OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

GOOD CATCH CALIFORNIA
Your Fish Advisor

Statewide Health Advisory and Guidelines for Eating Fish from California's Rivers, Streams, and Creeks without Site-Specific Advice

September 2022

Fish, Ecotoxicology, and Water Section
Pesticide and Environmental Toxicology Branch
Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

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LIST OF ACRONYMS AND ABBREVIATIONS

ATL	Advisory Tissue Level
CALFED	California Bay-Delta Program
CDFW	California Department of Fish and Wildlife, formerly California Department of Fish and Game (CDFG)
DDT(s)	dichlorodiphenyltrichloroethane (DDT) and its metabolites dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE)
DHA	docosahexaenoic acid
DWR	Department of Water Resources
EPA	eicosapentaenoic acid
FDA	United States Food and Drug Administration
FMP	Fish Mercury Project
Hg	mercury
MeHg	methylmercury
MDL	method detection limit
MLML	Moss Landing Marine Laboratories
mm	millimeters
OEHHA	Office of Environmental Health Hazard Assessment
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
PG&E	Pacific Gas and Electric
ppb	parts per billion
RL	reporting limit
RMP	Regional Monitoring Program
RWB	Regional Water Board
Se	selenium
SFB RMP	San Francisco Bay Regional Monitoring Program
SRWP	Sacramento River Watershed Program
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board

TMDL	Total Maximum Daily Load
TSMP	Toxic Substances Monitoring Program
UCD	University of California, Davis
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
USDA	United States Department of Agriculture
USDHHS	United States Department of Health and Human Services
US EPA	United States Environmental Protection Agency

PREFACE

The Office of Environmental Health Hazard Assessment (OEHHA), a department in the California Environmental Protection Agency, is responsible for evaluating potential public health risks from chemical contamination of sport fish.[1] This includes issuing fish consumption advisories, when appropriate, for the State of California. OEHHA's authorities to conduct these activities are based on mandates in the:

- California Health and Safety Code
  - Section 59009, to protect public health
  - Section 59011, to advise local health authorities
- California Water Code
  - Section 13177.5, to issue health advisories

The health advisories are published in the California Department of Fish and Wildlife's (CDFW) Inland and Ocean Sport Fishing Regulations in their respective sections on public health advisories.[2]

This report presents guidelines for eating fish from California rivers, streams, and creeks that do not have site-specific advice. The report provides background information and a technical description of how the guidelines were developed. The resulting advice is summarized in the illustrations after the Table of Contents and List of Figures and Tables.

[1] Sport fish includes all fish and shellfish caught from California waters for non-commercial purposes (e.g., recreational, tribal/cultural, and subsistence practices).
[2] CDFW's Inland and Ocean Sport Fishing Regulations can be found online at: https://wildlife.ca.gov/Fishing/Inland and https://wildlife.ca.gov/Fishing/Ocean, respectively.

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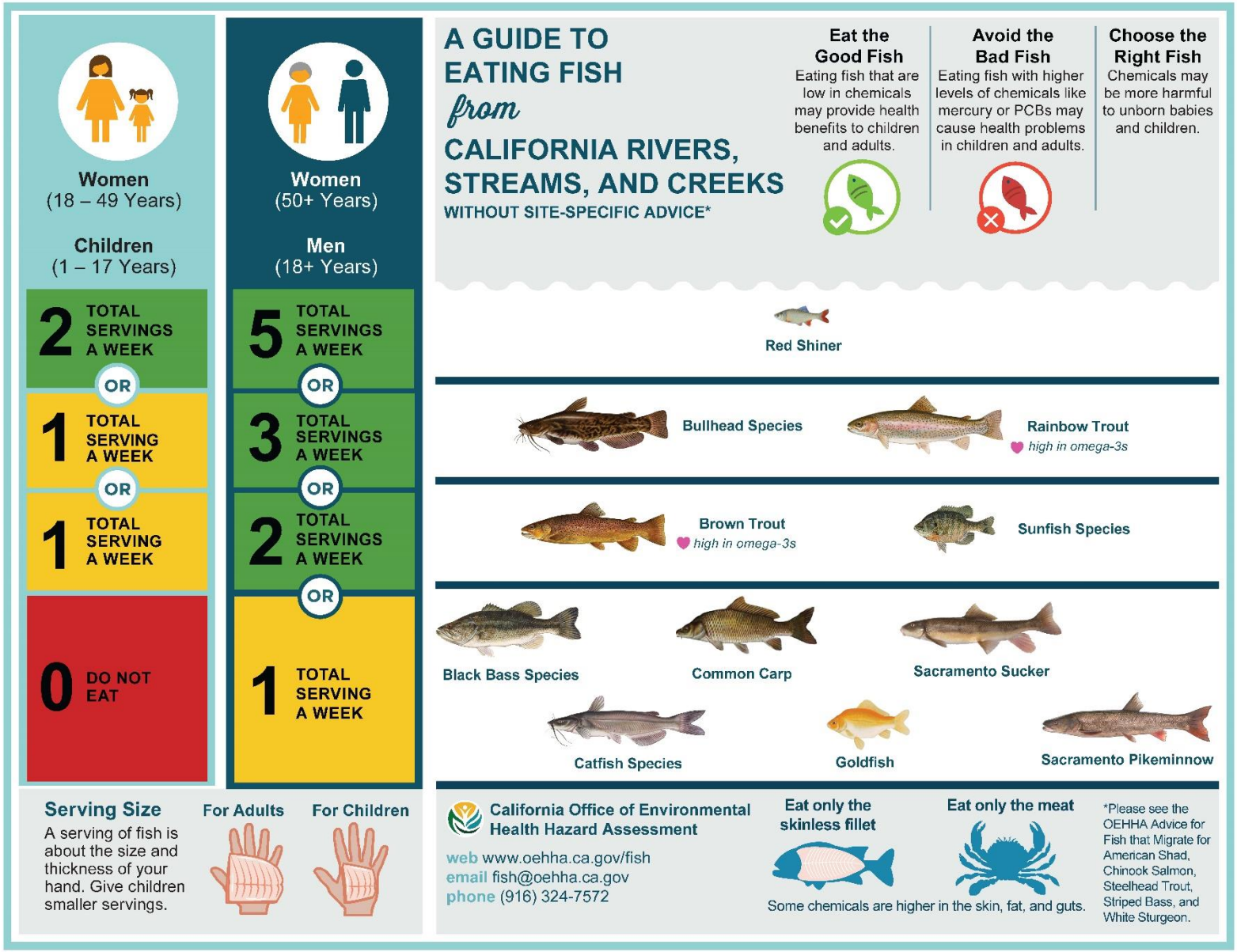

A GUIDE TO EATING FISH from CALIFORNIA RIVERS, STREAMS, AND CREEKS
WITHOUT SITE-SPECIFIC ADVICE*
Eat the Good Fish
Eating fish that are low in chemicals may provide health benefits to children and adults.
Avoid the Bad Fish
Eating fish with higher levels of chemicals like mercury or PCBs may cause health problems in children and adults.
Choose the Right Fish
Chemicals may be more harmful to unborn babies and children.
Women (18 – 49 Years)
Children (1 – 17 Years)
2 TOTAL SERVINGS A WEEK
OR
1 TOTAL SERVING A WEEK
OR
1 TOTAL SERVING A WEEK
0 DO NOT EAT
Women (50+ Years)
Men (18+ Years)
5 TOTAL SERVINGS A WEEK
OR
3 TOTAL SERVINGS A WEEK
OR
2 TOTAL SERVINGS A WEEK
OR
1 TOTAL SERVING A WEEK
Red Shiner
Bullhead Species
Rainbow Trout
high in omega-3s
Brown Trout
high in omega-3s
Sunfish Species
Black Bass Species
Common Carp
Sacramento Sucker
Catfish Species
Goldfish
Sacramento Pikeminnow
Serving Size
A serving of fish is about the size and thickness of your hand. Give children smaller servings.
For Adults
For Children
California Office of Environmental Health Hazard Assessment
web www.oehha.ca.gov/fish
email fish@oehha.ca.gov
phone (916) 324-7572
Eat only the skinless fillet
Eat only the meat
Some chemicals are higher in the skin, fat, and guts.
*Please see the OEHHA Advice for Fish that Migrate for American Shad, Chinook Salmon, Steelhead Trout, Striped Bass, and White Sturgeon.

SUMMARY

This report is the first OEHHA advisory for consumption of sport fish caught from California rivers, streams, and creeks that *do not have site-specific advice*.[3] It provides advice for safe consumption of eleven species or species groups. Separate advice of provided for the sensitive population (women 18 – 49 years and children 1 – 17 years) and the general population (women 50 years and older and men 18 years and older).

To develop this advisory, OEHHA compared chemical levels in fish caught from approximately 700 unique locations to levels that are considered safe for human consumption. OEHHA's consumption guidelines balance the risks and benefits of fish consumption, as low-contaminant fish are part of a healthy, well-balanced diet. Fish are a good source of protein and vitamins, and are a primary dietary source of heart-healthy omega-3 fatty acids.

OEHHA recommends the number of servings of each covered species that may be eaten safely. A serving is about the size and thickness of your hand for fish fillets. Children should be given smaller servings. For small fish species, several individual fish may make up a serving. The advice is as follows.

Women 18 – 49 and children 1 – 17 years

- **Should not eat**: black bass species, catfish species, Common Carp, Goldfish, Sacramento Sucker, or Sacramento Pikeminnow

- **May eat**:
  - One serving per week of Brown Trout, bullhead species, Rainbow Trout, or sunfish species, or
  - Two servings per week of Red Shiner.

Women 50 years and older and men 18 years and older

- **May eat**:
  - One serving per week of black bass species, catfish species, Common Carp, Goldfish, Sacramento Sucker, or Sacramento Pikeminnow, or
  - Two servings per week of Brown Trout or sunfish species, or
  - Three servings per week of bullhead species or Rainbow Trout, or
  - Five servings per week of Red Shiner.

[3] Site-specific consumption advice is available at https://oehha.ca.gov/fish/advisories for over 100 California water bodies, including lakes, rivers, bays, reservoirs, and the coast.

INTRODUCTION

This report provides statewide advice for eating recreationally caught fish from California rivers, streams, and creeks (hereafter referred to as "rivers") that did not have adequate sampling data to provide site-specific advice or for which advisories have not yet been developed. OEHHA has previously issued 27 advisories for flowing freshwaters (e.g., non-enclosed water bodies) in 27 counties, ranging from locations that recommend no consumption of any species (e.g., Guadalupe Creek and Guadalupe River) to those that recommend up to daily consumption for some species (e.g., Bishop Creek).

In every advisory issued for a California river to date, mercury results in the most restrictive consumption advice for at least one fish species. Excluding anadromous species, polychlorinated biphenyls (PCBs) result in the most restrictive advice for at least one species in 22% of these advisories. Different chemicals can be a risk driver (the chemical that results in the most restrictive consumption advice) for a given water body, dependent on the species and population group. This report provides consumption advice, based on mercury or PCBs, for eleven species or species groups: black bass species, Brown Trout, bullhead species, catfish species, Common Carp, Goldfish, Red Shiner, sunfish species, Rainbow Trout, Sacramento Pikeminnow, and Sacramento Sucker. Chlordanes, dichlorodiphenyltrichloroethane (DDT), dieldrin, polybrominated diphenyl ethers (PBDEs), selenium, and toxaphene were evaluated for this advisory but either did not impact advice or the data were too limited in geographic scope to be representative of levels typically found in fish from California rivers (see further discussion in the sections below). Separate advice is provided for the sensitive population (women 18 – 49 years and children 1 – 17 years) and the general population (women 50 years and older and men 18 years and older). OEHHA has previously issued statewide advisories for lakes and reservoirs and coastal areas that do not have site-specific advice, and for fish that migrate (known as anadromous species: American Shad, Chinook [King] Salmon, Steelhead Trout, Striped Bass, and White Sturgeon) when caught in rivers, bays, and coastal ocean waters. Anadromous species are not included in this advisory.

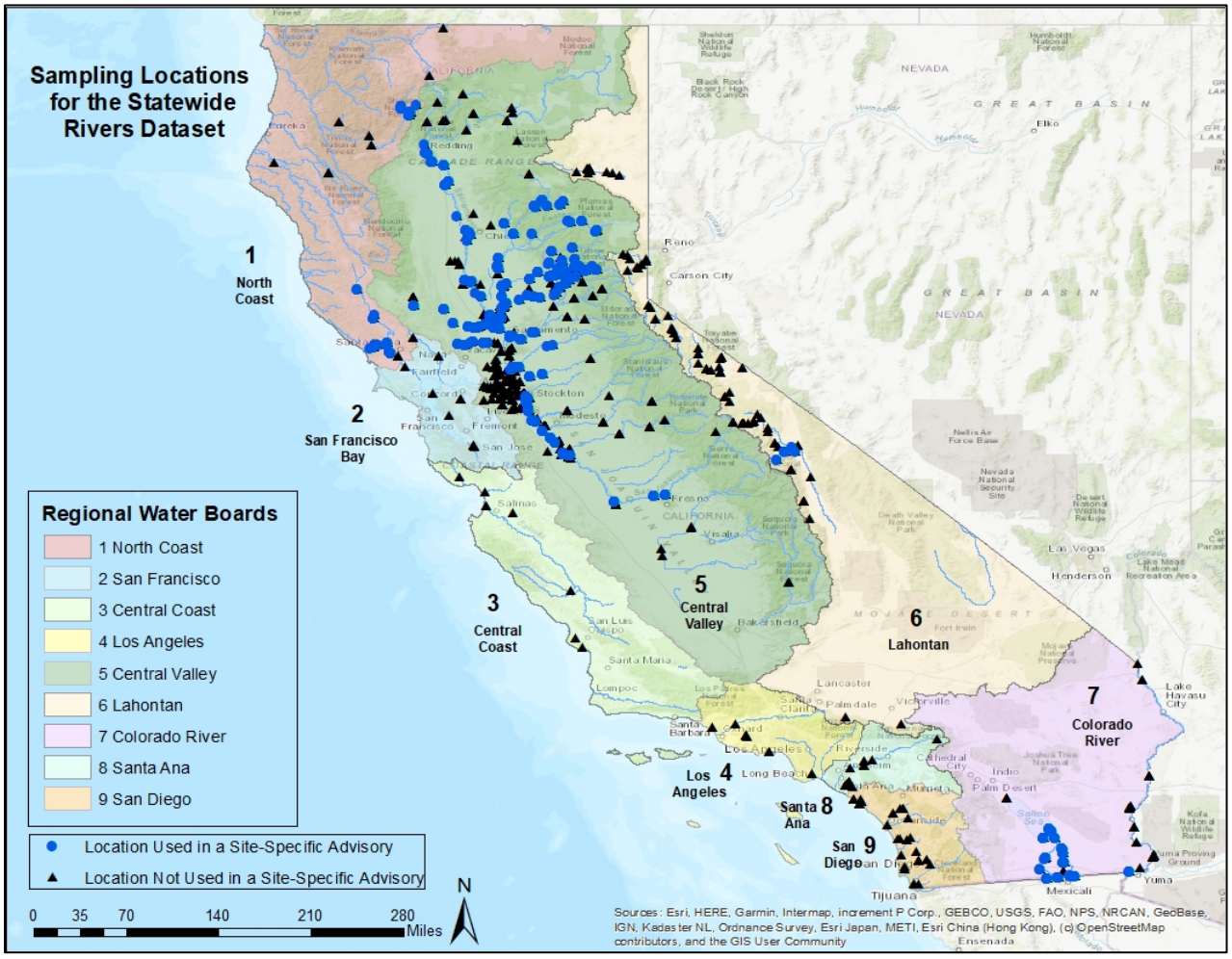
To develop this advisory, OEHHA compared chemical levels in finfish caught from approximately 700 unique locations in rivers throughout California, to levels that are considered safe for human consumption. Shellfish are not included in this advisory. OEHHA's consumption guidelines balance the risks and benefits of fish consumption, as low-contaminant fish are part of a healthy, well-balanced diet. Fish are a good source of protein and vitamins, and are a primary dietary source of heart-healthy omega-3 fatty acids.

Location of Rivers Contributing Mercury and PCB Data to the Statewide Advisory Dataset

Figure 1 shows California rivers where fish were collected and evaluated for mercury and PCB levels and met OEHHA's data quality criteria for inclusion in the statewide

dataset. Also shown are the regions covered by the State Water Resources Control Board's (SWRCB) nine Regional Water Quality Control Boards (Regional Water Boards, or RWBs). Maps of sampling locations for mercury and PCB analyses by species can be found in Appendix I and a list of water body names is provided in Appendix II.

FIGURE 1. RIVER, STREAM, AND CREEK SAMPLING LOCATIONS CONTRIBUTING MERCURY AND PCB DATA TO THE STATEWIDE ADVISORY DATASET



APPROACH USED

OEHHA used the results from the monitoring studies described in this report to develop the statewide advisory for rivers without site-specific advice. OEHHA used the following process in developing consumption advice for sport fish for this advisory:

1) Evaluation of all fish contaminant data available for each species from all rivers (with and without site-specific advisories) and selection of appropriate data that meet data quality criteria and sampling plan guidelines.
2) Determination of fish species for which adequate data are available to issue fish consumption advice.

3) Calculation of the species mean[4] and 90th percentile value of the sample[5,6] for each species, as well as other descriptive statistics of the contaminant data, as appropriate, for a chemical of potential concern for the selected fish species.
4) Comparison of the chemical concentrations with the OEHHA Advisory Tissue Levels (ATLs) for each chemical of potential concern.
5) Development of final advice based on a thorough review of the data and best professional judgment relating to the benefits and risks of consuming a particular fish species.

The ATLs (discussed further in a subsequent section of this report) are chemical levels in fish tissue that are considered acceptable, based on chemical toxicity, for a range of consumption rates. Development of the ATLs also included consideration of health benefits associated with including fish in the diet (OEHHA, 2008). The ATLs should not be interpreted as static "bright lines," but one component of a complex process of data evaluation and interpretation used by OEHHA in the assessment and communication of the benefits and risks of consuming sport fish.

CHEMICALS OF POTENTIAL CONCERN

Certain chemicals are of potential concern for people who eat fish because of their toxicity and their ability to accumulate in fish tissue. The majority of fish consumption advisories in California are issued because of mercury (Hg), followed by PCBs and, in a few cases, selenium (Se), PBDEs, or some legacy pesticides (pesticides that are no longer used but remain in the environment).

Mercury is a natural element found in some rocks and soil. Human activities, such as burning coal and the historical use of mercury to mine gold, also add mercury to the environment. If mercury enters waterways, it can be converted to a more toxic form known as methylmercury – that can pass into and build up in fish. High levels of methylmercury can harm the brain, especially in fetuses and children.

PCBs are industrial chemicals previously used in electrical transformers, plastics, and lubricating oils, and were often used as flame retardants or electrical insulators. Their use was banned in the 1970s, but they can accumulate in fish because they do not break down easily and they persist in the environment. Depending on the exposure level, PCBs may cause cancer or other health effects, including neurotoxicity, in humans.

Selenium is a naturally occurring metalloid and at low doses is an essential nutrient for many important human health processes, including thyroid regulation and vitamin C

[4] The species mean is the arithmetic average of individual values and/or composites (weighted by number of fish) of all samples for each species.
[5] 'Sample' includes both individual and composite samples.
[6] The 90th percentile value represents an upper bound value of the distribution of the sample chemical concentrations from all rivers for a fish species.

metabolism. Higher doses cause selenium toxicity, which can include symptoms ranging from hair loss and gastrointestinal distress to dizziness and tremors.

Chlordanes, DDT, dieldrin, and toxaphene are pesticides that were banned from use in 1973 (DDT), the late 1980s (chlordanes and dieldrin) and 1990 (toxaphene), but are still found in some fish in certain California water bodies. Depending on the exposure level, these chemicals may cause cancer or adverse effects on the nervous system.

PBDEs are a class of flame retardants historically used in a variety of consumer products, including furniture, textiles, automotive parts, and electronics. The use of PBDEs in new products was largely phased out by 2013 but, due to their wide usage and persistence in the environment, they are still being detected in fish tissues. PBDEs may affect hormone levels or learning and behavior in children.

A detailed discussion of the toxicity of these chemicals and references are presented in "Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, Dieldrin, Methylmercury, PCBs, Selenium, and Toxaphene" (OEHHA, 2008) and "Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Polybrominated Diphenyl Ethers (PBDEs)" (OEHHA, 2011).

All fish species used in advisory development were analyzed for mercury. Some fish were analyzed for PBDEs, PCBs, selenium, and legacy pesticides, as indicated in Table 1. Excluding Red Shiner, which are often analyzed in large numbers due to their small size (over 3,000 individuals were analyzed for mercury), advice based on mercury and PCBs was developed using analyses of over 7,500 and 1,100 fish, respectively. Fish species that do not normally accumulate PCBs or other organic chemicals may not be analyzed for those contaminants in a particular monitoring study.

DATA SOURCES

The guidelines for eating fish from California rivers that do not have site-specific advisories are based on the chemicals detected in the fish collected for the monitoring studies described below. These studies met OEHHA's data quality criteria, including adequate documentation of sample collection, fish preparation methods (e.g., skinning or filleting), chemical analyses, quality assurance, and sufficiently low detection limits. "Sample," as used in this report, refers to an individual fish or a composite of multiple fish for which contaminant data were reported. "Sampling" or "sampled" refers to the act of collecting fish for chemical analysis. The studies or entities contributing at least five percent of the statewide mercury data (based on number of fish) to this advisory are described below.

CALFED BAY-DELTA PROGRAM (CALFED)

The CALFED Bay-Delta Program was a state and federal interagency group, established in 1994, to develop strategies and provide funding for projects that improve

water quality, increase water supply, and support ecosystem restoration and levee improvement in the San Francisco Bay-Delta. This program was composed of more than 20 state and federal agencies including the California Environmental Protection Agency, the California Department of Fish and Wildlife, the US Environmental Protection Agency (US EPA), and the US Fish and Wildlife Service. CALFED funded the Surface Water Ambient Monitoring Program (SWAMP) sampling efforts for historical bioaccumulation studies in fish (Greenfield et al., 2002).

FISH MERCURY PROJECT (FMP)

The FMP was a three-year (2005 to 2007) sampling program funded by CALFED. Monitoring of sport fish from Central Valley water bodies was planned and conducted by staff at CDFW (then known as the California Department of Fish and Game), OEHHA, the California Department of Public Health, the University of California, Davis, and the San Francisco Estuary Institute. Fish were collected from popular fishing locations in the Central Valley Regional Water Quality Control Board (RWB5) jurisdiction to help characterize the spatial and temporal mercury trends in fishery resources (SFEI, 2009). The samples were analyzed for total mercury.

REGIONAL WATER QUALITY CONTROL BOARDS (RWBS 1, 5, 6, 7, 9)

The SWRCB develops water quality objectives and enforces implementation plans that protect the beneficial uses of waters in the State with consideration of the local differences between regions. One of these water quality objectives sets a numeric target for the concentration of methylmercury in fish tissue. The nine RWBs work in collaboration with the SWRCB to assist in that objective. The RWBs coordinate ongoing sampling efforts to monitor contaminant levels, including mercury and PCBs, in sport fish caught from water bodies within their regional boundaries.[7]

SACRAMENTO RIVER WATERSHED PROGRAM (SRWP)

The SRWP was founded in 1996 and certified as a California not-for-profit corporation in 2002.[8] Its mission is to sustain, restore, and enhance current and potential watershed resources. The SRWP operates through collaborative partnerships and conducts coordinated research and monitoring activities to assess water quality and other indicators of watershed health. SRWP conducted fish tissue sampling from 1998–2003 and analyzed mercury and, in some years, PBDEs and organochlorine compounds in the Sacramento River watershed including the Sacramento, San Joaquin, Feather, and American rivers.

[7] Further information on the SRWCB and the RWBs can be found online at: https://www.waterboards.ca.gov/water_issues/programs/mercury/ and https://www.waterboards.ca.gov/about_us/contact_us/rwqcbs_directory.html.
[8] Information about the Sacramento River Watershed Program can be found online at https://sacriver.org/.

Surface Water Ambient Monitoring Program: Statewide Monitoring Programs (SWAMP)[9]

SWAMP, operated by the SWRCB, provides environmental managers and the public with information to evaluate waters within the state. This is accomplished through the design and execution of water quality monitoring programs in California's surface waters. Three SWAMP studies contributed data to this statewide dataset: Contaminants in Fish from California Lakes and Reservoirs, 2007–2008 ("SWAMP1"; SWRCB, 2010), Contaminants in Fish from California Rivers and Streams, 2011 ("SWAMP 2"; SWRCB 2013a), and Long-Term Monitoring of Bass Lakes and Reservoirs in California, 2015–ongoing ("SWAMP 3"; Davis et al. 2019).

Toxic Substances Monitoring Program (TSMP)

The TSMP operated from 1976 to 2003 as a state water quality-monitoring program managed by the SWRCB (SWRCB, 2007 and 2013b). Its objective was to provide statewide information on the occurrence of toxic substances by monitoring water bodies with known or suspected water quality impairment.

University of California, Davis (UCD)

UCD conducted a series of studies on mercury concentrations in fish tissue between 1993 and 2001 to address various research objectives (Slotton et al., 1996; 1997a,b; 1998; 1999; 2002a,b) (Slotton and Ayers 2001).

Other Studies

Other studies, which cumulatively contributed less than six percent of the total number of fish used in the statewide dataset, are not described in this section. Those studies, along with the ones described above, are listed in Appendix III.

FISH SAMPLES INCLUDED IN THE STATEWIDE DATASET

The majority of the fish sampling data used in this advisory were retrieved from the California Environmental Data Exchange Network (CEDEN)[10], the state's repository for environmental data. Less than five percent of the total mercury and PCB data (by number of fish) included in the statewide dataset were not available in CEDEN. Data not available in CEDEN that were used previously in site-specific advisories were retrieved directly from the entity that collected the samples; refer to Appendix III for

[9] Further information on SWAMPs Bioaccumulation Monitoring Surveys for Lakes and Reservoirs, and Rivers and Streams, can be found online at: https://www.waterboards.ca.gov/water_issues/programs/swamp/lakes_study.html and https://www.waterboards.ca.gov/water_issues/programs/swamp/rivers_study.html, respectively.
[10] Online at: http://ceden.waterboards.ca.gov/AdvancedQueryTool.

further information on data sources. Samples were excluded when the fish were not of legal size to take, did not meet OEHHA's criteria for minimum "edible" size based on species size at maturity and professional judgment (as described in OEHHA, 2022), or were missing length for species with an established legal or edible size limit.

OEHHA established several criteria to determine whether data for a species were adequate to be included in the advisory. For species with a statewide range, it was determined that samples analyzed for mercury should be from the biogeographic jurisdictions of at least five Regional Water Boards and that there should be mercury data from at least 100 samples. For species with a limited range (e.g., Brown Trout and Sacramento Pikeminnow), it was determined that samples analyzed for mercury should be from two or more Regional Water Board jurisdictions in the species' range. These criteria were met for all species included in this advisory with the exception of bullhead species, which were just short of the criteria with 99 samples and was thus included.

As noted above, OEHHA evaluated fish contaminant data for all chemicals for which ATLs have been developed. Samples from several water bodies were excluded from the analysis initially because they have very high contaminant levels that are not representative of levels typically found in fish from California rivers. This included data for all species collected from Alamitos Creek, Calero Creek, Guadalupe Creek, and Guadalupe River, located in the vicinity of the historic New Almaden Mercury Mine, and Bear Creek, located near the Sulphur Creek mining district (Cooke et al., 2004). Additionally, PCB data for all species from the Port of Stockton and Smith Canal were excluded. Do-not-consume advice has already been established for these locations. Two trout samples from the Susan River were also excluded due to possible lab error.

Once the initial exclusions were made, contaminant data for other chemicals with ATLs were evaluated for each species. With the exception of selenium, for which there were more than 100 samples for three species groups, sample sizes were uniformly low for chemicals other than mercury. Although analysis of the data showed that DDTs and selenium would be risk drivers for one species, the sample sizes in those cases were not considered sufficiently large or geographically distributed to be representative of the levels of these contaminants statewide. Sampling for organic contaminants, in particular, is often targeted to specific locations because of the analytical expense and the limited number of locations where they have been found to impact advice. Likewise, selenium concentrations in fish are generally higher in certain areas of southern California and, thus, fish in that region are more likely to be analyzed for selenium. This intentional sampling bias, coupled with low overall sample numbers for most chemicals, can skew the statewide mean or 90th percentile so that they are not representative of levels typically found in fish from other California water bodies. Upon further evaluation of the data, several examples of this were evident. Whereas the initial evaluation indicated that selenium and DDTs would be risk drivers for Red Shiner for the general population, nearly 75% of the Red Shiner analyzed for selenium statewide were collected from only two sampling sites in southern California. Similarly, DDTs were only analyzed in Red Shiner collected from six sampling sites in the entire state. When

these data were excluded, mercury became the risk driver for the general population for this species, as was already the case for the sensitive population.

PCB data were also geographically limited for fish caught from California rivers, as no species had PCB samples from more than three Water Board regions and only three species or species groups (catfish species, Common Carp, and Sacramento Sucker) had 50 or more PCB samples. When PCB data were evaluated, advice was only affected for Sacramento Sucker; PCBs were a co-risk driver for catfish species. The PCB value for Sacramento Sucker was higher than for any species other than catfish. Thus, it was determined that PCB data should be included when developing consumption advice for Sacramento Sucker and catfish species.

For the reasons above, only mercury and PCB data were used for developing consumption advice for this advisory. Data for other chemicals are not shown. The use of the 90th percentile, rather than the mean, for establishing consumption advice is intended to compensate for regional and water body differences in contaminant concentrations. A summary of all fish species evaluated for this advisory is shown in Table 1, including the common and scientific name of the species, project or program name, year collected, and contaminants analyzed.

TABLE 1. FISH SAMPLES EVALUATED FOR THE STATEWIDE RIVERS ADVISORY

Common Name	Scientific Name	Program/Project Name[a]	Year Collected	Contaminants Analyzed[b]
Black Bullhead	*Ameiurus melas*	CALFED	1999	Hg
		Delta98 Organics	1998	Se
		TSMP	2000–2001	Chlordanes, DDTs, Dieldrin, Toxaphene
		TSMP	1983, 1993, 1998, 2000–2001	Hg
		TSMP	1993, 1998, 2000–2001	Se
Bluegill	*Lepomis macrochirus*	CALFED	1999–2000	Hg
		FMP	2005–2007	Hg
		RWB7	2014	Hg, Se
		RWB9	2013	Chlordanes, DDTs, Dieldrin, Hg, PBDEs, PCBs, Se
		SRWP	1999–2000	Hg
		SWAMP3	2016	Hg
		TMDL	2003	Hg
		TSMP	2000	Chlordanes, DDTs, Dieldrin, Toxaphene

Common Name	Scientific Name	Program/Project Name[a]	Year Collected	Contaminants Analyzed[b]
		TSMP	1979, 1985–1986, 1989–1991, 1993–1997, 2000	Hg
		TSMP	1986–1987, 1989, 1991, 1993–1997, 2000	Se
		UCD	1995–1996, 1998, 2000	Hg
		USGS	1999, 2006-2009	Hg
Brown Bullhead	*Ameiurus nebulosus*	FMP	2005, 2007	Hg
		RWB9	2013	Chlordanes, DDTs, Dieldrin, Hg, PBDEs, PCBs, Se
		SWAMP1	2007	Chlordanes, DDTs, Dieldrin, Hg, PBDEs, PCBs, Se
		TSMP	1980, 1982, 1988–1989, 1995, 1997, 1999	Hg
		TSMP	1988–1989, 1995, 1999	Se
		UCD	1995	Hg
Brown Trout	*Salmo trutta*	DWR	2003	Hg
		RWB6	2016–2017	Hg, Se
		RWB6	2016	PCBs
		SRWP	2000	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Toxaphene
		SWAMP2	2011	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se
		TSMP	2002	Chlordanes, DDTs, Dieldrin, Toxaphene
		TSMP	1978–2002	Hg
		TSMP	1984, 1986–2002	Se
		UCD	1993–1995, 2012	Hg
		USGS	1999, 2005–2006, 2010–2012	Hg
Bullhead Species (Unidentified)	*Ameiurus Spp.*	TSMP	1986, 1988, 1995	Hg, Se
Channel Catfish	*Ictalurus punctatus*	CALFED	1999–2000	Hg
		FMP	2005–2007	Hg
		RMP	2020	PBDEs
		RWB7	2004, 2012, 2014	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene

Common Name	Scientific Name	Program/Project Name[a]	Year Collected	Contaminants Analyzed[b]
		RWB7	2004, 2014	Hg, Se
		SRWP	2005	Chlordanes, DDTs, Dieldrin, PBDEs, PCBs, Toxaphene
		SRWP	2000	Hg
		TMDL	2011	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Toxaphene
		TSMP	2001–2003	Chlordanes, DDTs, Dieldrin, Toxaphene
		TSMP	1978–1988, 1990–1995, 1997–1998, 2001–2003	Hg
		TSMP	1985–2003	Se
		UCD	1995, 1998, 2000	Hg
		USGS	1999–2000	Hg
Common Carp	*Cyprinus carpio*	CALFED	2000	Hg
		FMP	2005–2007	Hg
		RWB1	2016	Chlordanes, DDTs, Dieldrin, Hg, PCBs
		RWB7	2004, 2012, 2014	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se, Toxaphene
		SRWP	1998, 2000–2001, 2005	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene
		SRWP	1998–2002	Hg
		SRWP	1998	PBDEs
		SWAMP2	2011	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se
		SWAMP3	2016	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se
		TMDL	2011	Hg, Toxaphene
		TMDL	2011, 2015–2016	Chlordanes, DDTs, Dieldrin, PCBs
		TSMP	2000, 2002	Chlordanes, DDTs, Dieldrin, Toxaphene
		TSMP	1981–1994, 1997–1998, 2000, 2002	Hg
		TSMP	1986–1995, 1997–2000, 2002	Se
		UCD	1995, 1998	Hg

Common Name	Scientific Name	Program/Project Name[a]	Year Collected	Contaminants Analyzed[b]
Goldfish	*Carassius auratus*	FMP	2005–2006	Hg
		TSMP	1981, 1983–1985, 1987, 1990	Hg
		TSMP	1987, 1990	Se
Green Sunfish	*Lepomis cyanellus*	RWB6	2015	Hg
		TSMP	2001	Chlordanes, DDTs, Dieldrin, Toxaphene
		TSMP	1978–1987, 1990–1993, 1995–1996, 1999, 2001	Hg
		TSMP	1986–1987, 1990–1996, 1999, 2001	Se
		UCD	1998, 2000	Hg
		USGS	1999, 2006	Hg
Largemouth Bass	*Micropterus salmoides*	CALFED	1999–2000	Hg
		Delta98 Organics	1998	Se
		DWR	2002, 2004	Hg, PCBs
		FMP	2005–2007	Hg
		RMP	2016, 2018	Hg
		RWB1	2015	Chlordanes, DDTs, Dieldrin, PBDEs, PCBs
		RWB1	2015–2016	Hg
		RWB5	2005–2006	Hg
		RWB7	2004, 2014	Hg
		RWB7	2012, 2014	Chlordanes, DDTs, Dieldrin, PCBs
		RWB7	2014	Se
		RWB7	2012	Toxaphene
		SRWP	1998–2000, 2002–2003	Hg
		SRWP	1998–2000	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene
		SRWP	1998	PBDEs
		SWAMP1	2007	Chlordanes, DDTs, Dieldrin, Hg, PBDEs, PCBs, Se
		SWAMP2	2011	Hg, Se

Common Name	Scientific Name	Program/Project Name[a]	Year Collected	Contaminants Analyzed[b]
		SWAMP3	2016	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se
		TSMP	2000–2002	Chlordanes, DDTs, Dieldrin, Toxaphene
		TSMP	1980, 1982–1983, 1985–1990, 1992–1993, 1998–2003	Hg
		TSMP	1986–1990, 1992–1993, 1995–1996, 1998–2003	Se
		UCD	1998, 2000	Hg
		USGS	1999–2000, 2005	Hg
Rainbow Trout	*Oncorhynchus mykiss*	DWR	2003	Hg, PCBs
		FMP	2005–2007	Hg
		PG&E	2003	Hg
		PG&E	2002	PCBs
		RWB1	2015	Hg
		RWB6	2016–2017	Hg, Se
		RWB6	2016	PCBs
		SRWP	1997–1998, 2000–2001	Hg
		SRWP	1998, 2000–2001, 2005	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene
		SRWP	1998	PBDEs
		SWAMP1	2008	Hg
		SWAMP2	2011	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se
		TMDL	2003	Hg
		TSMP	1980–1993, 1996–2000, 2002	Hg
		TSMP	1984–1993, 1996–2000, 2002	Se
		UCD	1993–1995, 1998	Hg
		USGS	1996–1999, 2002–2006, 2010–2012	Hg
Red Shiner	*Cyprinella lutrensis*	TSMP	2000–2002	Chlordanes, DDTs, Dieldrin, Toxaphene
		TSMP	1983–2002	Hg
		TSMP	1984–2002	Se

Common Name	Scientific Name	Program/Project Name[a]	Year Collected	Contaminants Analyzed[b]
		UCD	1996–1999, 2001	Hg
Redear Sunfish	*Lepomis microlophus*	CALFED	1999–2000	Hg
		FMP	2005–2007	Hg
		RWB7	2014	Hg, Se
		SRWP	2000–2001	Hg
		SRWP	2005	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene
		TSMP	1987–1989, 1998, 2002	Hg
		TSMP	1987, 1989, 1996, 1998, 2002	Se
		UCD	1998	Hg
Sacramento Pikeminnow	*Ptychocheilus grandis*	CALFED	1999–2000	Hg
		DWR	2003	Hg, PCBs
		FMP	2005–2007	Hg
		PG&E	2003	Hg
		RWB1	2015	Chlordanes, DDTs, Dieldrin, Hg, PBDEs, PCBs
		RWB5	2005–2006	Hg
		SRWP	1998–2003	Hg
		SRWP	1998–2001	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene
		SRWP	1998	PBDEs
		SWAMP2	2011	Hg, Se
		TSMP	1979–1980, 1982, 1984–1985, 1987–1988, 1992, 2002	Hg
		TSMP	1985, 1987, 1992, 2002	Se
		UCD	1993, 1998, 2000	Hg
		USGS	2005	Hg
Sacramento Sucker	*Catostomus occidentalis*	CALFED	1999–2000	Hg
		FMP	2005–2007	Hg
		PG&E	2002–2003	PCBs

Common Name	Scientific Name	Program/Project Name[a]	Year Collected	Contaminants Analyzed[b]
		RMP	2020	PBDEs
		RWB1	2015–2016	Chlordanes, DDTs, Dieldrin, Hg, PCBs
		RWB1	2015	PBDEs
		RWB5	2005–2006	Hg
		SRWP	1998–2003	Hg
		SRWP	1998–2002, 2005	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene
		SRWP	1998, 2002, 2005	PBDEs
		SWAMP1	2007–2008	Hg
		SWAMP1	2007	Chlordanes, DDTs, Dieldrin, PBDEs, PCBs, Se
		SWAMP2	2011	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se
		TMDL	2003	Hg
		TSMP	2000	Chlordanes, DDTs, Dieldrin, Toxaphene
		TSMP	1981–1991, 1997–2000, 2002	Hg
		TSMP	1986–1989, 1997–1998, 2000, 2002	Se
		UCD	1995, 1998, 2000–2001	Hg
		USGS	2012	Hg
Smallmouth Bass	*Micropterus dolomieu*	DWR	2003	Hg, PCBs
		FMP	2005	Hg
		PG&E	2003	Hg
		PG&E	2002–2003	PCBs
		RWB1	2015	Hg
		SRWP	2001	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Toxaphene
		SWAMP2	2011	Hg, Se
		TSMP	2001	Chlordanes, DDTs, Dieldrin, Hg, Toxaphene
		UCD	2000	Hg
		USGS	1999, 2006	Hg

Common Name	Scientific Name	Program/Project Name[a]	Year Collected	Contaminants Analyzed[b]
Spotted Bass	*Micropterus punctulatus*	DWR	2003	Hg
		FMP	2005–2007	Hg
		PG&E	2003	Hg, PCBs
		RMP	2016, 2018	Hg
		USGS	1999	Hg
Sunfish (hybrid)	*Lepomis spp.*	UCD	1998	Hg
White Catfish	*Ameiurus catus*	CALFED	1999–2000	Hg
		Delta98 Organics	1998	Se
		FMP	2005–2007	Hg
		SRWP	1997–2000	Hg
		SRWP	1998–2000, 2005	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene
		SRWP	1998, 2005	PBDEs
		TSMP	2000	Chlordanes, DDTs, Dieldrin, Toxaphene
		TSMP	1978–1987, 1991–1993, 1998, 2000	Hg
		TSMP	1986–1987, 1989–1990, 1993, 1996–1998, 2000	Se
		UCD	1998, 2000	Hg
Yellow Bullhead	*Ameiurus natalis*	TSMP	1989	Hg, Se

[a] The sample preparation method was not reported for approximately half of the samples used in this dataset. Of the samples for which the preparation method was reported, just over 40% were analyzed skinless and less than 10% were analyzed with skin on (excluding Red Shiner, which were analyzed whole).

[b] Organic data (chlordanes, DDTs, dieldrin, PCBs, or toxaphene) generated prior to 1998 were excluded from the analysis because data that are more recent are considered more reliable due to improved analytical methods and are likely to be more representative of fish caught today.

CHEMICAL CONCENTRATIONS

As shown in Table 1, samples were analyzed for one or more of the following: total mercury, selenium, chlordanes, DDTs, dieldrin, toxaphene, PBDEs (6 – 27 congeners), and PCBs (38 – 59 congeners).[11] Among the chemicals analyzed in fish tissue

[11] Congeners are related compounds with similar chemical forms. Of the 209 possible PBDE and PCB congeners, 6–7 and 48–54 are generally analyzed, respectively.

samples, only mercury and PCB levels were sufficiently high to impact consumption advice with the exclusions noted above.

The sample preparation method was not reported for approximately half of the samples used in this advisory. Of the samples for which the preparation method was reported, approximately 40% were prepared as skinless fillets and 10% were prepared with skin on (excluding Red Shiner, which are small and were analyzed as whole bodies). Samples were analyzed as individual fish or composites.

For this advisory, OEHHA used the 90th percentile of the sample chemical concentrations (in wet weight) for each fish species to estimate human exposure.

MERCURY

Most samples were analyzed for total mercury, as either individual fish or composite samples, using a direct mercury analyzer (DMA) at the CDFW Moss Landing Marine Laboratories (MLML). Some studies used other laboratories for analyses. The DMA method utilizes thermal decomposition and atomic absorption. OEHHA assumed all mercury detected was methylmercury, which is the most common form found in fish and is also the more toxic form (Bloom, 1992). Some samples were analyzed for mercury using cold vapor atomic fluorescence spectrometry or a flow injection mercury system. Table 2 shows the number of samples, total number of fish, the mean mercury concentration and range for each species, the number of Regional Water Boards, the average and range of total length,[12] and the 90th percentile of the sample mercury concentrations for each species. Depending on the study, the DMA method detection limits (MDLs)[13] for total mercury were most commonly reported between 3 and 12 parts per billion (ppb) and the reporting limits (RLs) were reported between 9 and 36 ppb. Some studies, such as TSMP, did not report the MDL or RL for mercury.

PCBS, PBDES, AND PESTICIDES

Some samples were analyzed for PCBs, PBDEs, and/or pesticides as either composites or individuals. Most PCBs were analyzed by gas chromatography at the CDFW Water Pollution Control Laboratory. Some samples were analyzed at other laboratories. Table 3 shows the number of samples, total number of fish, the mean PCB concentration and range for each species, the number of Regional Water Boards, the average and range of total length, and the 90th percentile of sample PCB concentrations in each species. For chlordanes, DDTs, PCBs, and PBDEs, each of the concentrations presented was the sum of the detected parent compound, congeners, or metabolites, where applicable. Since the MDLs or RLs were relatively low (generally ≤ 5 ppb), individual congeners or metabolites with concentrations reported as non-detects were

[12] Total length is the maximum length of the fish, measured from the tip of the closed mouth to the tip of the pinched tail fin.
[13] The MDL is the lowest quantity of a chemical that can be distinguished (as greater than zero) in a sample.

assumed to be zero. This is a standard method of handling non-detect values for PCBs and other chemicals with multiple congeners or metabolites in a given sample when detection levels are adequate (US EPA, 2000a).

SELENIUM

Some samples were analyzed for selenium as either composites or individual samples, using inductively coupled plasma-mass spectrometry (ICP-MS). The ICP-MS method uses desolvation, atomization, and ionization with ion separation based on a mass-to-charge ratio to detect the total selenium concentration in a sample. Depending on the study, the MDLs were most commonly reported between 100 and 200 ppb and the RLs were reported between 100 and 400 ppb.

Concentrations of chlordanes were lower than the corresponding ATL threshold value for daily consumption (OEHHA, 2008 and 2011). Concentrations of DDTs and selenium were higher than the corresponding ATL threshold values, but were not considered further for developing consumption advice for reasons discussed above. Dieldrin, PBDEs, and toxaphene were also higher than the corresponding ATL threshold values for daily consumption for one species, but at levels that did not drive risk, and were not included due to the limited geographic distribution of the samples as well as not meeting sample size criteria.

DEVELOPMENT OF GUIDELINES FOR EATING FISH FROM STATEWIDE RIVERS, STREAMS, AND CREEKS WITHOUT SITE-SPECIFIC ADVICE

The OEHHA fish advisory process considers the health benefits of fish consumption as well as the risk from exposure to the chemical contaminants found in fish. Benefits are included in the advisory process because there is considerable evidence and scientific consensus that fish should be part of a healthy, well-balanced diet. Fish contain many nutrients that are important for general health and, in particular, help promote optimal growth and development of babies and young children, and may reduce the incidence of heart disease in adults (FDA/US EPA, 2017; American Heart Association, 2016; OEHHA, 2008; Institute of Medicine, 2007; Kris-Etherton et al., 2002). Fish are a significant source of the beneficial omega-3 fatty acids, docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) (USDA/USDHHS, 2020; Weaver et al., 2008).

The US Department of Agriculture (USDA) recommends “including at least 8 ounces of cooked seafood[14] per week. Young children need less, depending on their age and calorie needs” (MyPlate.gov).[15] According to the 2020–2025 Dietary Guidelines (USDA/USDHHS, 2020), “women who are pregnant or lactating should consume at least 8 and up to 12 ounces of a variety of seafood per week from choices that are

[14] Seafood food as used here refers to fish and shellfish from freshwater and marine environments.
[15] Online at: https://www.myplate.gov/.

lower in methylmercury." Additionally, "based on FDA and EPA's advice, depending on body weight, some women should choose seafood lowest in methylmercury or eat less seafood than the amounts in the Healthy U.S.-Style Dietary Pattern" (USDA/USDHHS, 2020). For more detailed information, see USDA/USDHHS (2020) and other USDA MyPlate.gov materials. The particular fish that people eat is an important factor in determining the net beneficial effects of fish consumption. For example, studies have shown that children of mothers who ate low-mercury fish during pregnancy scored better on cognitive tests compared to children of mothers who did not eat fish or ate high-mercury fish (Oken et al., 2005 and 2008). Accordingly, because of the high mercury content of certain fish species, the US Food and Drug Administration (FDA) and the US EPA recommend that women who are pregnant (or might become pregnant) or breastfeeding, and young children avoid consuming shark, swordfish, tilefish (Gulf of Mexico), bigeye tuna, marlin, orange roughy, and king mackerel (FDA/US EPA, 2017).

To address the potential health concerns associated with exposure to contaminants in sport fish, OEHHA has established ATLs for chemicals that are known to accumulate in the edible tissues of fish. ATLs consider both the toxicity of the chemical and potential benefits of eating fish. OEHHA uses the ATLs to determine the maximum number of servings per week that consumers can eat safely, for each species and from each location, to limit their exposure to these contaminants. Consumers can use OEHHA's guidance when choosing which fish and how much to eat as part of an overall healthy diet.

There are two sets of ATLs for methylmercury in fish because of the age-related toxicity of this chemical (OEHHA, 2008). The fetus and children are more sensitive to the toxic effects of methylmercury. Thus, the ATLs for the sensitive population, including women who might become pregnant (typically 18 to 49 years of age) and children 1–17 years of age, are lower than those for women 50 years and older, and men 18 years and older. The lower ATL values for the sensitive population provide additional protection to allow for normal growth and development of the brain and nervous system of unborn babies and children. Detailed discussion about the toxicity of common fish contaminants and health benefits of fish consumption, as well as derivation of the ATLs, are provided in "Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, Dieldrin, Methylmercury, PCBs, Selenium, and Toxaphene" (OEHHA, 2008) and "Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Polybrominated Diphenyl Ethers (PBDEs)" (OEHHA, 2011). A list of the ATLs used in this report is presented in Appendix IV.

TABLE 2. MERCURY CONCENTRATIONS IN THE STATEWIDE RIVERS DATASET BY SPECIES

Species	Number of Regional Water Boards Sampled	Number of Samples[a]	Total Number of Fish	Total Length (mm)		Mercury Concentration (ppb)		
				Mean[b]	Range[c]	Mean[b]	90th Percentile[d]	Range[c]
Black Bass Species	5	1168	1494	374	305 – 647	534	1050	17 – 2350
Largemouth Bass	5	1071	1389	375	305 – 647	518	1022	17 – 2350
Smallmouth Bass	2	40	48	352	305 – 479	824	1425	200 – 1646
Spotted Bass	1	57	57	352	305 – 455	659	1130	190 – 1500
Brown Trout[e]	3	175	465	266	200 – 470	117	314	0 – 430
Bullhead Species	8	99	200	262	183 – 390	108	213	25 – 640
Black Bullhead	5	11	45	231	183 – 325	71	158	32 – 192
Brown Bullhead	6	83	124	278	201 – 390	120	218	25 – 580
Yellow Bullhead	1	1	1	210	n/a	640	n/a	n/a
Unidentified Bullhead Species	2	4	30	246	212 – 321	97	150	70 – 150
Catfish Species	6	703	1255	341	201 – 780	278	554	0 – 1300
Channel Catfish	5	289	598	393	201 – 726	214	510	0 – 1300
White Catfish	2	414	657	294	204 – 780	337	577	31 – 1270
Common Carp and Goldfish	9	366	703	471	200 – 879	192	479	0 – 938
Common Carp	7	345	656	485	201 – 879	196	482	0 – 938
Goldfish	5	21	47	278	200 – 403	131	294	25 – 488
Rainbow Trout	5	494	775	296	200 – 550	65	154	0 – 411
Red Shiner	5	146	3336	-	-	48	119	0 – 181

Species	Number of Regional Water Boards Sampled	Number of Samples[a]	Total Number of Fish	Total Length (mm)		Mercury Concentration (ppb)		
				Mean[b]	Range[c]	Mean[b]	90th Percentile[d]	Range[c]
Sacramento Pikeminnow	2	250	402	351	250 – 638	555	1200	0 – 2261
Sacramento Sucker	6	455	870	394	205 – 626	245	423	0 – 910
Sunfish Species	8	668	1489	151	100 – 307	162	309	0 – 993
Bluegill	6	291	544	147	102 – 258	160	350	15 – 993
Green Sunfish	7	70	507	124	100 – 193	193	330	20 – 395
Redear Sunfish	3	306	437	187	130 – 307	128	242	0 – 810
Sunfish (hybrid)	1	1	1	187	n/a	190	n/a	n/a

[a] Excluding Red Shiner, which were prepared whole, 49% of fish included in mercury analyses did not report the preparation method, 42% were analyzed skinless, and 9% were analyzed with skin on.
[b] Means are an arithmetic average of individual values and/or a weighted average of composites.
[c] Range of individuals and/or range of the composites.
[d] The 90th percentile value is calculated from the sample distribution.
"-" indicates incomplete length records.
n/a = not applicable due to a single sample.

TABLE 3. PCB CONCENTRATIONS IN THE STATEWIDE RIVERS DATASET BY SPECIES

Species	Number of Regional Water Boards Sampled	Number of Samples[a]	Total Number of Fish	Total Length (mm)		PCBs Concentration (ppb)		
				Mean[b]	Range[c]	Mean[b]	90th Percentile[d]	Range[c]
Black Bass Species	3	46	202	361	305 – 647	11	19	0 – 112
Largemouth Bass	3	36	177	363	305 – 647	12	23	0 – 112
Smallmouth Bass	1	8	19	349	308 – 400	4	6	0 – 6
Spotted Bass	1	2	6	346	344 – 347	4	5	4 – 5
Brown Bullhead	2	2	10	289	241 – 307	3	4	3 – 4
Brown Trout	3	4	33	271	202 – 416	3	11	0 – 14
Catfish Species	2	51	202	348	207 – 707	30	52	1 – 183
Channel Catfish	2	33	108	414	207 – 707	35	53	1 – 183
White Catfish	1	18	94	273	230 – 395	24	44	1 – 59
Common Carp	3	50	196	500	237 – 879	14	34	0 – 95
Rainbow Trout	2	43	180	299	208 – 572	6	13	0 – 24
Sacramento Pikeminnow	2	22	107	314	252 – 495	14	30	1 – 32
Sacramento Sucker	2	58	250	425	205 – 626	26	44	0 – 352
Sunfish Species	2	2	15	148	115 – 200	1	2	1 – 2
Bluegill	1	1	10	129	115 – 153	1	n/a	n/a
Redear Sunfish	1	1	5	187	177 – 200	2	n/a	n/a

[a] 53% of fish included in PCB analyses did not report the preparation method and 47% were analyzed skinless.
[b] Means are an arithmetic average of individual values and/or a weighted average of composites.
[c] Range of individuals and/or range of the composites.
[d] The 90th percentile value is calculated from the sample distribution.
n/a = not applicable due to a single composite.

For each fish species in this advisory, OEHHA compared the 90th percentile of the sample chemical concentrations detected in the fillet to the corresponding ATLs to establish the maximum number of servings per week that could be consumed (see Appendix IV). For fish fillets, a serving size is considered to be 8 ounces, prior to cooking, or about the size and thickness of a hand. Children should be given smaller servings. For smaller fish species, several individual fish may be required to yield a serving.

The consumption advice for a fish species is initially based on the chemical with the lowest allowable number of servings per week. Because some chemicals, such as DDTs, mercury, and PCBs are known to have similar adverse effects, additivity of toxicity is assumed in such cases and may be assessed using a multiple chemical exposure methodology (US EPA, 1989 and 2000b). If two or more chemicals with similar adverse effects are present in fish tissue, multiple chemical exposure methodology involving hazard index calculations is employed. This may result in advising the sensitive population to consume fewer meals per week than would be the case for the presence of either chemical alone, in a similar concentration. The potential effect of multiple chemical exposures (DDTs, mercury, PCBs) was assessed and found to impact advice only for Sacramento Sucker. Advice for all other species in this advisory except catfish species was based solely on mercury concentrations. The advice for catfish species for the general population was based on mercury or PCBs.

OEHHA recommends that individuals strive to meet the US Dietary Guidelines seafood consumption recommendations, while also adhering to federal and OEHHA recommendations to limit the consumption of fish with higher contaminant levels. The advice discussed in the following section represents the maximum recommended number of servings per week for different fish species. People should eat no more than the recommended number of servings for each fish species or species group. OEHHA's consumption advice for a particular fish species can be extended to other closely related fish species[16] known to accumulate similar levels of contaminants.

Consumption advice should not be combined. That is, if a person chooses to eat a fish from the "one-serving-a-week'' category, then they should not eat any other fish from any source (including commercial) until the next week. If a person chooses to eat a fish from the "two-servings-per-week" category, they can combine fish species from that category, or eat one fish from that category and one from a category that recommends more than two-servings-per-week (if available), for a total of two servings in that week. Then they should not eat any other fish from any source (including commercial) until the following week.

[16] Fish species within the same genus are most closely related, and family is the next level of relationship.

CONSUMPTION ADVICE FOR FISH FROM STATEWIDE RIVERS WITHOUT SITE-SPECIFIC ADVICE

The following advice is based solely on mercury concentrations for all species with the exception of Sacramento Sucker and catfish species where PCBs impacted advice, and applies to all rivers that do not have a site-specific advisory.

The advice covers both the sensitive population and the general population. The sensitive population is defined as women 18 to 49 years and children 1 to 17 years, and the general population is defined as women 50 years and older, and men 18 years and older.

Black Bass Species (Largemouth Bass, Smallmouth Bass, Spotted Bass)

Black bass species are one of the most targeted species of freshwater game fish in California. OEHHA groups black bass species because they have similar predatory diets which suggests a comparable chemical uptake (Long and Fisher, 2000). They are also known to hybridize (Pierce and Van Den Avyle, 1997), largely due to species introductions for angling purposes and weak genetic barriers between members of the genus (Thongda et al., 2020). OEHHA has also evaluated mercury concentrations in black bass species in many water bodies in California and has found a similar range of mercury concentrations when two or more of these species were caught from the same water body. OEHHA extends the consumption advice for Largemouth, Smallmouth, and Spotted Bass to other black bass species, including Redeye.

The 90th percentile of the sample mercury concentrations in black bass species was 1050 ppb. The 90th percentile mercury concentrations for individual black bass species were as follows: Largemouth Bass, 1022 ppb; Smallmouth Bass, 1425 ppb; and Spotted Bass, 1130 ppb. OEHHA recommends no consumption of black bass species for the sensitive population, and a maximum of one serving per week for the general population.

Brown Trout

The 90th percentile of sample mercury concentrations in Brown Trout was 314 ppb. Mercury concentrations are known to increase as fish age (grow), and, for this reason, OEHHA advises consumers to eat smaller (legal-sized) fish of a species. Brown Trout, in particular, are known to change diet from invertebrates to fish as they age, which results in greater mercury accumulation. Brown Trout exceeding 16 inches feed almost exclusively on fish (Moyle, 2002). For this reason, providing advice for Brown Trout adjusted for size was explored. Nonetheless, consumption advice was found to be the same for Brown Trout above and below 16 inches so size-based advice was not indicated. OEHHA recommends a maximum of one serving per week for the sensitive population and a maximum of two servings per week for the general population.

BULLHEAD SPECIES (BLACK BULLHEAD, BROWN BULLHEAD, YELLOW BULLHEAD, UNIDENTIFIED BULLHEAD SPECIES)

These species of bullhead are grouped because they are benthic, opportunistic omnivores, with adults feeding primarily on plants, invertebrates, and small fish. They can tolerate a wide range of conditions, including waters with low oxygenation and high pollution levels. Bullhead species are bottom-dwellers, which can expose them to chemical contaminants in bottom sediments. Black and Brown Bullhead are known to hybridize in some water bodies where they are co-located (Cingolani et al., 2007). Although there are not sufficient data to state conclusively, due to their similar diet and habitat preferences, it is expected that Black, Brown, and Yellow Bullhead would have similar levels of contaminant uptake. There was only one Yellow Bullhead that met sample inclusion criteria for this advisory and it was collected from the New River in the Imperial Valley. Although it had a significantly higher mercury concentration (640 ppb) than other bullhead samples evaluated for this advisory, it was included in the data set because of its similar diet and habitat to other bullhead species. OEHHA has evaluated mercury concentrations in Black Bullhead and Brown Bullhead in water bodies in California (comparable data on Yellow Bullhead are limited), and has found a similar range of mercury concentrations when both of these species were caught from the same water body. These two species also have a similar statewide mean mercury concentration.

The 90th percentile of the sample mercury concentrations in bullhead species was 213 ppb. The 90th percentile mercury concentrations for individual bullhead species were as follows: Black Bullhead, 158 ppb; Brown Bullhead, 218 ppb; Yellow Bullhead, not applicable due to single sample; and unidentified bullhead species, 150 ppb. OEHHA recommends a maximum of one serving a week of bullhead species for the sensitive population, and a maximum of three servings a week for the general population.

CATFISH SPECIES (CHANNEL CATFISH, WHITE CATFISH)

The 90th percentiles of the sample mercury and PCB concentrations in catfish species were 554 and 52 ppb, respectively. The 90th percentile mercury and PCB concentrations for individual catfish species were as follows: Channel Catfish, Hg: 510 ppb, PCB: 53 ppb; and White Catfish, Hg: 577 ppb, PCB: 44 ppb. OEHHA recommends no consumption of catfish species for the sensitive population based on mercury, and a maximum of one serving per week for the general population based on either mercury or PCBs.

COMMON CARP, GOLDFISH

Common Carp and Goldfish were grouped because they are very closely related and frequently hybridize when they are co-located, making them difficult to distinguish (Halas et al., 2018). Further, the data show that mercury and PCB concentrations for Common Carp and Goldfish are relatively similar, and similar advice would be provided for the two species if they were to be considered separately.

The 90th percentile of the sample mercury concentrations in Common Carp and Goldfish was 479 ppb. The 90th percentile mercury concentrations for individual species were as follows: Common Carp, 482 ppb; and Goldfish, 294 ppb. OEHHA recommends no consumption of Common Carp or Goldfish for the sensitive population, and a maximum of one serving a week for the general population.

RAINBOW TROUT

The 90th percentile of the sample mercury concentrations in Rainbow Trout was 154 ppb. OEHHA recommends a maximum of one serving per week for the sensitive population. To simplify risk communication by reducing the number of different meal frequency categories, OEHHA decreased the number of recommended servings a week of Rainbow Trout from four to three for the general population. This was justified in this case because the mercury concentration of 154 ppb in this species was close to the cutoff (i.e., 160 ppb) for the next, more restrictive, meal frequency for the general population.

RED SHINER

The 90th percentile of the sample mercury concentrations in Red Shiner was 119 ppb. OEHHA recommends a maximum of two servings per week of Red Shiner for the sensitive population, and a maximum of five servings per week for the general population.

SACRAMENTO PIKEMINNOW

The 90th percentile of the sample mercury concentrations in Sacramento Pikeminnow was 1200 ppb. OEHHA recommends no consumption of Sacramento Pikeminnow for the sensitive population, and a maximum of one serving per week for the general population.

SACRAMENTO SUCKER

The 90th percentiles of the sample mercury and PCB concentrations in Sacramento Sucker were 423 and 44 ppb, respectively. OEHHA recommends no consumption of Sacramento Sucker for the sensitive population based on a multi-chemical exposure analysis of mercury and PCBs, and a maximum of one serving per week for the general population, based on PCBs.

SUNFISH SPECIES (BLUEGILL, GREEN SUNFISH, HYBRID SUNFISH, REDEAR SUNFISH)

OEHHA groups sunfish species due to extensive dietary overlap (Kirby, 1982), which suggests a similar contaminant uptake, and a known ability to hybridize (Avise and Smith, 1974). OEHHA has evaluated mercury concentrations in sunfish species in many water bodies in California and has found a similar range of mercury concentrations when two or more of these species were caught from the same water

body. OEHHA extends the consumption advice for sunfish species (Bluegill, Green Sunfish, Redear Sunfish) to other sunfish species, including Pumpkinseed.

The 90th percentile of the sample mercury concentrations in sunfish species was 309 ppb. The 90th percentile mercury concentrations for individual sunfish species were as follows: Bluegill, 350 ppb; Green Sunfish, 330 ppb; Redear Sunfish, 242 ppb; and hybrid sunfish, not applicable due to a single sample. OEHHA recommends a maximum of one serving per week for the sensitive population and a maximum of two servings per week for the general population.

RECOMMENDED MAXIMUM NUMBER OF SERVINGS

The recommended maximum number of servings per week for fish from rivers, streams, and creeks without site-specific advice are shown in Table 4.

TABLE 4. RECOMMENDED MAXIMUM NUMBER OF SERVINGS PER WEEK FOR FISH FROM CALIFORNIA RIVERS, STREAMS, AND CREEKS WITHOUT SITE-SPECIFIC ADVICE

Fish Species	Women 18–49 years and Children 1–17 years	Women 50 years and older and Men 18 years and older
Black Bass Species	0	1
Brown Trout	1	2
Bullhead Species	1	3
Catfish Species	0	1
Common Carp	0	1
Goldfish	0	1
Rainbow Trout	1	3
Red Shiner	2	5
Sacramento Pikeminnow	0	1
Sacramento Sucker	0	1
Sunfish Species	1	2

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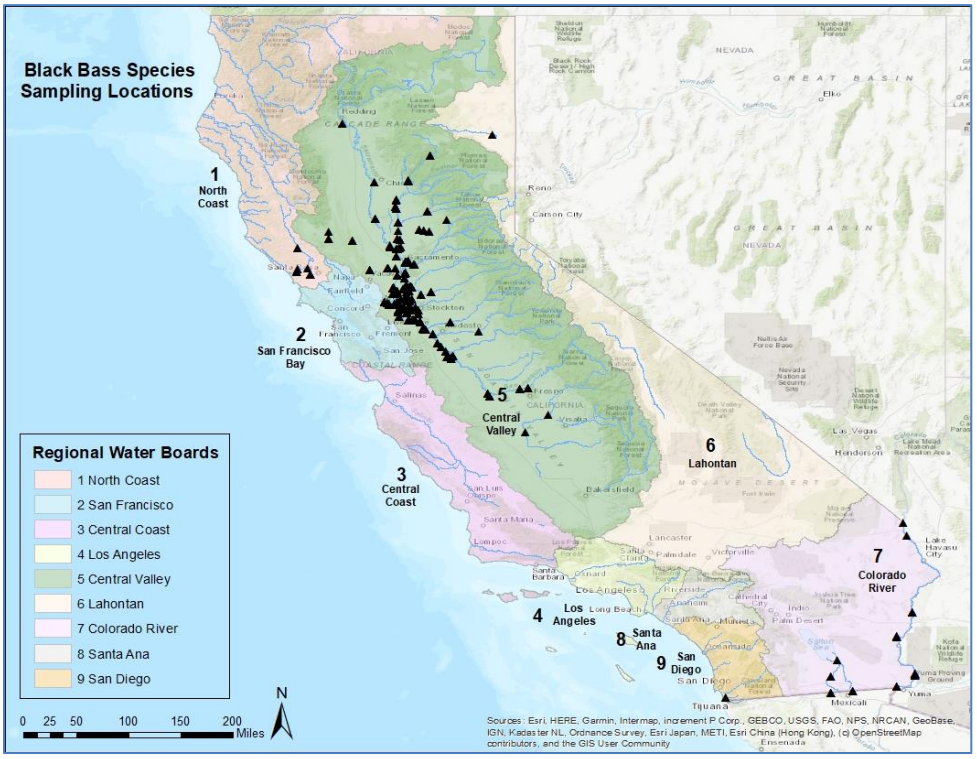
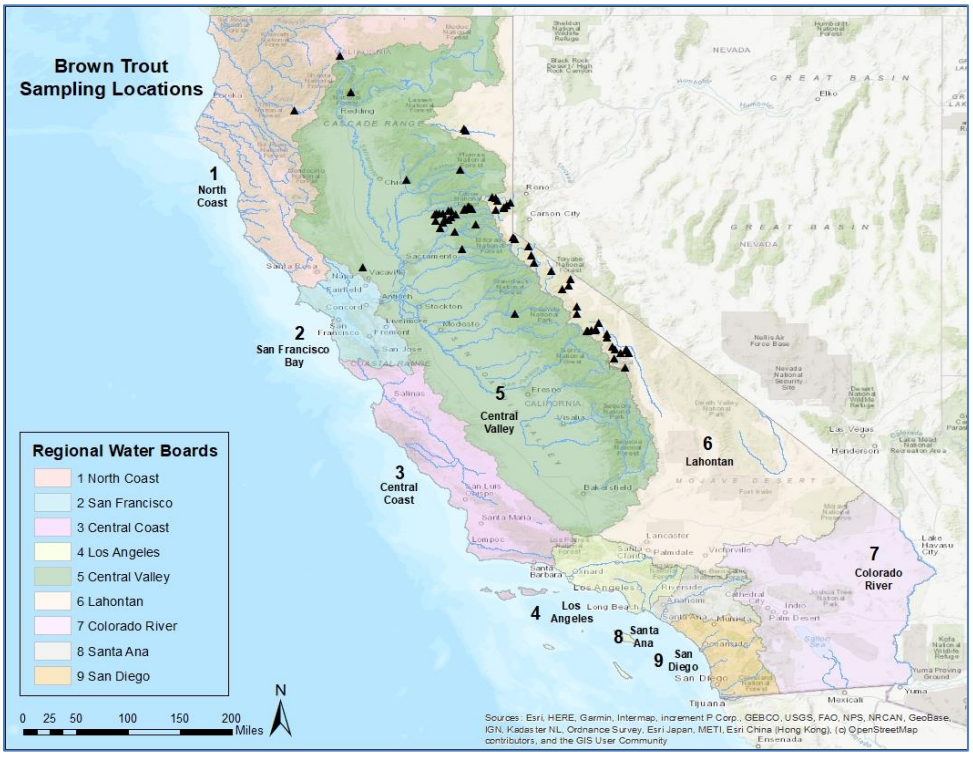
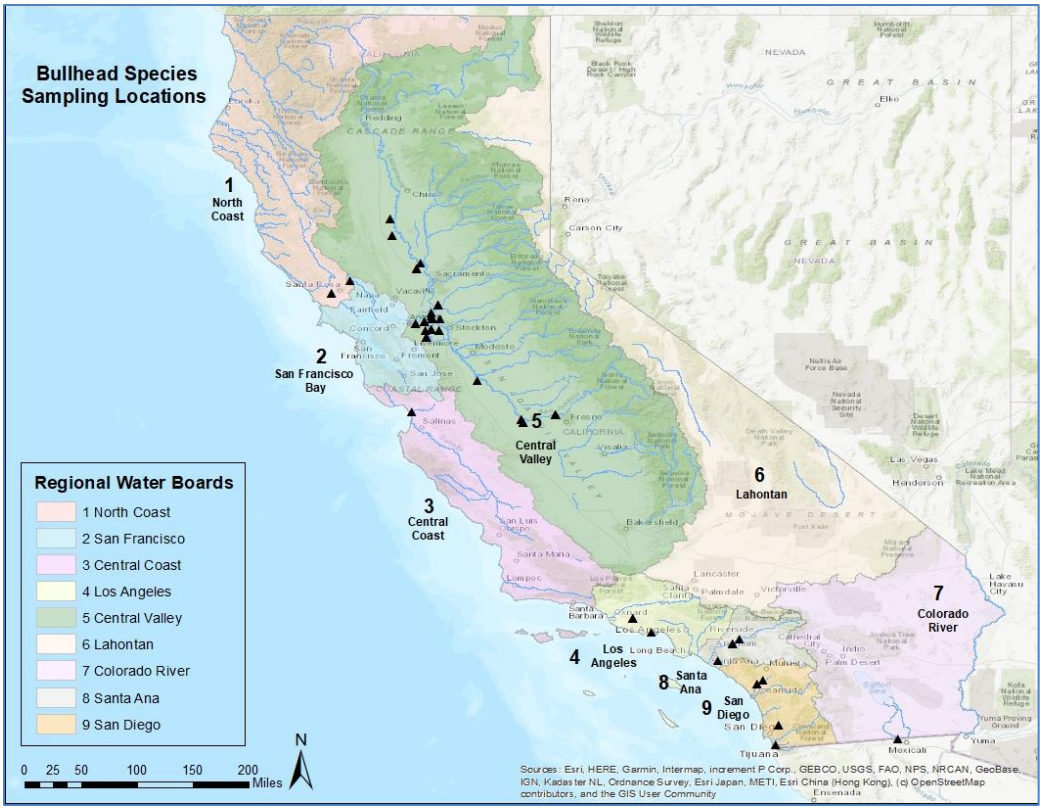
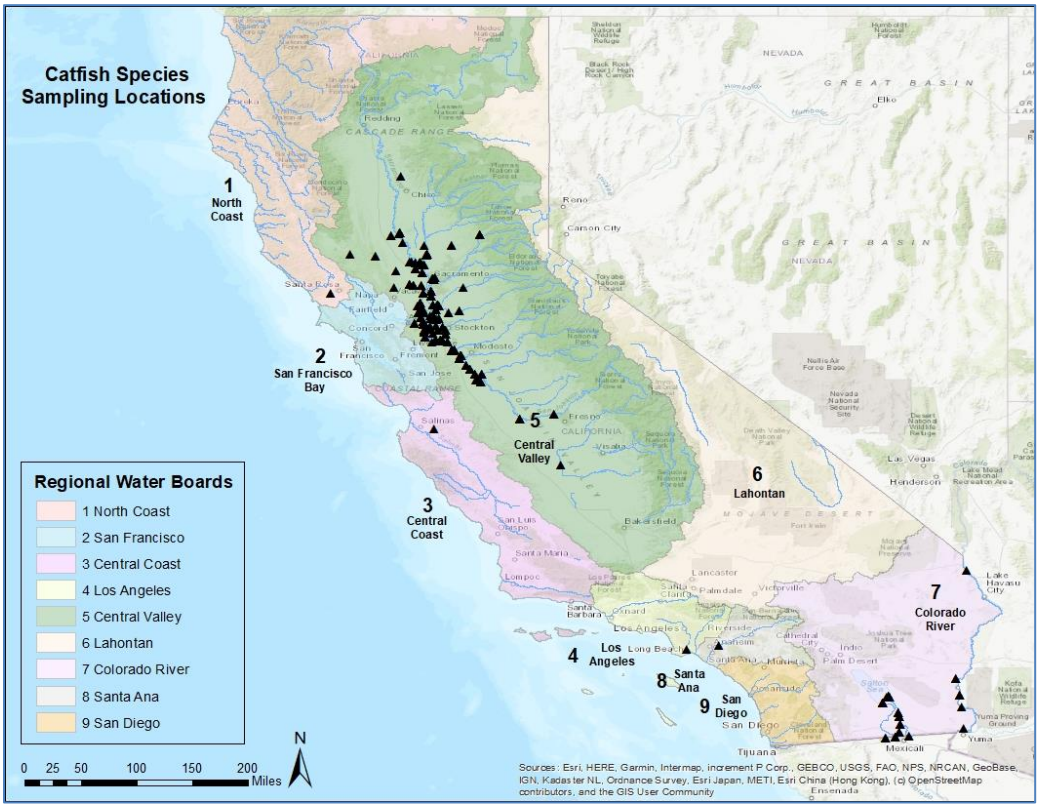
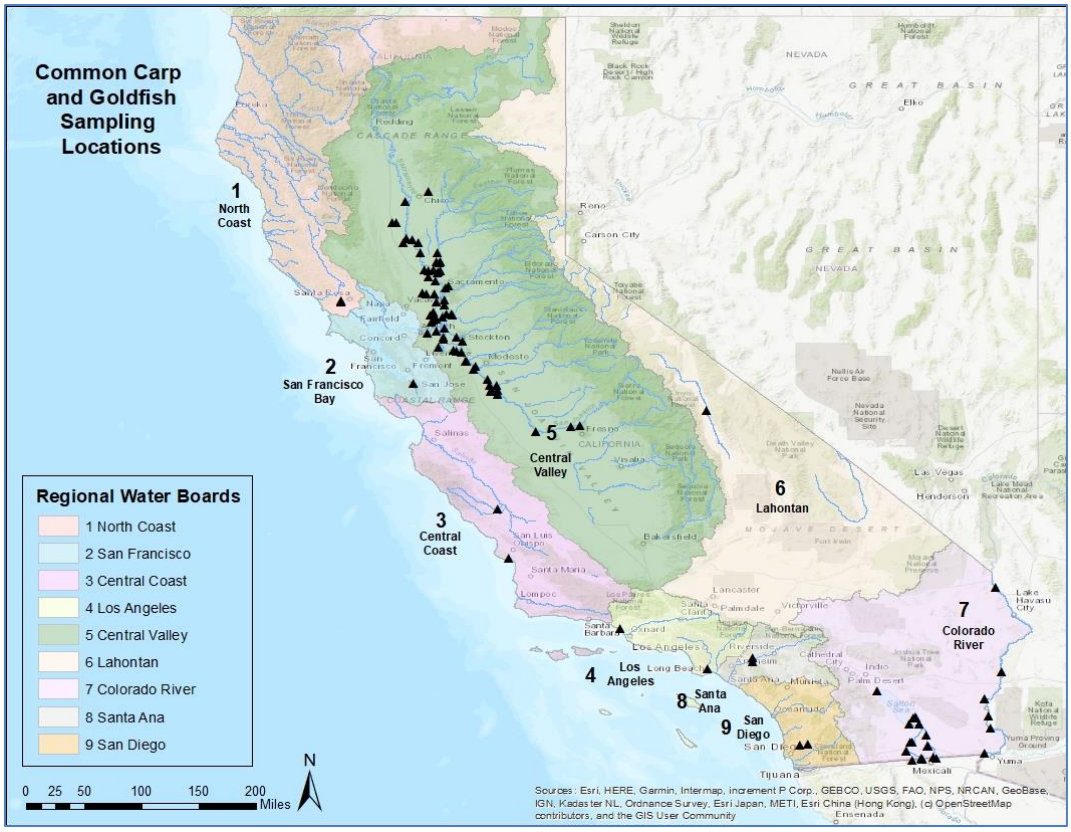
APPENDIX I. RIVER, STREAM, AND CREEK SAMPLING LOCATIONS CONTRIBUTING MERCURY AND PCB DATA TO THE STATEWIDE ADVISORY DATASET BY SPECIES

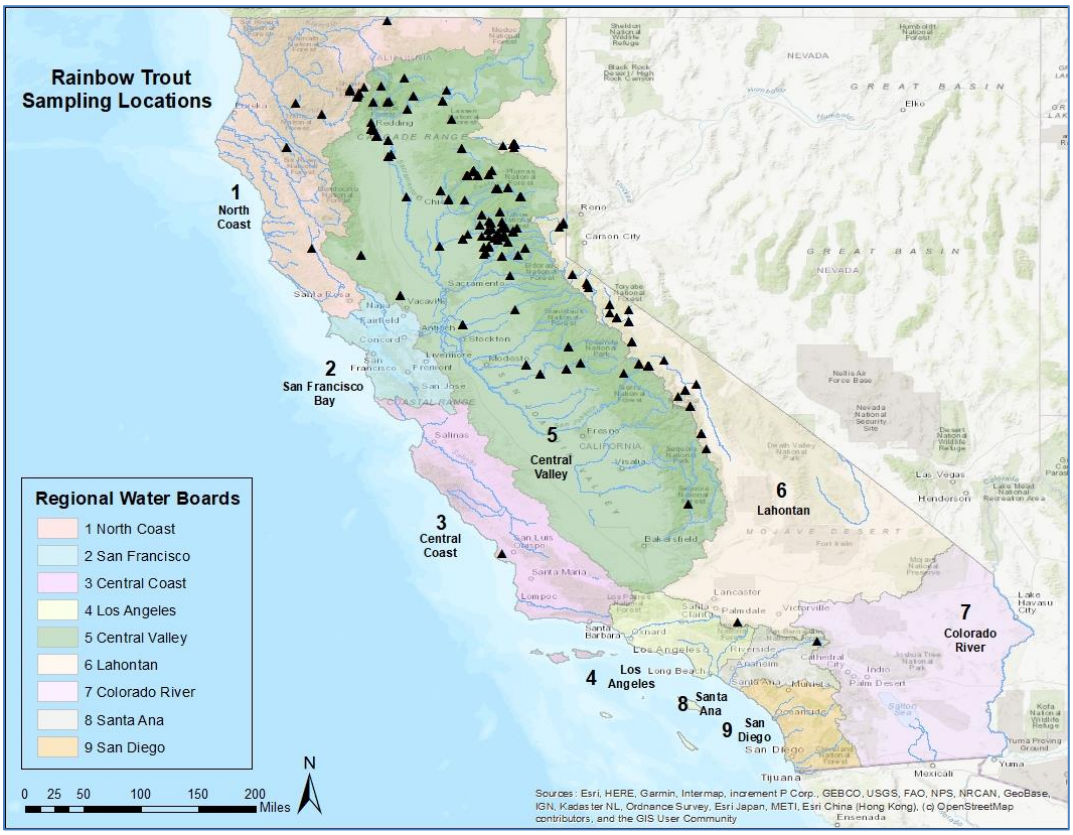


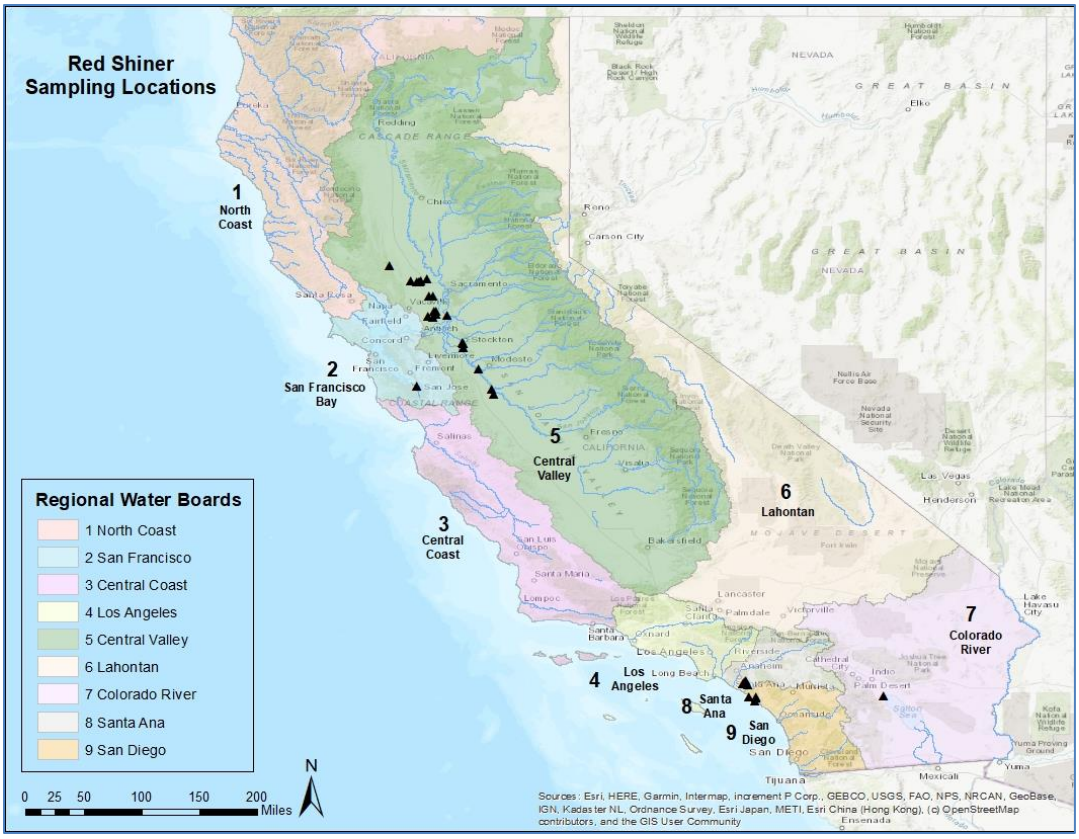


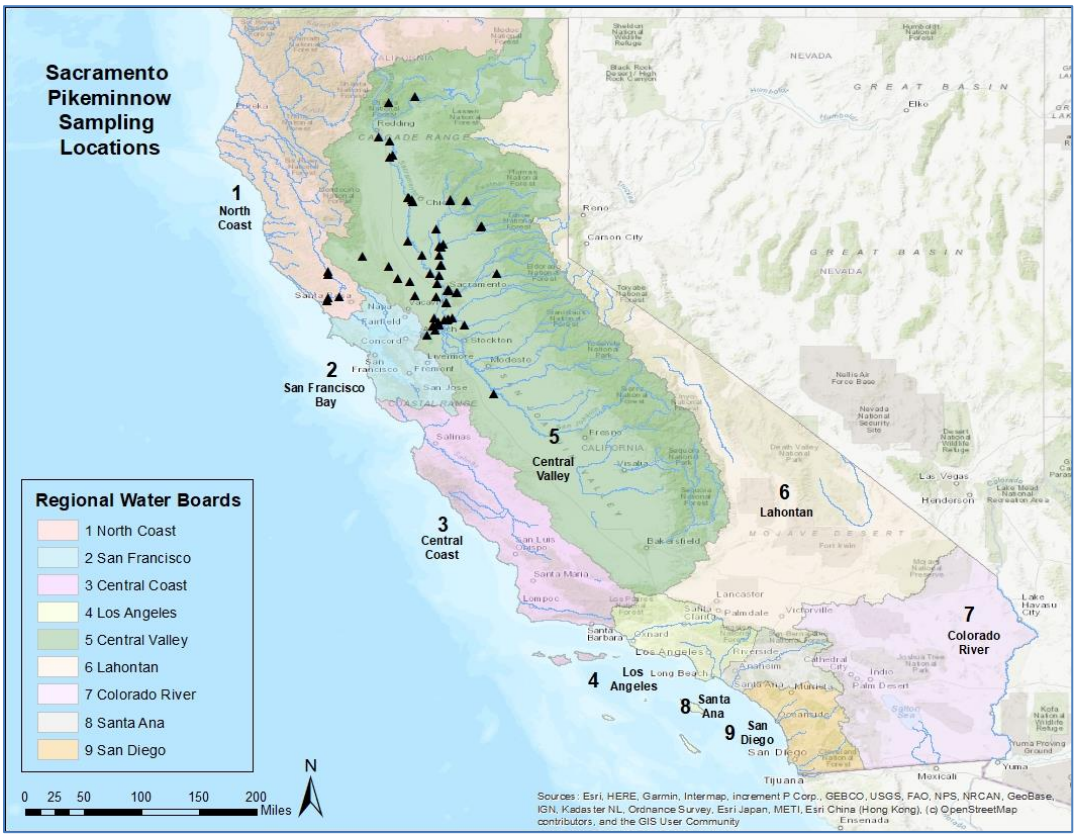

Bullhead Species
Sampling Locations
1
North
Coast
2
San Francisco
Bay
3
Central
Coast
4
Los
Angeles
5
Central
Valley
6
Lahontan
7
Colorado
River
8
Santa
Ana
9
San
Diego
Regional Water Boards
1 North Coast
2 San Francisco
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River
8 Santa Ana
9 San Diego
0 25 50 100 150 200
Miles
N
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

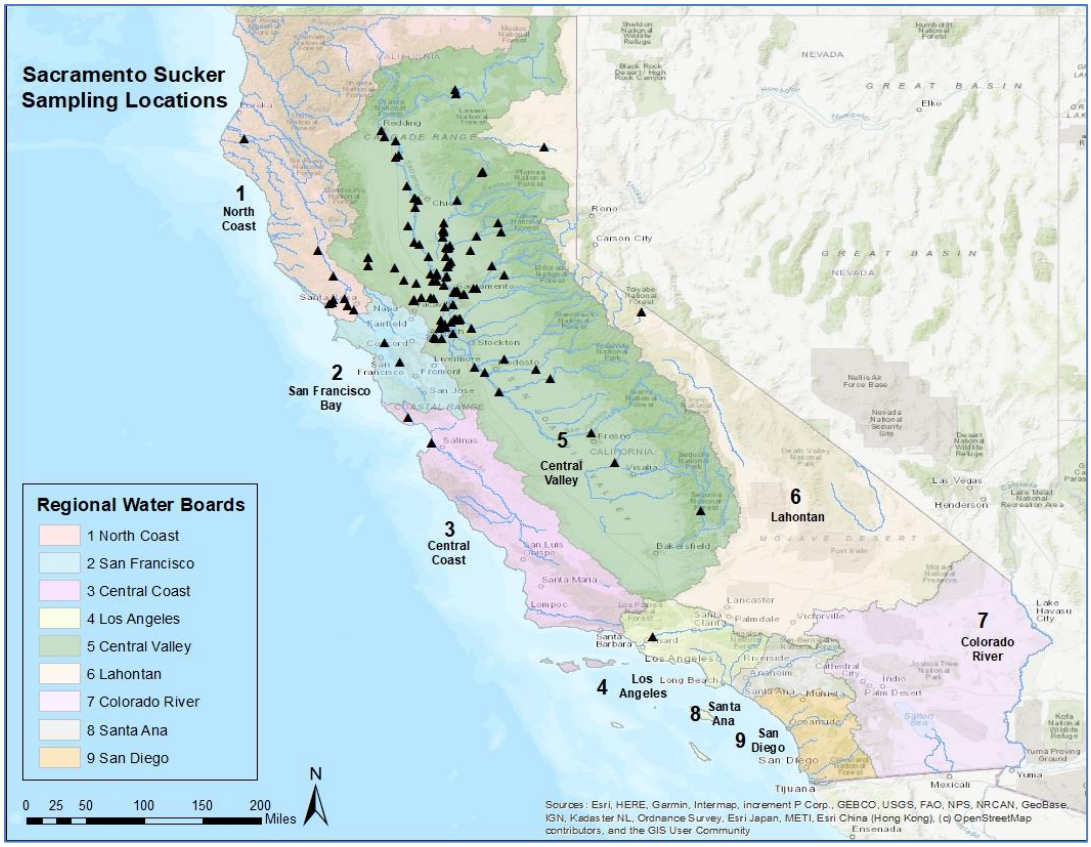

Catfish Species
Sampling Locations
1
North
Coast
2
San Francisco
Bay
3
Central
Coast
4
Los
Angeles
5
Central
Valley
6
Lahontan
7
Colorado
River
8
Santa
Ana
9
San
Diego
Regional Water Boards
1 North Coast
2 San Francisco
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River
8 Santa Ana
9 San Diego
0 25 50 100 150 200
Miles
N
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

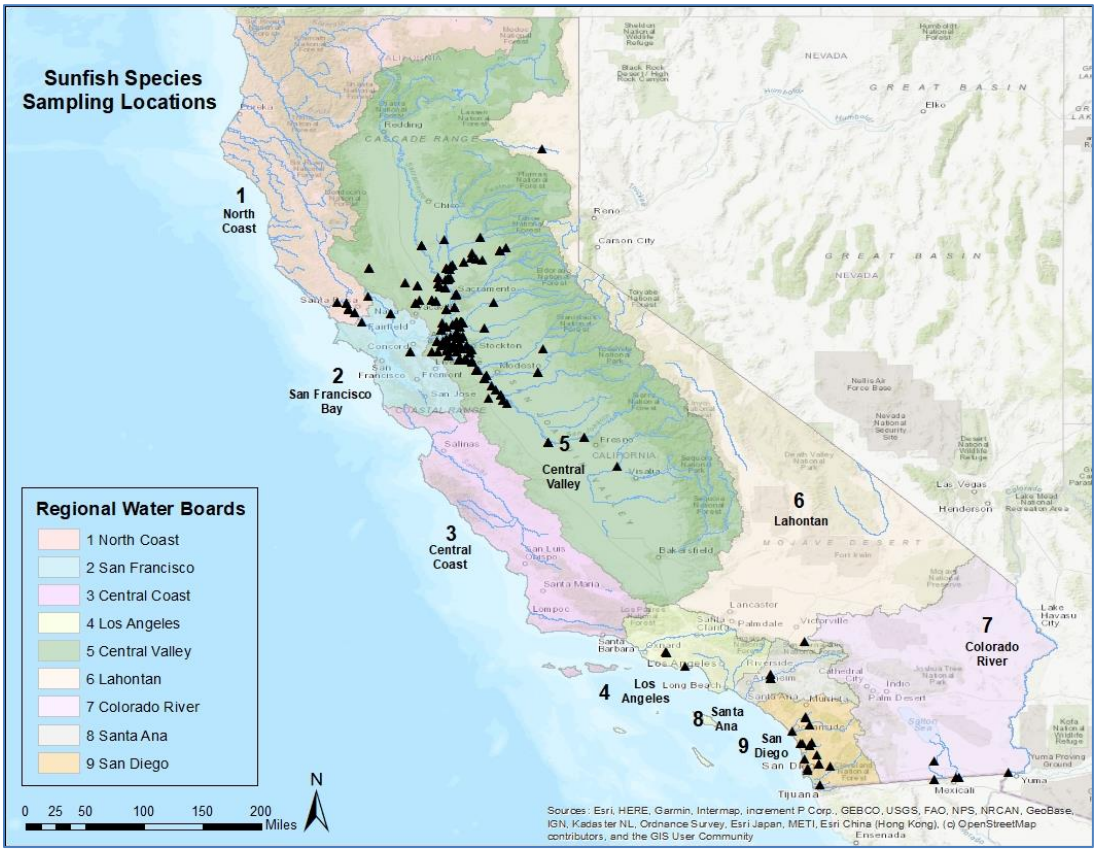

Common Carp and Goldfish Sampling Locations
1 North Coast
2 San Francisco Bay
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River
8 Santa Ana
9 San Diego
Regional Water Boards
1 North Coast
2 San Francisco
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River
8 Santa Ana
9 San Diego
0 25 50 100 150 200 Miles
N
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Rainbow Trout Sampling Locations
1 North Coast
2 San Francisco Bay
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River
8 Santa Ana
9 San Diego
Regional Water Boards
1 North Coast
2 San Francisco
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River
8 Santa Ana
9 San Diego
0 25 50 100 150 200 Miles
N
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Red Shiner
Sampling Locations
1
North
Coast
2
San Francisco
Bay
3
Central
Coast
4
Los
Angeles
5
Central
Valley
6
Lahontan
7
Colorado
River
8
Santa
Ana
9
San
Diego
Regional Water Boards
1 North Coast
2 San Francisco
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River
8 Santa Ana
9 San Diego
0 25 50 100 150 200
Miles
N
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Sacramento
Pikeminnow
Sampling
Locations
1
North
Coast
2
San Francisco
Bay
3
Central
Coast
4
Los
Angeles
5
Central
Valley
6
Lahontan
7
Colorado
River
8
Santa
Ana
9
San
Diego
Regional Water Boards
1 North Coast
2 San Francisco
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River
8 Santa Ana
9 San Diego
0 25 50 100 150 200
Miles
N
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Sacramento Sucker
Sampling Locations
1
North
Coast
2
San Francisco
Bay
3
Central
Coast
4
Los
Angeles
5
Central
Valley
6
Lahontan
7
Colorado
River
8
Santa
Ana
9
San
Diego
Regional Water Boards
1 North Coast
2 San Francisco
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River
8 Santa Ana
9 San Diego
0 25 50 100 150 200
Miles
N
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Sunfish Species
Sampling Locations
1
North
Coast
2
San Francisco
Bay
3
Central
Coast
4
Los
Angeles
5
Central
Valley
6
Lahontan
7
Colorado
River
8
Santa
Ana
9
San
Diego
Regional Water Boards
1 North Coast
2 San Francisco
3 Central Coast
4 Los Angeles
5 Central Valley
6 Lahontan
7 Colorado River
8 Santa Ana
9 San Diego
0 25 50 100 150 200
Miles
N
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

APPENDIX II. RIVERS, STREAMS, AND CREEKS INCLUDED IN THE STATEWIDE RIVERS DATASET

Rivers, Streams, and Creek Names	
Agua Hedionda Creek	Mendota Pool/Slough
Alameda Creek	Merced River
Alamo River	Middle River
Aliso Creek	Middle Truckee River
All American Canal	Mildred Island
Alvarado Creek	Mokelumne River, Lower
American River, Lower	Mokelumne River at Lodi Lake
American River, Upper	Mud Slough
Aptos Creek	Napa River
Arroyo Conejo	Natomas East Main Drain
Ballona Creek	Natomas Slough
Barbara Worth Drain	Nelson Creek
Bear River	New River
Beaughton Creek	Ocean View Channel
Beaver Slough	Old Prospect Slough
Bella Oaks Hg Mine signal	Old River
Big Break	Oleander Drain
Big Chico Creek[1]	Orange Drain
Big Pine Creek	Otay River
Big Rock	Owens River
Big Sulfur Creek	Pajaro River
Bishop Creek	Palo Verde Lagoon
Bodie Creek	Palo Verde Outfall Drain
Bounde Creek[1]	Paradise Cut
Buckeye Creek	Peach Drain
Butte Creek [1]	Petaluma River
Bypass Slough[1]	Peters Canyon Channel
Cache Creek	Pine Creek[1]
Cache Creek Nature Preserve Wetlands	Pismo Creek
Cache Creek Settling Basin	Pit River
Cache Slough[1]	Piute Creek
Calaveras River	Prospect Slough[1]
Canyon Creek	Pumice Drain
Carbonera Creek	Putah Creek
Carson River	Rainbow Creek
Central Drain[1]	Reclamation Slough[1]
Chino Creek	Reservation Main Drain
Clear Creek	Revolon Slough
Coachella Valley Stormwater Channel	Rice 3 Drain
Coffee Creek	Rice Drain
Cold Stream Creek	Rio de Santa Clara

Rivers, Streams, and Creek Names	
Colorado River	Robinson Creek
Colusa Basin Drain[1]	Rock Creek
Conejo Creek	Rose Creek
Cosumnes River, Lower	Rose Drain
Coyote Creek	Rough & Ready Island/Burns Cut
Cross Canal[1]	Rowdy Creek
Cucamonga-Mill Creek	Rush Creek
Darell's Cosumnes River	Russian River
Dead Horse Slough[1]	Sacramento River and Northern Delta
Deep Creek	Sacramento River Deep Water Ship Channel[1]
Deer Creek	Sacramento Slough [1]
Delta Meadows Slough[1]	Sagehen Creek
DeLuz Creek	Salinas River
Discovery Bay	Salt Creek Slough
Dixie Drain No. 1, 3, 5	Salt Slough
Dominguez Channel	San Antonio River
Downie River	San Clemente Canyon Creek
Dry Creek	San Diego Creek
Duncan Creek	San Diego River
East Walker River	San Felipe Creek
Eel River	San Joaquin River
El Modena Channel	San Jose Creek
Escondido Creek	San Juan Creek
Fall River	San Leandro Creek
Feather River, Lower	San Lorenzo River
Feather River, Upper	San Luis Obispo Creek
Felicita Creek	San Marcos Creek
Fig Drain	San Pablo Creek
Fordyce Creek	Sand Mound Slough
Forester Creek	Sandia Canyon Creek
Franks Tract	Santa Ana River
Fresno Slough	Santa Clara River
Georgiana Slough[1]	Santa Margarita River
Glenn-Colusa Canal[1]	Scotchman Creek
Gold Run Creek	Sherman Island
Gordon Slough	Smith River
Granite Creek	Snodgrass Slough[1]
Greenhorn Creek	Soquel Creek
Greeson Drain	South Central Drain
Hat Creek	South Yuba River
Holtville Main Drain	Spanish Creek
Honker Cut	Stanislaus River
Horton Creek	Steamboat Slough[1]
Hot Creek	Steelhead Creek

Rivers, Streams, and Creek Names	
Humbug Creek	Steephollow Creek
Imperial Wetlands	Susan River
Independence Creek	Sutter Bypass
Indian Creek	Sycamore Slough
Italian Slough	Taylor Slough
Kern River	Tecolote Creek
Keys Creek	Tembladero Slough
Kings River	Tijuana River
Klamath River	Toe Drain[1]
La Joya Hg Mine Signal	Tokay Drain
Laguna de Santa Rosa	Trabuco Creek
Lee Vining Creek	Trinity River
Liberty Island[1]	Trinity River, East Fork
Lindsey Slough[1]	Trout Creek
Little Deer Creek	Truckee River
Little Hastings Tract[1]	Tuolumne River
Little Holland Tracts 1 and 2[1]	Van Duzen River
Little Potato Slough	Venice Cut Island
Little Truckee River	Ventura River
Little Walker River	Verde Drain
Logan Creek[1]	Virginia Creek
Loma Alta Creek	Walker Slough
Lone Pine Creek	Walnut Creek
Los Angeles River	Warner Creek
Los Osos Creek	Warren Drain
Los Penasquitos Creek	Werner Dredger Cut
Lost Slough[1]	West Walker River
Mad River	Westminster Channel
Malibu Creek	Whiskey Slough
Mammoth Creek	White Slough
Mark West Creek	Willow Creek[1]
Marsh Creek	Wolf Creek
Martis Creek	Woods Creek
Mayflower Drain	Yellow Creek
McCloud River	Yuba River (including North and Middle Yuba Rivers)
Meadows Slough	-

[1] These waterbodies are included in the Sacramento River and Northern Delta Fish Advisory

APPENDIX III. DATA SOURCES

Program or Project Name	Data Source[a]	Fish Advisory Using Non-CEDEN data[b]
CALFED	CEDEN	-
Delta Regional Monitoring Program (RMP)	CEDEN	-
Delta98 Organics	CEDEN	-
Department of Water Resources (DWR)	DWR	Lower Feather River, Upper Feather River
Fish Mercury Project (FMP)	CEDEN, FMP	Yuba River, Bear River
Pacific Gas and Electric (PG&E)	PG&E	Upper Feather River
Regional Water Boards (1,5,6,7,9)	CEDEN, RWB5	Lower Feather River
Sacramento River Watershed Program (SRWP)	CEDEN	-
Contaminants in Fish from California Lakes and Reservoirs (SWAMP1)	CEDEN	-
Contaminants in Fish from California Rivers and Streams (SWAMP2)	CEDEN	-
Long-Term Monitoring of Bass Lakes and Reservoirs in California (SWAMP3)	CEDEN	-
Total Maximum Daily Load (TMDL)	CEDEN, TMDL	Cache Creek
Toxic Substances Monitoring Program (TSMP)	CEDEN	-
University of California-Davis (UCD)	CEDEN, USGS	Cache Creek
United States Geological Survey (USGS)	CEDEN, USGS	Bear River, Deer Creek, South Yuba River

[a] Data sourced from the California Environmental Data Exchange Network (CEDEN) can be found online at: https://ceden.waterboards.ca.gov/AdvancedQueryTool.

[b] OEHHA's fish consumption advisories are online at: https://oehha.ca.gov/fish/advisories. Fish advisory reports provide either the raw or summarized data used to develop advice for a particular water body.

APPENDIX IV. ADVISORY TISSUE LEVELS

Advisory Tissue Levels (ATLs) guide the development of advice for people eating sport fish. ATLs are levels of contaminants found in fish that correspond to the maximum numbers of recommended fish servings. OEHHA uses ATLs to provide advice to prevent consumers from being exposed to:

- More than the reference dose[17] on an average daily basis for chemicals not known to cause cancer, such as methylmercury, or
- For cancer-causing chemicals, a risk level greater than one additional cancer case in a population of 10,000 people consuming fish at the given consumption rate over a lifetime. This cancer risk level is the maximum acceptable risk level recommended by the US EPA (2000b) for fish advisories.

For each chemical, ATLs were determined for both cancer and non-cancer risk, if appropriate, for one to seven eight-ounce servings per week. The most health-protective ATLs for each chemical, selected from either cancer or non-cancer based risk, are shown in the table below for zero to seven servings per week. When the guidelines for eating fish from a water body are followed, exposure to chemicals in fish from the water body would be at or below the average daily reference dose or the cancer risk probability of one in 10,000.

ADVISORY TISSUE LEVELS FOR SELECTED ANALYTES

Contaminant	Consumption Frequency Categories (8-ounce servings/week)[a] and ATLs (in ppb)							
	7	6	5	4	3	2	1	0
Chlordanes	≤ 80	>80–90	>90–110	>110–140	>140–190	>190–280	>280–560	>560
DDTs	≤ 220	>220–260	>260–310	>310–390	>390–520	>520–1,000	>1,000–2,100	>2,100
Dieldrin	≤ 7	>7–8	>8–9	>9–11	>11–15	>15–23	>23–46	>46
MeHg (Women 18–49 and children 1–17)	≤ 31	>31–36	>36–44	>44–55	>55–70	>70–150	>150–440	>440
MeHg (Women ≥ 50 and men ≥ 18)	≤ 94	>94–109	>109–130	>130–160	>160–220	>220–440	>440–1,310	>1,310
PBDEs	≤ 45	>45–52	>52–63	>63–78	>78–100	>100–210	>210–630	>630
PCBs	≤ 9	>9–10	>10–13	>13–16	>16–21	>21–42	>42–120	>120
Selenium	≤ 1000	>1,000–1200	>1,200–1,400	>1,400–1,800	>1,800–2,500	>2,500–4,900	>4,900–15,000	>15,000
Toxaphene	≤ 87	>87–100	>100–120	>120–150	>150–200	>200–300	>300–610	>610

[a] Serving sizes (prior to cooking, wet weight) are based on an average 160-pound person. Individuals weighing less than 160 pounds should eat proportionately smaller amounts.

[17] The reference dose is an estimate of the maximum daily exposure to a chemical likely to be without significant risk of harmful health effects over a lifetime.