# MONITORING AND ANALYSIS PLAN

# Long-term Monitoring of Bass Lakes and Reservoirs in California

Bioaccumulation Monitoring Program

Surface Water Ambient Monitoring Program

Version 2

October 2021

#### **Table of Contents**

MONITORING AND ANALYSIS PLAN	1
Background	2
Monitoring Design Updates	3
Table 2. Schedule of long-term monitoring of bass lakes and reservoirs in CA	4
Table 6. Target species, size ranges, and processing instructions	5
Table 7. Summary of sport fish analytes included in the monitoring	6
Table 8. Parameters to be measured in sport fish	6
Figure 2a. Sampling design for a small lake: sport fish	9
Figure 2b. Sampling design for a small lake: prey fish	10
Figure 3a. Sampling design for a medium lake: sport fish	11
Figure 3b. Sampling design for a medium lake: prey fish	12
Table A. Final list of lakes to be sampled in 2021	13

## **Background**

In 2015, the Surface Water Ambient Monitoring Program's (SWAMPs) <u>Bioaccumulation Monitoring Program</u> began implementation of a <u>long-term monitoring plan</u> for a set of approximately 190 lakes and reservoirs where black bass are present and that were identified as priority water bodies for monitoring of contaminants in fish. To match the effort to the annual amount of funding available for SWAMP fish monitoring, the 190 lakes were divided into five subsets, or "panels", of 38 lakes each, with one panel to be sampled every other year. The long-term plan is to sample each of the five panels, and then repeat the cycle going forward to provide updated information on each lake on a ten-year cycle. A Sampling and Analysis Plan (also known as Monitoring Plan) was published in 2015 to document the objectives and design details of the study (see the <u>2015 Monitoring Plan</u> for more details). The first two rounds of sampling were conducted in 2015 (Panel 1) and 2017 (Panel 2) and data reports summarizing the results were developed in October 2019 (<u>2015 Data Report</u>) and November 2019 (<u>2017 Data Report</u>). A data report on the results from 2019 sampling (Panel 3) is in preparation. Sampling for Panel 4 will be conducted in 2021.

# **Monitoring Design Updates**

The Safe to Eat Workgroup (formerly known as the Bioaccumulation Oversight Group) has provided valuable input and feedback throughout the monitoring process, which has resulted in minor modifications to the monitoring design. This update to the original 2015 Monitoring Plan documents the modifications that have been made, as well as the latest status of the lakes on the Panel 4 list with regard to whether they can be sampled in 2021. All other aspects of the monitoring design match what was outlined in the 2015 Monitoring Plan.

The updated tables and figures are provided below, following the numbering used in the original plan. Where changes were minor, revisions to the original tables are highlighted in yellow.

Table 2. Schedule of long-term monitoring of bass lakes and reservoirs in CA

Long-term plan for sport fish monitoring in California by SWAMP and other programs, 2015-2032 (updated 10/26/21)

Waterbody category	Specific category (n=approximate)	Revisit frequency	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Lakes	1) Bass Lakes: Statewide Core Monitoring (n=190)	10 yr	x		х		х		х		х		Х		Х		Х		Х	
	2) Bass Lakes: "New"	Screening		х																
	3) Bass Lakes: with mgmt actions	1 yr											0	0	0	0	0	0	0	
	4) Trout Lakes: > 0.2 ppm (n=5)	10 yr												Х						
	5) Trout Lakes: < 0.2 ppm (n=90)	20 yr												Х						
	6) Trout Lakes: "New"	Screening		х																
Rivers and Streams	7) Bass Sites: in the Delta (n=7)	1 yr		0	0	0	0	0	0	0	0	0	0		0		0		0	
	8) Bass Sites: Other (n=10)	10 yr								X		X								
	9) Trout Sites: < 0.2 ppm (n=50)	20 yr										Х								
	10) Trout Sites: > 0.2 ppm (n=10)	10 yr										Х								
Coast	11) SF Bay Zones (n=5+)	5 yr					0					0					0			
	12) SC Bight Zones (n=27)	10 yr				хо										ХО				
	13) Other Coastal Zones (n=35)	10 yr				X	Х	х		X						X		Х		Х

X = funded by SWAMP, O = funded by another program, **bold** = solidified plan, not bold = tentative plan

# Table 6. Target species, size ranges, and processing instructions

I - process as individuals. C - process as composites. Target sizes will be adjusted as necessary based on lake-specific size limits to maintain a focus on legal sized fish. Revised elements are highlighted.

	Process for Mercury	Process for Organics and Selenium	Numbers and Size Ranges (mm)								
	Primary Targets: stay on location until one of these targets from both Group 1 and 2 is obtained, or collect secondary targets if primary targets are not available										
Group 1) Predator											
Black bass	I		2X(200-249), 2X(250-304), 7X(305-406), 3X(407-500)								
Sacramento pikeminnow	I		3X(200-299), 7X(300-399), 3X(400-500)								
Striped bass	Ī		2X(250-349), 2X(350-449), 7X(450-599), 3X(>600)								
Group 2) Bottom	feeder										
White catfish	С	С	5X(229-305)								
Channel catfish	С	С	5X(375-500)								
Common carp	С	С	5X(450-600)								
Brown bullhead	С		5X(262-350)								
Sacramento sucker	С	С	5X(375-500)								
Secondary Targe	ets: collect these	if primary target	ts are not available								
Bluegill	С	С	5X(127-170)								
Redear sunfish	С	С	5X(165-220)								
Black crappie	С	С	5X(187-250)								
Tilapia	С	С	5X(235-314)								
Green sunfish	С	С	5X(119-159)								

#### Table 7. Summary of sport fish analytes included in the monitoring

Selenium was not included in 2015 but was added in 2017. PCBs and legacy pesticides are analyzed in selected water bodies where the information is needed for advisory development or tracking trends for management. Revised elements are <a href="highlighted">highlighted</a>.

Analyte	Included in Study?				
Methylmercury <sup>1</sup>	All individuals				
Selenium <b>Selenium</b>	All composites				
PCBs	Selected composites				
DDTs	Selected composites				
Dieldrin	Selected composites				
Aldrin	Selected composites				
Chlordanes	Selected composites				

<sup>&</sup>lt;sup>1</sup>Measured as total mercury, which provides a direct estimate of methylmercury in fish muscle.

#### Table 8. Parameters to be measured in sport fish

Selenium was not included in 2015 but was added in 2017. Revised elements are highlighted.

Table 8 a. Fish Attributes

Fish Attributes
Total length (mm)
Fork Length (mm)
Standard Length (mm; small fish only)
Weight (g)
Sex (sport fish only)
Moisture (%)
Lipid (%; only when organics are analyzed)
Age (for black bass)

Fish attributes are physical measurements or observations.

Table 8 b. Metals and Metalloids in Tissue

Analyte	Matrix Type
Total Mercury	Whole Body Small Fish and Sport Fish filet muscle
Total Selenium	Whole Body Small Fish and Sport Fish filet muscle

Table 8 c. Organochlorine (OC) Pesticides in Tissue

Analyte Group	Analyte	Matrix Type				
Chlordanes	Chlordane, cis-	Sport Fish filet muscle				
	Chlordane, trans-	Sport Fish filet muscle				
	Heptachlor	Sport Fish filet muscle				
	Heptachlor epoxide	Sport Fish filet muscle				
	Nonachlor, cis-	Sport Fish filet muscle				
	Nonachlor, trans-	Sport Fish filet muscle				
	Oxychlordane	Sport Fish filet muscle				
DDTs	DDD(o,p')	Sport Fish filet muscle				
	DDD(p,p')	Sport Fish filet muscle				
	DDE(o,p')	Sport Fish filet muscle				
	DDE(p,p')	Sport Fish filet muscle				
	DDMU(p,p')	Sport Fish filet muscle				
	DDT(o,p')	Sport Fish filet muscle				
	DDT(p,p')	Sport Fish filet muscle				
Cyclodienes	Aldrin	Sport Fish filet muscle				
	Dieldrin	Sport Fish filet muscle				
	Endrin	Sport Fish filet muscle				
HCHs	HCH, alpha	Sport Fish filet muscle				
	HCH, beta	Sport Fish filet muscle				
Others	Dacthal	Sport Fish filet muscle				
	Endosulfan I	Sport Fish filet muscle				
	Hexachlorobenzene	Sport Fish filet muscle				
	Methoxychlor	Sport Fish filet muscle				
	Mirex	Sport Fish filet muscle				
	Oxadiazon	Sport Fish filet muscle				

Table 8 d. Polychlorinated biphenyls (PCB) in Tissue

Analyte	Matrix Type					
All 209 PCB congeners	Sport Fish filet muscle					

There are some details worth noting on the reporting of data on PCB congeners. The number of congeners analyzed has been increasing over the years. In 2021 the full suite of 209 congeners will be analyzed. The sums of PCBs reported will include all 209 congeners, with "not detected" values for individual congeners set to zero. For rigorous comparisons with past data a subset of common congeners can be used.

Figure 2a. Sampling design for a small lake: sport fish

This graphic was updated in April 2019 and is still accurate for 2021. For predator species, the same fish are used for the individual and composite analyses.

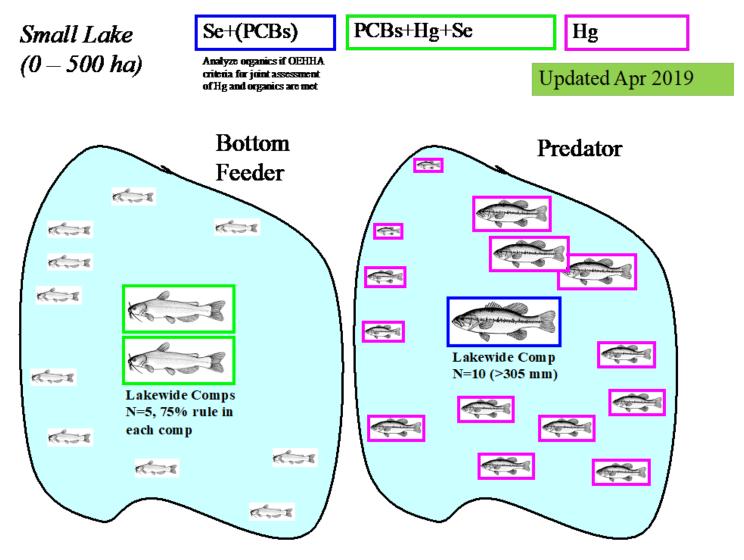
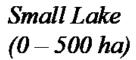


Figure 2b. Sampling design for a small lake: prey fish

The 2015 plan did not include a diagram for prey fish.



Hg+Se

Updated Jan 2021

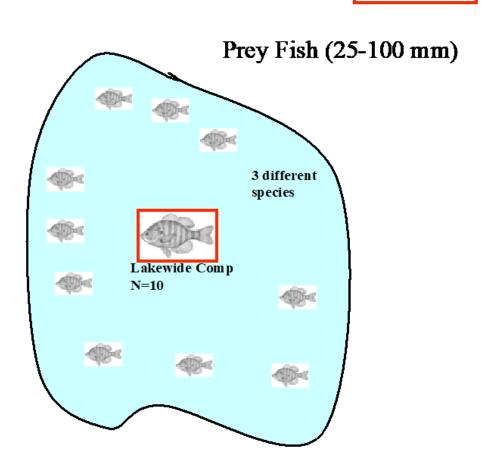


Figure 3a. Sampling design for a medium lake: sport fish

This graphic was updated in April 2019 and is still accurate for 2021. For predator species, the same fish are used for the individual and composite analyses.

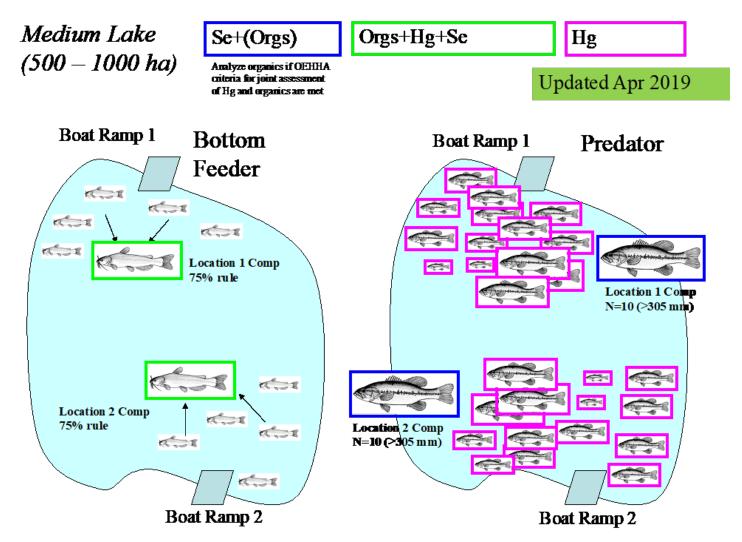


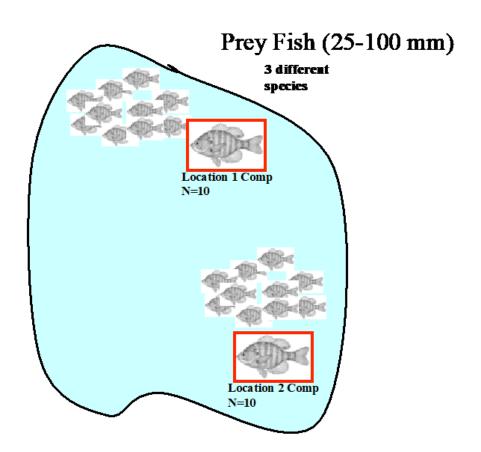
Figure 3b. Sampling design for a medium lake: prey fish

The 2015 plan did not include a diagram for prey fish.

Medium Lake (500 – 1000 ha)

Hg+Se

Updated Jan 2021



### Table A. Final list of lakes to be sampled in 2021

Table A includes information as of April 2021 on accessibility for sampling. Several lakes on the Panel 4 list will not be sampled because they were either already sampled under other projects in 2019 or have water levels that are too low. Due to these deletions, two lakes were added: Lafayette Reservoir (Region 2) and Diamond Valley Reservoir (Region 9).

Note Table A is split into two parts below: Sampling Details (pages 13 - 17) and Request Details (pages 17 - 26). See the spreadsheet source file for full notations. Email Jay Davis (<u>jay@sfei.org</u>) to request a copy of the spreadsheet.

#### **Sampling Details**

Region	Station Code	Lake Name	Publicly Accessible?	Sampling Notes	Sampled in 2019	Include PCBs	Include OC Pesticides
Panel 4 L	akes						
1	105TS0941	Shastina, Lake	Yes	None	No	No	No
1	106PTL209	Trinity Lake	Yes	None	No	No	No
2	205ALMDNR	Almaden Reservoir	Yes, no boats	Removed because sampled in 2019	Yes	No	No
2	205PCR128	Calero Reservoir	Yes	None	No	No	No
2	204PLC157	Chabot, Lake (Vallejo)	Yes	None	No	Yes	No
2	204PDV169	Del Valle Reservoir	Yes	None	No	No	No
2	204TC0114	Lower Crystal Springs Reservoir	No fishing allowed	Of interest wrt MeHg cycling; high in 2007	No	No	No

Region	Station Code	Lake Name	Publicly Accessible?	Sampling Notes	Sampled in 2019	Include PCBs	Include OC Pesticides
2	204PSC113	Shadow Cliffs Reservoir	Yes, currently closed	From Billy (4/12/21): Not sampleable this year at the current water level (See email string).	No	Yes	No
2	201PSL093	Soulejoule Lake	Yes, no boats	None	No	No	No
3	304PLL184	Loch Lomond Reservoir	Yes	None	No	No	No
4	412BLDPRK	Belvedere Park Lake	Yes, no boats	None	No	Yes	No
4	403CSTLAG	Castaic Lagoon	Yes	Removed because sampled in 2019: 14 LMB, 5 adult Bluegill, 5 Carp; not worth it to try to get RBT and Black Crappie	Yes	Yes	No

Region	Station Code	Lake Name	Publicly Accessible?	Sampling Notes	Sampled in 2019	Include PCBs	Include OC Pesticides
4	405ELDOLK	El Dorado Park	Yes	Removed because sampled in 2019: 14 LMB, 10 adult Redear sunfish, 10 Carp; not worth it to try to get RBT and catfish	Yes	No	No
	TOSELBOEK	Editos	103	Sampled in 2019, Micro lake, <4ft deep:	103	140	No
4	412HANSLK	Hansen Dam Lake	Yes	10 LMB	Yes	No	No
4	403HUGHLK	Hughes, Lake	No water in 2020	Removed because dry in 2020	Yes	No	No
4	404TM0284	Malibou Lake	Private	Removed because sampled in 2019: 14 LMB, 5 Carp	Yes	Yes	No
4	<del>70411010204</del>	Peck Road Water	i iivale	•	163	169	INO
4	412PECPRK	Conservation Park	Yes, no boats	Sampled in 2019: 14 LMB	Yes	Yes	No
5	532PLA129	Amador, Lake	Yes	None	No	No	No
5	518PAL175	Antelope Lake	Yes	None	No	No	No

Region	Station Code	Lake Name	Publicly Accessible?	Sampling Notes	Sampled in 2019	Include PCBs	Include OC Pesticides
				Gary 4/9/21: I just spoke with Tejon Ranch (owners of Castac Lake)			
5	556TC0084	Castac Lake	No, private	and it is still dry	No	No	No
5	516TC0293	Combie, Lake	No, private	None	No	Yes	No
5	514FINONR	Finnon Reservoir	Yes, private	None	No	Yes	No
5	513PIV081	Indian Valley Reservoir	Yes	None	No	Yes	No
5	540PML138	Millerton Lake	Yes	None	No	No	No
5	517PNB117	New Bullards Bar Reservoir	Yes	None	No	No	No
5	552PPF042	Pine Flat Lake	Yes	None	No	No	No
5	522PSG041	Stony Gorge Reservoir	Yes	None	No	No	No
5	514PUV156	Union Valley Reservoir	Yes	None	No	No	No
6	628PLA091	Arrowhead, Lake	Yes	None	No	No	No
6	637PETSVR	Pete's Valley Reservoir	No information	Delete: appears to be on private land and also looks like it goes dry	No	Yes	No

Region	Station Code	Lake Name	Publicly Accessible?	Sampling Notes	Sampled in 2019	Include PCBs	Include OC Pesticides
_		Gene Wash					
7	714TG0155	Reservoir	Yes	None	No	No	No
8	801PBB131	Big Bear Lake	Yes	None	No	Yes	No
8	802PPR203	Perris Reservoir	Yes	None	No	Yes	No
8	801PPP187	Prado Lake	Yes	None	No	No	No
9	907PEC062	El Capitan	Yes	None	No	No	No
9	911PMR110	Morena Reservoir**	Yes	None	No	No	No
9	902ONEILL	O'Neill Lake	Yes**	None	No	Yes	No
9	904PLW126	Wohlford, Lake	Yes	None	No	No	No
Additiona	Additional Lakes						
		Lafayette					
2	NA	Reservoir	INCLUDE	None	No	Yes	No
9	NA	Diamond Valley	INCLUDE	None	Yes	Yes	No

# **Request Details**

Region	Station Code	Lake Name	OEHHA Requests	Regional Board Requests & Comments
Panel 4 L	akes			
1	105TS0941	Shastina, Lake	Need 2 additional species (not black bass): 9 Brown Trout, crappie, sunfish, or RBT.	None

Region	Station Code	Lake Name	OEHHA Requests	Regional Board Requests & Comments
1	106PTL209	Trinity Lake	Could add additional species: 4 Brown Bullhead; 7 Chinook Salmon; 9 Kokanee	None
2	205ALMDNR	Almaden Reservoir	No request at this time	Carrie Austin (11/05/20): Recommend removal because sampled in 2019; Carrie Austin (3/8/19): No need for PCB analysis. No one should eat any fish because of such high mercury levels. Best to spend the lab analysis budget on a different location where it can be used to protect human health
2	205PCR128	Calero Reservoir	No request at this time	Carrie Austin (11/05/20): Include 20 prey size LMB; Carrie Austin (11/13/20): permit should allow for collection of other species if for some reason young LMB not present in large numbers
2	204PLC157	Chabot, Lake (Vallejo)	Need 2 additional species (not carp): 2 black bass, 6 White Catfish, or 9 individuals from 2 other species. Recommend PCBs for catfish. RBT have been stocked in the past	Include per email from Carrie Austin on 6/18/15

Region	Station Code	Lake Name	OEHHA Requests	Regional Board Requests & Comments
2	204PDV169	Del Valle Reservoir	9 trout to add species to current advisory	Carrie Austin (11/13/20): could MPSL please save the remainder of the sport LMB carcass & ship to EB Parks fisheries staff for stomach content analysis: Del Valle Reservoir (I'll ask Joe Sullivan if he wants these – he's previously investigated Del Valle stomach contents and found a diet primarily of crayfish)
2	204TC0114	Lower Crystal Springs Reservoir	No request at this time	None
2	204PSC113	Shadow Cliffs Reservoir	7 RBT to add species to current advisory	Carrie Austin (11/13/20): Include 20 prey size LMB. Permit should allow for collection of other species if for some reason young LMB not present in large numbers; Include per email from Carrie Austin on 6/18/15

	Station			Regional Board Requests &
Region	Code	Lake Name	OEHHA Requests	Comments
2	201PSL093	Soulejoule Lake	7 Ccats; Hg is high so recommend as many species as possible.	Carrie Austin (11/05/20): Include 20 prey size LMB; Carrie Austin (11/13/20): For Soulajule, could you please include in your permit application collection of 30 prey fish 50–150 mm. The previous data set is for prey fish 50–150 mm, and these species: Bluegill (most plentiful), then Golden shiner & Black crappie. Please put in a permit application for 30 total from up to four species (these 3 plus Largemouth bass). In the field, please aim to collect Bluegill, but if not plentiful then the permit will allow for a grand total of 30 young fish. permit should allow for collection of other species if for some reason young LMB not present in large numbers. 30 young Bluegill; 20: 50–100 mm FL and another 10: 100–150 MM
		,	Request 1 additional species	
3	304PLL184	Loch Lomond Reservoir	(not black bass): 9 catfish and/or trout and/or carp	None
4	412BLDPRK	Belvedere Park Lake	Need 5 Carp; 9 trout, catfish, and/or black bass. Get PCBs for carp and catfish. Youth fishing club holds an annual fishing derby here.	None

Region	Station Code	Lake Name	OEHHA Requests	Regional Board Requests & Comments
4	403CSTLAG	Castaic Lagoon	Could add species to current advisory: 4 RBT; 9 Black Crappie	None
4	405ELDOLK	El Dorado Park Lakes	Could add additional species: 9 RBT or Catfish	None
4	412HANSLK	Hansen Dam Lake	Need 1 additional species (not black bass or carp): 8 White Catfish; 9 trout or sunfish	None
4	403HUGHLK	Hughes, Lake	We have sufficient bullhead and LMBs; are these useful after lake is dry. If so, need at least 1 additional species: 9 Sunfish, crappie, and/or catfish	None
4	404TM0284	Malibou Lake	No request at this time	None
4	412PECPRK	Peck Road Water Conservation Park	Need two additional species (not black bass): sunfish, carp, crappie, and/or RBT. Recommend running PCBs on all species.	None
5	532PLA129	Amador, Lake	Need two additional species (not black bass): 3 Black Crappie and 9 carp, catfish, shad, sunfish, and/or trout. Trout recommended.	None

	Station			Regional Board Requests &
Region	Code	Lake Name	OEHHA Requests	Comments
5	518PAL175	Antelope Lake	Could add species (not black bass, bullhead, or sunfish: 7 Brown Trout; 8 Rainbow Trout; 9 crappie or Sac Sucker)	None
5	556TC0084	Castac Lake	No request at this time	None
5	516TC0293	Combie, Lake	Can add additional species (not black bass or Sac Sucker): Need 7 RBT; 8 Sacramento Pikeminnow; 6 Sunfish	Lauren S: Suggest adding PCBs to Combie since Suckers were pretty high in 2007
5	514FINONR	Finnon Reservoir	Website says catch and release only	None
5	513PIV081	Indian Valley Reservoir	Need 2 additional species (not sunfish): 1 black bass; 4 carp; 2 Ccats; 4 Sac Sucker. We would also recommend adding additional species (Kokanee, RBT, and/or crappie due to high Hg levels. Also recommend PCBs.	None
5	540PML138	Millerton Lake	Could add two species to current advisory: 4 carp and 8 catfish.	None
5	517PNB117	New Bullards Bar Reservoir	Could add species: 9 crappie. No PCB data.	None

	Station			Regional Board Requests &
Region	Code	Lake Name	OEHHA Requests	Comments
5	552PPF042	Pine Flat Lake	Need 1 more species (not black bass or carp); 9 Brown Trout, catfish, crappie, Kokanee, RBT, and/or sunfish.	None
5	522PSG041	Stony Gorge Reservoir	Could add species to current advisory: 4 Crappie	None
5	514PUV156	Union Valley Reservoir	Need 1 additional species (not RBT or sunfish): 5 Kokanee; 5 Lake Trout; 7 black bass; 9 Brown Trout.	None
6	628PLA091	Arrowhead, Lake	Need 2 additional species (not black bass) 9 catfish, crappie, RBT, and/or sunfish	None
6	637PETSVR	Pete's Valley Reservoir	Does fishing occur here?	Kelly Huck (3/16/21): Billy just reached out regarding any information I had regarding Pete's Valley Reservoir and I cannot find anything about it. It appears to be on private land and also looks like it goes dry. I reached out to Tom Suk and he said he has never heard of it. Since there is no past data and no evidence of it being fished, I would say it is safe to skip this site.

				October 2021
	Station			Regional Board Requests &
Region	Code	Lake Name	OEHHA Requests	Comments
7	714TG0155	Gene Wash Reservoir	Need 2 additional species (not carp): 2 black bass; 9 individuals of additional species. Confirm fishing occurs here.	None
8	801PBB131	Big Bear Lake	Could add species to current advisory: 1 Black Bullhead; 7 Ccats; 6 Sunfish. Recommend PCBs on Ccats.	None
8	802PPR203	Perris Reservoir	Could add species: 9 Ccats or RBT. Need PCBs for Ccats.	None
8	801PPP187	Prado Lake	Could add species: 9 crappie, Striped Bass, and/or trout.	None
9	907PEC062	El Capitan	Need 2 additional species (not black bass): 9 crappie, Bcats and/or Ccats, and/or sunfish. Recommend PCBs (LMBs were 13 ppb in one sample)	Crappie a priority for El Cap: targeted consumption species
9	911PMR110	Morena Reservoir**	Need additional species (not carp): 1 black bass; 9 carp, catfish, RBT, and/or sunfish.	Crappie priority species here
9	902ONEILL	O'Neill Lake	Need 8 black bass and 9 individuals from 2 additional species.	No data here that I know of. Let me know if you need a base contact.
9	904PLW126	Wohlford, Lake	Need 2 additional species (not black bass): 9 Ccats, crappie, sunfish, and/or RBT.	Catfish priority species here

Region	Station Code	Lake Name	OEHHA Requests	Regional Board Requests & Comments
Additiona	al Lakes			
		Lafayette		Carrie Austin (11/13/20): Would it be possible to move Lafayette Reservoir into 2021 (it is in next panel, planned for 2023)? Rationale: it is an excellent pilot test site for mercury controls. (It is only functional for emergency fire suppression. It is not plumbed into drinking water treatment plant. Plus, it rarely discharges, and when it does that creek has poor habitat for many miles.) If yes, would it be possible to add collection of young LMB (20, prey size, whole, individual, Hg)? Permit should allow for collection of other species if for some reason young LMB not present in large numbers. Carrie Austin requested
2	NA	Reservoir	None	PCBs in email from 6/18/15

# Bioaccumulation Monitoring Program Bass Lakes & Reservoirs Monitoring Plan Version 2 October 2021

Region	Station Code	Lake Name	OEHHA Requests	Regional Board Requests & Comments
				Accessible, CDFW on-site; High PCBs. Anglers target stripers and flatheads for consumption. Cyano blooms. We did sample there in 2019. Chad hoping they could get more/bigger stripers if possible as they are targeted for consumption there. We also got some unexpected PCB hits. I was hoping to get enough data for OEHHA to update the advice for Diamond Valley for flathead catfish and striped bass. The OEHHA advisory was done in October 2019 so I'm not sure if there is enough data yet (I thought they wanted more
9	NA	Diamond Valley	None	but I could be wrong).