OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

GOOD CATCH CALIFORNIA
Your Fish Advisor

Health Advisory and Guidelines for Eating Fish from Lake San Antonio (Monterey and San Luis Obispo counties)

April 2017

Fish, Ecotoxicology, and Water Section
Pesticide and Environmental Toxicology Branch
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LIST OF ACRONYMS AND ABBREVIATIONS

ATL	Advisory Tissue Level
CDFW	California Department of Fish and Wildlife
DDT(s)	dichlorodiphenyltrichloroethane (DDT) and its metabolites dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE)
DWR	Department of Water Resources, California
DHA	docosahexaenoic acid
EPA	eicosapentaenoic acid
FDA	Food and Drug Administration
Hg	mercury
MDL	method detection limit
MLML	Moss Landing Marine Laboratories
mm	millimeters
n	sample size
OEHHA	Office of Environmental Health Hazard Assessment
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
ppb	parts per billion
RL	reporting limit
RWB3	Regional Water Board 3
Se	selenium
SWAMP	Surface Water Ambient Monitoring Program

TSMP	Toxic Substances Monitoring Program
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. 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 Sport Fishing Regulations in the section on public health advisories.

This report presents guidelines for eating fish from Lake San Antonio in Monterey and San Luis Obispo counties. 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.

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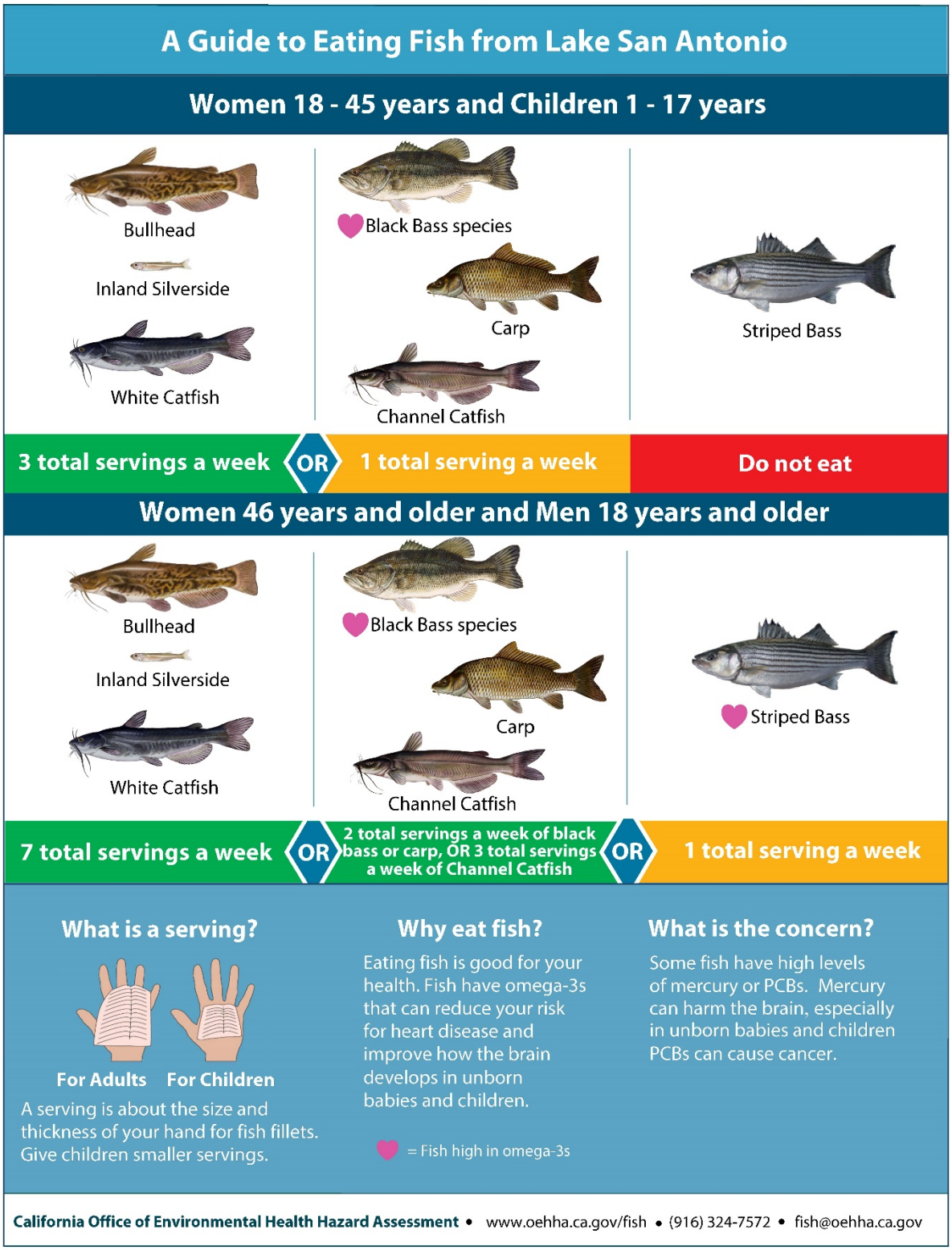
A Guide to Eating Fish from Lake San Antonio
Women 18 - 45 years and Children 1 - 17 years
Bullhead
Inland Silverside
White Catfish
Black Bass species
Carp
Channel Catfish
Striped Bass
3 total servings a week
OR
1 total serving a week
Do not eat
Women 46 years and older and Men 18 years and older
Bullhead
Inland Silverside
White Catfish
Black Bass species
Carp
Channel Catfish
Striped Bass
7 total servings a week
OR
2 total servings a week of black bass or carp, OR 3 total servings a week of Channel Catfish
OR
1 total serving a week
What is a serving?
For Adults
For Children
A serving is about the size and thickness of your hand for fish fillets. Give children smaller servings.
Why eat fish?
Eating fish is good for your health. Fish have omega-3s that can reduce your risk for heart disease and improve how the brain develops in unborn babies and children.
= Fish high in omega-3s
What is the concern?
Some fish have high levels of mercury or PCBs. Mercury can harm the brain, especially in unborn babies and children PCBs can cause cancer.
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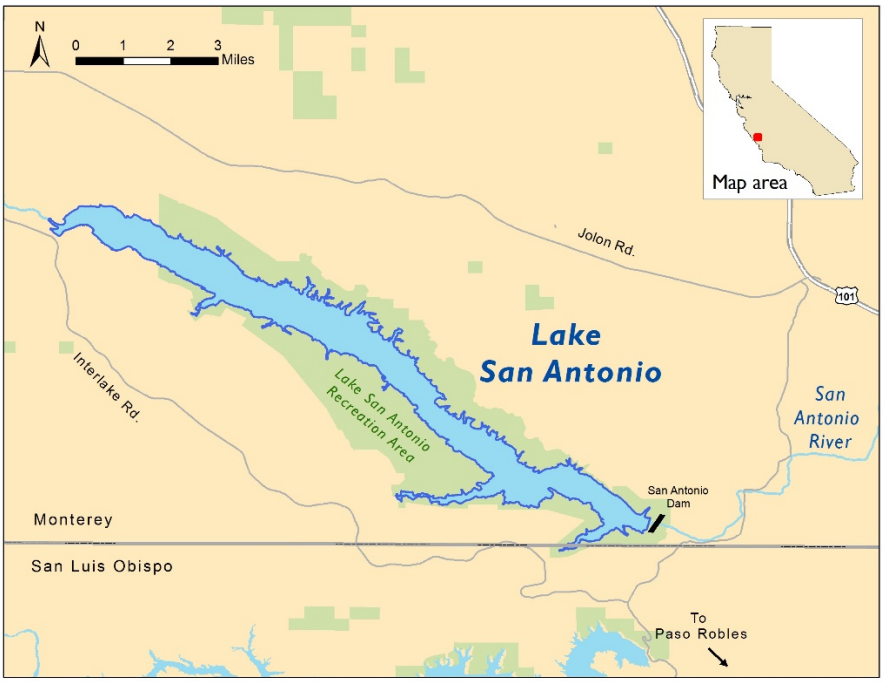
INTRODUCTION

This report presents guidelines for eating fish from Lake San Antonio (Figure 1) in Monterey and San Luis Obispo counties, located approximately 16 miles northwest of Paso Robles, California.

LOCATION

An earthen dam on the San Antonio River forms Lake San Antonio.[1] The Lake San Antonio Dam, completed in 1967, is managed by the California Department of Water Resources and has a 335,000-acre-foot capacity. The Monterey County Water Resources Agency operates the dam and reservoir, which functions to regulate water flow for recharging groundwater levels, flood protection, and recreation. Lake San Antonio is primarily fed by the San Antonio River and is connected to minor creeks within the greater watershed. This advisory applies only to Lake San Antonio and not adjacent water bodies.

FIGURE 1. LOCATION OF LAKE SAN ANTONIO



[1] Information regarding Lake San Antonio and the Lake San Antonio Dam was obtained from the Monterey County Water Resources Agency web page. Online at:http://www.mcwra.co.monterey.ca.us/reservoirs-dams/reservoirs-dams_overview.php.

APPROACH USED

The Office of Environmental Health Hazard Assessment (OEHHA) used the results from five monitoring studies described in this report to develop the Lake San Antonio Advisory. OEHHA uses the following general process in developing consumption advice for sport fish:

1) Evaluation of all fish contaminant data available from a water body 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 an appropriate measure of central tendency (often a weighted arithmetic mean[2]) and 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 benefits and risks of consuming sport fish.

CHEMICALS OF POTENTIAL CONCERN

Certain chemicals are considered to be 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, followed by polychlorinated biphenyls (PCBs) and, in a few cases, selenium or some legacy pesticides (pesticides that are no longer used but remain in the environment).

Mercury is a natural element found in some rock and soil. Human activities, such as burning coal and the historic 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

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[2] Means are an arithmetic average of individual values and/or a weighted average of composites. A weighted average of composites is calculated by multiplying the chemical concentration in each composite by the number of fish in that composite for each species. Products are then summed and divided by the total number of fish in all composites for that species, combined.

known as methylmercury – which 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, often as flame retardants or electrical insulators. Their use was banned in the 1970s, but they persist in the environment because they do not break down easily and can accumulate in fish. 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 metabolism. Higher doses cause selenium toxicity, which can include symptoms ranging from hair loss and gastrointestinal distress to dizziness and tremors.

Chlordanes, dichlorodiphenyltrichloroethane (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 water bodies in California. Depending on the exposure level, these chemicals may cause cancer or adverse effects on the nervous system.

Polybrominated diphenyl ethers (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.

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 collected from Lake San Antonio and used in advisory development were analyzed for mercury (as a measure of methylmercury). Additionally, black bass species and White Catfish were analyzed for selenium and Common Carp were analyzed for PBDEs, PCBs, and the legacy pesticides (chlordanes, dieldrin, DDTs [DDT and its metabolites]). Fish species that do not normally accumulate PCBs or other organic chemicals may not be analyzed for those contaminants in a particular monitoring study. Among the chemicals analzed in fish tissue samples from Lake San Antonio, only mercury levels were sufficiently high to impact consumption advice, for this reason, levels of other contaminants are not shown in this report.

DATA SOURCES

The guidelines for eating fish from Lake San Antonio are based on the chemicals detected in the fish collected for the five monitoring studies described below. These studies met OEHHA's data quality criteria, including adequate documentation of sample collection, fish preparation method (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 was reported. "Sampling" or "sampled" refers to the act of collecting fish for chemical analysis.

CALFED Bay-Delta Program (CALFED)

The CALFED Bay-Delta Program is 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 is 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, and the US Fish and Wildlife Service. CALFED funded SWAMP sampling efforts for historical bioaccumulation studies in fish (CALFED, 1999). Largemouth Bass were collected from Lake San Antonio (1999) and samples were analyzed for mercury.

Central Coast Ambient Monitoring Program (CCAMP)

This monitoring program is a regional-scale water quality monitoring and assessment program administered by the Central Coast Regional Water Quality Control Board (CCRWQCB). CCAMP is funded by the Surface Water Ambient Monitoring Program (SWAMP) and the Bay Foundation of Morro Bay. CCAMP follows SWAMP protocols for data quality and management, and collected Channel Catfish, Smallmouth Bass, and Striped Bass from Lake San Antonio in 2012 (CCRWQCB, 2016). These species were analyzed for mercury.

Contaminants in Fish From California Lakes and Reservoirs, 2007-2008 (SWAMP)

The Surface Water Ambient Monitoring Program (SWAMP), operated by the SWRCB in cooperation with Regional Water Quality Control Board staff, monitors water quality in California's surface waters. The program collected Common Carp and Largemouth Bass from Lake San Antonio in 2007 to analyze mercury in both species, and PCBs, chlordanes, DDTs, dieldrin, PBDEs, and selenium in Common Carp, as part of a SWAMP statewide sampling effort to survey contaminants in sport fish found in California lakes and reservoirs (SWRCB, 2010).

Survey of Mercury Exposure and Risk in Wildlife in California Lakes and Reservoirs, 2012 (SWAMP)

SWAMP conducted a bird, prey fish and sport fish sampling survey at lakes and reservoirs throughout California to estimate mercury concentrations in birds and other wildlife based on mercury levels in fish at different trophic levels. Results of this study are intended to help risk managers understand mercury exposure for wildlife and develop TMDLs for impaired water bodies. This program sampled Largemouth Bass and Inland Silverside from Lake San Antonio in 2012 (SWRCB, 2012; Ackerman, 2015).

Toxic Substances Monitoring Program (TSMP)

The TSMP (1976-2003) was a state water quality-monitoring program managed by the SWRCB (SWRCB, 2007 and 2013). Its objective was to provide statewide information on the occurrence of toxic substances by monitoring water bodies with known or suspected water quality impairment. CDFW staff, then known as the California Department of Fish and Game, collected Brown Bullhead (1984), Largemouth Bass (1982-1985), Smallmouth Bass (1985), and White Catfish (1988-1989) from Lake San Antonio, as part of the program. All fish samples were analyzed for mercury and selenium except bullhead, which were only analyzed for mercury.

FISH SAMPLED FROM LAKE SAN ANTONIO

The fish sampling data used in this advisory were retrieved from the California Environmental Data Exchange Network (CEDEN), the State's repository for environmental data. Samples were excluded when the fish were not legal size to take or did not meet OEHHA's criteria for minimum "edible" size based on species size at maturity and professional judgment (as described in OEHHA, 2005). A summary of all fish species included in this advisory is shown in Table 1, including the name of the species, number of samples collected, total number of fish, project name, year sampled, and contaminants analyzed.

TABLE 1. FISH SAMPLES EVALUATED FOR THE LAKE SAN ANTONIO ADVISORY

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed
Brown Bullhead	*Ameiurus nebulosus*	2[a]	12	TSMP	1984	Hg
Channel Catfish	*Ictalurus punctatus*	2	10	CCAMP	2012	Hg
Common Carp	*Cyprinus carpio*	3	75	SWAMP	2007	Hg
		1	75	SWAMP	2007	Chlordanes, DDTs, dieldrin, PBDEs, PCBs, Se
Largemouth Bass	*Micropterus salmoides*	5[a]	14	TSMP	1982-1985	Hg
		7[b]	7	CALFED	1999	Hg
		24	92	SWAMP	2007	Hg
		10	10	SWAMP	2012	Hg
		1[a]	3	TSMP	1985	Se
Inland Silverside	*Menidia beryllina*	10	10	SWAMP	2012	Hg
Smallmouth Bass	*Micropterus dolomieu*	1[a]	3	TSMP	1985	Hg, Se
		9	9	CCAMP	2012	Hg
Striped Bass	*Morone saxatilis*	9	9	CCAMP	2012	Hg
White Catfish	*Ameiurus catus*	2[a]	13	TSMP	1988-1989	Hg, Se

DDTs = dichlorodiphenyltrichloroethane (DDT) and its metabolites dichlorodiphenyldichloroethane (DDD) dichlorodiphenyldichloroethylene (DDE)
Hg = Mercury
PBDEs = polybrominated diphenyl ethers PCBs = polychlorinated biphenyls Se = Selenium
[a]Study report did not specify whether skin was removed from fillets prior to tissue analysis.
[b]Skin was not removed from fillets prior to tissue analysis.

CHEMICAL CONCENTRATIONS

As shown in Table 1, samples were analyzed for one or more of the following: total mercury, selenium, chlordanes, DDTs, dieldrin, PBDEs, and PCBs (54-55 congeners[3]). All fish samples were prepared as skinless fillets, except for the CALFED study where the skin was not removed from the Largemouth Bass fillet samples, the TSMP study where the fillet preparation method for Brown Bullhead, Largemouth Bass, Smallmouth Bass, and White Catfish was not recorded, and the SWAMP 2012 study where Inland Silverside were analyzed as whole bodies. For fillet samples, the presence or absence of skin did not alter advice based on mercury. Small prey fish species, such as Inland Silverside, are typically analyzed as whole bodies because of their small size. Additionally, consumers may eat some small prey fish species as whole bodies. Samples were analyzed as individual fish or composites.

Composites were prepared from equal amounts of tissue from several similarly sized individual fish of a species. For composite samples, the total length of the smallest fish in a composite sample must be at least 75% of the length of the largest fish in the sample (US EPA, 2000a). Composite samples for all species from Lake San Antonio met this requirement.

For this advisory, OEHHA used the weighted (by the number of individual fish) arithmetic mean (average) of the chemical concentrations (in wet weight) for each fish species to estimate average human exposure.

MERCURY

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). 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). Table 2 shows the averages and ranges for total length[4], as well as mercury concentrations in each fish species. The DMA method detection limit (MDL)[5] and the reporting limit (RL)[6] for total mercury were reported at 12 and 12 or 36 parts per billion (ppb), respectively. Although mercury was detected at commonly found concentrations in the TSMP study, the MDL and RL for mercury were not reported for this study.

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[3] Congeners are related compounds with similar chemical forms. Of the 209 possible PCB congeners, 54-55 are generally reported.
[4] 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.
[5] The MDL is the lowest quantity of a chemical that can be distinguished (as greater than zero) in a sample.
[6] The RL is the lowest quantity of a chemical that can be accurately quantified in a sample.

PCBs, PBDEs, and Pesticides

Some composite samples were analyzed for PCBs, PBDEs, and the legacy pesticides (chlordanes, DDTs, and dieldrin). Pesticides, PBDEs and PCBs were analyzed by gas chromatography at the CDFW Water Pollution Control Laboratory. 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, ≤ 0.9 and ≤ 5 ppb, respectively, individual congeners or metabolites with concentrations reported as non-detects were 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). Concentrations of chlordanes, dieldrin, DDTs, PBDEs, and PCBs were not sufficiently high to alter consumption advice and are not shown.

Selenium

The CDFW MLML analyzed species collected from Lake San Antonio for selenium, as composite samples, using inductively coupled plasma-mass spectrometry (ICP-MS). The ICP-MS method utilizes desolvation, atomization and ionization with ion separation based on a mass-to-charge ratio to detect the total selenium concentration in a sample. The ICP-MS MDL and RL for total selenium were reported at 100 and 300 ppb, respectively. Although selenium was detected at levels commonly found concentrations in the TSMP study, the MDL and RL for mercury were not reported for this study. The selenium concentrations were not sufficiently high to alter consumption advice and are not shown.

TABLE 2. MERCURY CONCENTRATIONS IN FISH FROM LAKE SAN ANTONIO

Species from Lake San Antonio	Number of Samples	Total Number of Fish	Mean* Total Length (mm)	Range of Total Lengths** (mm)	Mercury (ppb)	
					Mean*	Range**
Black Bass species***	56	135	376	303 - 492	305	30 – 643
Bass, Largemouth	46	123	378	305 - 492	303	30 - 643
Bass, Smallmouth	10	12	352	303 - 420	315	50 - 602
Brown Bullhead	2	12	371	369 - 373	65	60 - 70
Channel Catfish	2	10	501	372 - 650	183	135 - 231
Common Carp	3	75	568	496 - 628	241	172 - 298
Inland Silversides	10	10	72	66 - 79	60	46 - 92
Striped Bass	9	9	742	694 – 794	462	328 - 528
White Catfish	2	13	388	350 – 433	55	50 - 60

*Means are an arithmetic average of individual values and/or a weighted average of composites.
**Range of individuals and/or range of the composites.
***Largemouth and Smallmouth bass were combined for “Black Bass species” for the purpose of developing consumption advice.

DEVELOPMENT OF GUIDELINES FOR EATING FISH FROM LAKE SAN ANTONIO

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, 2014; OEHHA, 2008; Institute of Medicine, 2007; Kris-Etherton et al., 2002). Fish are a significant source of the specific omega-3 fatty acids, docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) thought to be associated with these beneficial health effects (USDA/USDHHS, 2015; Weaver et al., 2008).

The 2015-2020 U.S. Dietary Guidelines recommend that 1) the general population "consume eight or more ounces per week (less for young children)" of a variety of seafood[7] "for the total package of nutrients that seafood provides, including its EPA and DHA content" and 2) "women who are pregnant or breastfeeding should consume at least eight and up to twelve ounces of a variety of seafood per week from choices that are lower in methylmercury" (USDA/USDHHS, 2015). 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 FDA and 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).

In order 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, for each species and at 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.

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[7] "Marine animals that live in the sea and in freshwater lakes and rivers. Seafood includes fish, such as salmon, tuna, trout, and tilapia, and shellfish, such as shrimp, crab, and oysters" (USDHHS/USDA, 2015).

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 45 years of age) and children 1-17 years, are lower than those for women 46 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 I.

For each fish species in this advisory, OEHHA compared the mean mercury concentrations detected in the fillet to the corresponding ATLs to establish the maximum number of servings per week that could be consumed (see Appendix I).

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 mercury and PCBs, are known to have similar adverse effects, additivity of toxicity is assumed in such cases and may be assessed using multiple chemical exposure methodology (US EPA, 1989 and 2000b). If two or more chemicals with similar adverse effects are present in fish tissue at levels above the corresponding ATL values for daily consumption, multiple chemical exposure methodology 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 one chemical alone, in a similar concentration. For the Lake San Antonio Advisory, PCBs, chlordanes, DDTS, dieldrin, and PBDEs were only measured in Common Carp, a species considered likely to accumulate these chemicals if they are present in a water body. Because the concentrations of these chemicals were below the corresponding ATL values for daily consumption, the potential effect of multiple chemical exposures was not evaluated. Advice for all species in this advisory was based on mercury concentrations.

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 advice on consuming a particular fish species can be extended to other closely related fish species[8] 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.

CONSUMPTION ADVICE FOR FISH FROM LAKE SAN ANTONIO

OEHHA's advisory protocol requires at least nine fish of a species to be collected from a water body before an advisory can be developed for the primary contaminant of concern. This is to ensure the sample dataset is representative of the fish species population in the water body. In some cases, an exception is made for species that are commonly caught and consumed from a given water body but where available data may be limited. For Lake San Antonio, the sample size criterion was met for the following species: Brown Bullhead, Channel Catfish, Common Carp, Largemouth Bass, Inland Silverside, Smallmouth Bass, Striped Bass, and White Catfish. There were not sufficient data to evaluate other species that may be found in this water body.

BLACK BASS SPECIES (LARGEMOUTH, SMALLMOUTH)

Based on the mean mercury concentration of 305 ppb, OEHHA recommends a maximum of one serving a week of black bass species for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of two servings a week for the general population (women 46 years and older, and men 18 years and older). The mean mercury levels in individual black bass species were 303 and 315 ppb for Largemouth and Smallmouth bass, respectively.

OEHHA evaluated mercury concentrations in black bass species in many water bodies in California and found a similar range of mercury concentrations when two or more of these species were caught from the same water body. Therefore, OEHHA extends the consumption advice for Largemouth Bass and Smallmouth Bass to other black bass species, including Redeye and Spotted Bass.

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

Brown Bullhead

The mean mercury concentration in Brown Bullhead from Lake San Antonio was 65 ppb. OEHHA recommends a maximum of three servings a week of Brown Bullhead for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of seven servings a week for the general population (women 46 years and older, and men 18 years and older), based on mercury.

Channel Catfish

The mean mercury concentration in catfish from Lake San Antonio was 183 ppb. OEHHA recommends a maximum of one serving a week of Channel Catfish for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of three servings a week for the general population (women 46 years and older, and men 18 years and older), based on mercury.

Common Carp

The mean mercury concentration in Common Carp from Lake San Antonio was 241 ppb. OEHHA recommends a maximum of one serving a week of carp for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of two servings a week for the general population (women 46 years and older, and men 18 years and older), based on mercury.

Inland Silverside

The mean mercury concentration in Inland Silverside from Lake San Antonio was 60 ppb. OEHHA recommends a maximum of three servings a week of Inland Silverside for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of seven servings a week for the general population (women 46 years and older, and men 18 years and older), based on mercury.

Striped Bass

Based on the mean mercury concentration of 462 ppb, OEHHA recommends no consumption of Striped Bass from Lake San Antonio for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of one serving a week for the general population (women 46 years and older, and men 18 years and older), based on mercury.

WHITE CATFISH

The mean mercury concentration in White Catfish from Lake San Antonio was 55 ppb. Although 55 ppb is at the upper limit of the four meal per week consumption category for the sensitive population, OEHHA recommends a maximum of three servings a week of White Catfish for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of seven servings a week for the general population (women 46 years and older, and men 18 years and older), based on mercury. In some cases, OEHHA may smooth consumption advice to facilitate risk communication.

RECOMMENDED MAXIMUM NUMBER OF SERVINGS

The recommended maximum numbers of servings per week for fish from Lake San Antonio are shown in Table 3.

TABLE 3. RECOMMENDED MAXIMUM NUMBER OF SERVINGS PER WEEK FOR FISH FROM LAKE SAN ANTONIO

Fish Species	Women 18–45 years and Children 1–17 years	Women 46 years and older and Men 18 years and older
Black Bass species	1	2
Brown Bullhead	3	7
Channel Catfish	1	3
Common Carp	1	2
Inland Silverside	3	7
Striped Bass	0	1
White Catfish	3	7

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APPENDIX I. 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 average daily reference dose[9] 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 endpoint 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 Lake San Antonio are followed, exposure to chemicals in fish from Lake San Antonio 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 18-45 and children 1-17)	≤ 31	>31-36	>36-44	>44-55	>55-70	>70-150	>150-440	>440
MeHg (Women > 45 and men)	≤ 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.

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