG. **New 303(d) Listing**
4	Elizabeth Lake	Crappie, Bullhead, RBT		Hg 0.21 in 2007, under in 2010 - repeat? (Tier 4 based on 2010)
4	Lake Lindero	Carp		Not impaired. Hg low in 2007 and 2010. Organics above FCGs.
4	Malibou Lake	LMB, Carp, Bluegill	2	Not impaired. Hg low in 2007 & 2010. PCBs, dieldrin, chlordanes above FCGs.
4	Westlake Lake	LMB		Not impaired. PCBs, dieldrin above FCGs.
4	Cerritos Park Lake	LMB, Carp, RBT		Impaired. PCBs above ATL, DDTs, dieldrin above FCGs. **New 303(d) Listing**
4	Wilderness Park Lake	CCAT, Carp		Dieldrin above FCG.
4	Harbor Lake (Lake Machado)	Carp		Not impaired. PCBs above FCG.
4	Balboa Lake	Carp		DDTs, dieldrin above FCG.
4	Belvedere Park Lake	Carp	*	PCBs at 22 ppb (above ATL). Strong Region 4 interest in sampling this lake.
4	Lake Calabasas	LMB		Not impaired. PCBs above FCG.
4	Legg Lake	LMB, Carp, Redear, CCAT	3	Impaired. PCBs very high in 2005. Hg low in 2007 and 2010. PCBs above FCG in 2010. **New 303(d) Listing**
4	Lincoln Park Lake	LMB, Carp	2	Not impaired. Hg low in 2007 & 2010. PCBs above FCG.
4	Sepulveda Lake	Carp		PCBs, DDTs, dieldrin above FCGs.
4	Toluca Lake	LMB		Not impaired. PCBs above FCG.
4	Echo Lake	LMB, Carp	*	PCBs above ATLs in past sampling, but cleanup and restocking have

occurred. Expected to be clean now.

Table 4. Candidates for inclusion in the Clean Lakes Study (continued).

Candidates for the Clean Lakes Study: Region 5. See Table 3 for tier and color scheme. Letters indicate priority of the Tier 4 lakes.

Region	Lake	Species	Tier	Comments
5	McCumber Reservoir	RBT		
5	North Battle Creek Reservoir	Brown Trout		
5	Blue Lakes	LMB		Tribes interested. Impaired.
5	Big Reservoir	RBT		
5	Caples Lake	Brown Trout	4b	Not impaired.
5	French Meadows Reservoir	RBT		Impaired.
5	Hell Hole Reservoir	Brown Trout		Impaired.
5	Ice House Reservoir	RBT	4e	
5	Union Valley Reservoir	RBT		Also SMB, 1 sample = 0.419
5	Lake of the Pines	LMB	4a	Not impaired.
5	Bowman Lake	Brown Trout		PCBs above FCG
5	Faucherie Lake	RBT		Impaired.
5	Jackson Meadow Reservoir	RBT		Impaired.
5	Lake Spaulding	RBT		Brown Tr(n=5) = 1.1, Chinook(n=3) = 0.58
5	Scotts Flat Reservoir	RBT		Impaired, BG, LMB, Brown Tr, Green Sunfish
5	Fuller Lake	Brown Trout		Not impaired.
5	Feeley Lake	Bullhead		
5	Kidd Lake	Bullhead		
5	Antelope Lake	LMB, Bullhead	1	Not impaired.
5	Bucks Lake	RBT		Not impaired. Brown Tr(n=10) = 0.069, Lake Tr(n=5) = 0.024
5	Butt Valley Reservoir	SMB		Impaired.
5	Frenchman Lake	RBT		
5	Gold Lake	RBT	4c	
5	Little Grass Valley Reservoir	RBT		
5	Lake Almanor	SMB		Impaired.
5	Lake Davis	RBT, Bullhead		

5	Lower Bucks Lake	Kokanee		
5	Paradise Lake	LMB		Impaired.
5	Whiskeytown Lake	LMB		Impaired.
5	Castle Lake	RBT		
5	Gumboot Lake	RBT		
5	Big Lake	RBT, Sucker		
5	Reservoir C	RBT		
5	Duncan Reservoir	RBT, Bullhead		
5	Iron Canyon Reservoir	RBT		
5	Lake Britton	SMB, Carp	3	Impaired. **303(d) Listed Sucker up to 0.5 in 2006. SMB 350 mean above 0.2 in 2008.**
5	Medicine Lake	Brook Trout		
5	Cave Lake	Brook Trout		
5	Lily Lake	RBT		
5	Lower Bear River Reservoir	RBT		
5	Lower Blue Lake - Alpine County	RBT		Impaired. Dieldrin above FCG
5	Upper Blue Lake	RBT		
5	White Pines Lake	RBT		
5	Lake Alpine	RBT	4d	Nearby Spicer Meadow also possible, but Alpine had lower Hg.
5	Beardsley	RBT		
5	Pinecrest	RBT		
5	Spicer Meadow Reservoir	RBT		
5	La Grange Reservoir	RBT		
5	Bass Lake	LMB, Bullhead	1	Not impaired.
5	Florence Lake	Brown Trout		Not impaired.
5	Huntington Lake	RBT	4f	Kokanee(n=1) = 0.10
5	Mammoth Pool Reservoir	RBT		
5	Contra Loma Reservoir	LMB		Impaired.
5	545TU0164	LMB, Carp		Impaired. Would be Tier 3, but not popular for fishing. PCBs, DDTs, dieldrin above FCG,

5	Marsh in Fresno Slough	LMB, Bullhead	**New 303(d) Listing** Impaired. Would be Tier 3, but not popular for fishing. DDTs, dieldrin above FCG. **New 303(d) Listing**
5	Courtright Reservoir	RBT	Brown Tr(n=1) = 0.06
5	Hume Lake	RBT	
5	Wishon Reservoir	RBT	Brown Tr(n=1) = 0.29

Table 4. Candidates for inclusion in the Clean Lakes Study (continued).

Candidates for the Clean Lakes Study: Region 6. See Table 3 for tier and color scheme. Letters indicate priority of the Tier 4 lakes.

Region	Lake	Species	Tier	Comments
6	Ellery Lake	RBT		
6	Grant Lake	RBT		
6	Gull Lake	RBT		
6	June Lake	RBT		
6	Lundy Lake	RBT		Dieldrin above FCG.
6	Saddlebag Lake	RBT		Dieldrin above FCG.
6	Tioga Lake	RBT		
6	Convict Lake	RBT		
6	Lake Crowley	RBT		
6	Lake George	RBT		
6	Lake Mary	RBT		
6	Lake Mamie	RBT		
6	Pleasant Valley Reservoir	RBT		
6	Rock Creek Lake	RBT		
6	Lake Sabrina	RBT		
6	Twin Lakes	RBT		Dieldrin above FCG.
6	Apollo Lake	RBT		
6	Palmdale Lake	LMB, CCAT	3	PCBS, dieldrin above FCG. **New 303(d) Listing**
6	Lake Gregory	LMB, Carp	3	Dieldrin above FCG. **New 303(d) Listing**
6	Spring Valley Lake	RBT		PCBs above FCG.
6	Bridgeport Reservoir	RBT		
6	Virginia Lakes	RBT		
6	Topaz Lake	Sucker, RBT	4b	Very popular.
6	Indian Creek Reservoir	RBT	4d	Dieldrin above FCG. Wastewater was discharged into this reservoir for decades, Nutrient TMDL was done, and they are actively oxygenating the bottom to reduce nutrient mobilization. Due to all the waste discharged over the decades, i'm curious what any non-trout species may show. This reservoir is rather warm, and may not support trout

				long-term without continual physical manipulations, Probably will shift to warm-water species as climate warms).
6	Fallen Leaf Lake	Lake Trout	4c	Not impaired. PCBs, DDTs, dieldrin, chlordane above FCG. Suspect pesticides from numerous homes around the lake; however may not be able to capture any "bottom" species in this oligotrophic (cold) lake; if design requires multiple species, may kick this out of clean lakes study)
6	Lake Tahoe	RBT		
6	Lake Tahoe - Tahoe Keys		4a	Little/no data for non-trout species, which are caught & eaten by local people "of color" [potential EJ issue]; also, JRowan of DFW is actively shocking in the Keys Lagoons so costs could be modest compared to mobilizing a whole crew
6	Prosser Creek Reservoir	RBT		
6	Boca Reservoir	Sucker, RBT		
6	Stampede Reservoir	RBT		
6	Eagle Lake	Eagle Lk Trout		
6	Crater Lake	RBT		
6	Dodge Reservoir	RBT		

Table 4. Candidates for inclusion in the Clean Lakes Study (continued).

Candidates for the Clean Lakes Study: Region 7. See Table 3 for tier and color scheme. Letters indicate priority of the Tier 4 lakes.

Region	Lake	Species	Tier	Comments
7	Lake Havasu	Carp		RB7 plans to sample in 2015
7	Gene Wash Reservoir	LMB, Carp	1	Not impaired. RB7 plans to sample in 2015
7	Ferguson Lake	LMB, Carp	1	Not impaired. RB7 plans to sample in 2015
7	Senator Wash Reservoir	LMB, Carp	1	Not impaired. RB7 plans to sample in 2015
7	Lake Cahuila	Carp		DDTs above FCG
7	Fig Lake	Tilapia, Carp		
7	Ramer Lake	Crappie, Carp		Not impaired. RB7 plans to sample in 2015
7	Wiest Lake	CCAT, Carp		Not impaired. RB7 plans to sample in 2015. PCBs, DDTs, dieldrin above FCG.
7	Sunbeam Lake	LMB, CCAT	2	Not impaired. RB7 plans to sample in 2015. PCBs, DDTs, dieldrin above FCG. Data from 2004 only.
7	Salton Sea	Tilapia		RB7 plans to sample in 2015

Table 4. Candidates for inclusion in the Clean Lakes Study (continued).

Candidates for the Clean Lakes Study: Region 8. See Table 3 for tier and color scheme. Letters indicate priority of the Tier 4 lakes.

Region	Lake	Species	Tier	Comments
8	Lee Lake/Corona Lake	LMB		Impaired. PCBs above FCG.
8	Lake Evans	LMB, Carp	2	Not impaired. PCBs abo e FCG.
8	Prado Lake	LMB, Carp	2	Not impaired. PCBs above FCG.
8	Lake Hemet	RBT, Carp		Not impaired.
8	Perris Reservoir	LMB		Not impaired. PCBs and DDTs above FCG.

Table 4. Candidates for inclusion in the Clean Lakes Study (continued).

Candidates for the Clean Lakes Study: Region 9. See Table 3 for tier and color scheme. Letters indicate priority of the Tier 4 lakes.

Region	Lake	Species	Tier	Comments
9	Lake Henshaw	LMB, Carp	3	Impaired. Popular. Sampled lots of large bass. Organics below FCGs. R9 Sampling in late summer for cyanotoxins in tissues. **New 303(d) Listing**
9	Dixon Lake	LMB	4a	Not impaired. In/close to urbanized areas. Lots of fishing for stocked species (catfish in summer and trout in winter). Popular for fishing. Newer Reservoir, dam built in 1960s? Storage for imported water treatment.
9	Lake Wohlford	LMB		Not impaired. Moderately popular. Private boats prohibited. Downstream from Henshaw…receives Henshaw water via canal
9	Lake Poway	LMB	4b	Not impaired. In/close to urbanized areas. Lots of fishing for stocked species (catfish in summer and trout in winter). Popular for fishing. Newer Reservoir, dam built in 1971. Storage for imported water treatment.
9	Lake Jennings	LMB, CCAT	3	Impaired. Dieldrin above FCG. **New 303(d) Listing**

Table 5. Tier assignments for candidate lakes.

Tier 1

1. Antelope Lake (R5)
2. Bass Lake (R5)
3. Gene Wash Reservoir (R7)
4. Ferguson Lake (R7)
5. Senator Wash Reservoir (R7)

Tier 2

1. Lopez Lake (R3)
2. Lincoln Park Lake (R4)
3. Malibou Lake (R4)
4. Sunbeam Lake (R7)
5. Lake Evans (R8)
6. Prado Lake (R8)

Tier 3

1. Castaic Lagoon (R4)
2. Legg Lake (R4)
3. Palmdale Lake (R6)
4. Lake Gregory (R6)
5. Lake Henshaw (R9)
6. Lake Jennings (R9)

Tier 4 (top choices for each region shown, in priority order)

1. Lewiston Lake (R1)
2. Lake of the Pines (R5)
3. Caples Lake (R5)
4. Gold Lake (R5)
5. Lake Alpine (R5)
6. Ice House Reservoir (R5)
7. Huntington Lake (R5)
8. Lake Tahoe (Tahoe Keys) (R6)
9. Topaz Lake (R6)
10. Fallen Leaf Lake (R6)
11. Indian Creek Reservoir (R6)
12. Dixon Lake (R9)

Table 6. Target species and their characteristics.

	Foraging Type		Trophic Level	Distribution			
Species	Water column	Bottom feeder		Low Eleva-tion	Foothills	High Elevation	Priority for Collection
Largemouth bass	X		4	**X**	**X**		**A**
Smallmouth bass	X		4	x	**X**		**A**
Spotted bass	X		4	x	**X**		**A**
Sacramento pikeminnow	X		4	x	x		B
White catfish		X	4	x	x		**A**
Brown bullhead		X	3	x			B
Channel catfish		X	4	**X**	**X**		**A**
Carp		X	3	**X**	**X**		**A**
Sacramento sucker		X	3	x	x		B
Tilapia		X	3				B
Bluegill	X		3	**X**	**X**		B
Green sunfish	X		3	**X**	**X**		B
Crappie	X		3/4	x	x		B
Redear sunfish	X		3	**X**	**X**		B
Rainbow trout	X		3/4	x	x	**X**	**A**
Brown trout	X		3/4		x	x	**A**
Brook trout	X		3			x	**A**
Kokanee	X		3	?	x	x	B

Trophic levels are the hierarchical strata of a food web characterized by organisms that are the same number of steps removed from the primary producers. The USEPA's 1997 Mercury Study Report to Congress used the following criteria to designate trophic levels based on an organism's feeding habits:

Trophic level 1: Phytoplankton.
Trophic level 2: Zooplankton and benthic invertebrates.
Trophic level 3: Organisms that consume zooplankton, benthic invertebrates, and TL2 organisms.
Trophic level 4: Organisms that consume trophic level 3 organisms.

X widely abundant x less widely abundant "A" primary target for collection "B" secondary target for collection

Table 7. Target species, size ranges, and processing instructions.

	Process as Individuals (I) and/or Composites (C)	Process for Organics	Numbers and Size Ranges (mm)
Primary Targets: stay on location until one of these targets from both Group 1 and 2 is obtained			
Group 1) Predator			
Black bass	I		2X(200-249), 2X(250-304), 5X(305-407), 2X(>407)
Sacramento pikeminnow	I		3X(200-300), 3X(300-400), 3X(400-500)
Brown trout	I and C	X	3X(200-300), 3X(300-400), 3X(400-500)
Rainbow trout	I and C	X	5X(300-400)
Brook trout	I and C	X	5X(300-400)
Group 2) Bottom feeder			
White catfish	C	X	5X(229-305)
Channel catfish	C	X	5X(375-500)
Common carp	C	X	5X(450-600)
Brown bullhead	C		5X(262-350)
Sacramento sucker	C	X	5X(375-500)
Secondary Targets: collect these if primary targets are not available			
Bluegill	C	X	5X(127-170)
Redear sunfish	C	X	5X(165-220)
Black crappie	C	X	5X(187-250)
Tilapia	C		Xx
Green sunfish	C		Xx
Kokanee			Xx

Table 8. Summary of analytes included in the study.

Analyte	**Included in Study?**
Methylmercury[1]	Some individuals, all composites
PCBs	One composite per location
DDTs	One composite per location
Dieldrin	One composite per location
Aldrin	One composite per location
Chlordanes	One composite per location
Selenium	Selected composites based on regional needs
Microcystins	Not included (except for work funded by Region 9)
PBDEs	Not included
Dioxins	Not included
Perfluorinated chemicals	Not included
Omega-3 fatty acids	Not included

[1] Measured as total mercury, which provides a direct estimate of methylmercury in fish muscle.

Table 9. Parameters to be measured.

FISH ATTRIBUTES

1. Total length
2. Fork length
3. Weight
4. Sex
5. Moisture
6. Lipid content
7. Age (for black bass)

METALS AND METALLOIDS

1. Total mercury
2. Selenium

PESTICIDES

Chlordanes

1. Chlordane, cis-
2. Chlordane, trans-
3. Heptachlor
4. Heptachlor epoxide
5. Nonachlor, cis-
6. Nonachlor, trans-
7. Oxychlordane

DDTs

1. DDD(o,p')
2. DDD(p,p')
3. DDE(o,p')
4. DDE(p,p')
5. DDMU(p,p')
6. DDT(o,p')
7. DDT(p,p')

Cyclodienes

1. Aldrin
2. Dieldrin
3. Endrin

HCHs

1. HCH, alpha
2. HCH, beta

Others

1. Dacthal

2. Endosulfan I
3. Hexachlorobenzene
4. Methoxychlor
5. Mirex
6. Oxadiazon

PCBs

1. PCB 008
2. PCB 011
3. PCB 018
4. PCB 027
5. PCB 028
6. PCB 029
7. PCB 031
8. PCB 033
9. PCB 044
10. PCB 049
11. PCB 052
12. PCB 056
13. PCB 060
14. PCB 064
15. PCB 066
16. PCB 070
17. PCB 074
18. PCB 077
19. PCB 087
20. PCB 095
21. PCB 097
22. PCB 099
23. PCB 101
24. PCB 105
25. PCB 110
26. PCB 114
27. PCB 118
28. PCB 126
29. PCB 128
30. PCB 137
31. PCB 138
32. PCB 141
33. PCB 146
34. PCB 149
35. PCB 151
36. PCB 153
37. PCB 156
38. PCB 157
39. PCB 158

40. PCB 169
41. PCB 170
42. PCB 174
43. PCB 177
44. PCB 180
45. PCB 183
46. PCB 187
47. PCB 189
48. PCB 194
49. PCB 195
50. PCB 198/199
51. PCB 200
52. PCB 201
53. PCB 203
54. PCB 206
55. PCB 209

Algal Toxins

Microcystins
1. MCY-RR
2. MCY-LR
3. MCY-YR
4. MCY-LA

MC metabolites
1. Desmethyl-LR
2. Desmethyl-RR

Cyanotoxins
1. anatoxin a