OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

GOOD CATCH CALIFORNIA
Your Fish Advisor

Health Advisory and Guidelines for Eating Fish from El Capitan Reservoir (San Diego County)

September 2023

Fish, Ecotoxicology, and Water Section
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LIST OF ACRONYMS AND ABBREVIATIONS

ATL	Advisory Tissue Level
CDFW	California Department of Fish and Wildlife
CEDEN	California Environmental Data Exchange Network
DDT(s)	dichlorodiphenyltrichloroethane (DDT) and its metabolites dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE)
DHA	docosahexaenoic acid
DMA	direct mercury analyzer
EPA	eicosapentaenoic acid
FDA	United States Food and Drug Administration
Hg	mercury
ICP-MS	inductively coupled plasma-mass spectrometry
MDL	method detection limit
MeHg	methylmercury
mm	millimeters
MPSL	Marine Pollution Studies Laboratory at Moss Landing Marine Laboratories
NLFTS	National Lake Fish Tissue Study
OEHHA	Office of Environmental Health Hazard Assessment
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
ppb	parts per billion
RL	reporting limit
RWB9	Regional Water Board 9 (San Diego)
Se	selenium
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
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 El Capitan Reservoir in San Diego County. 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 the 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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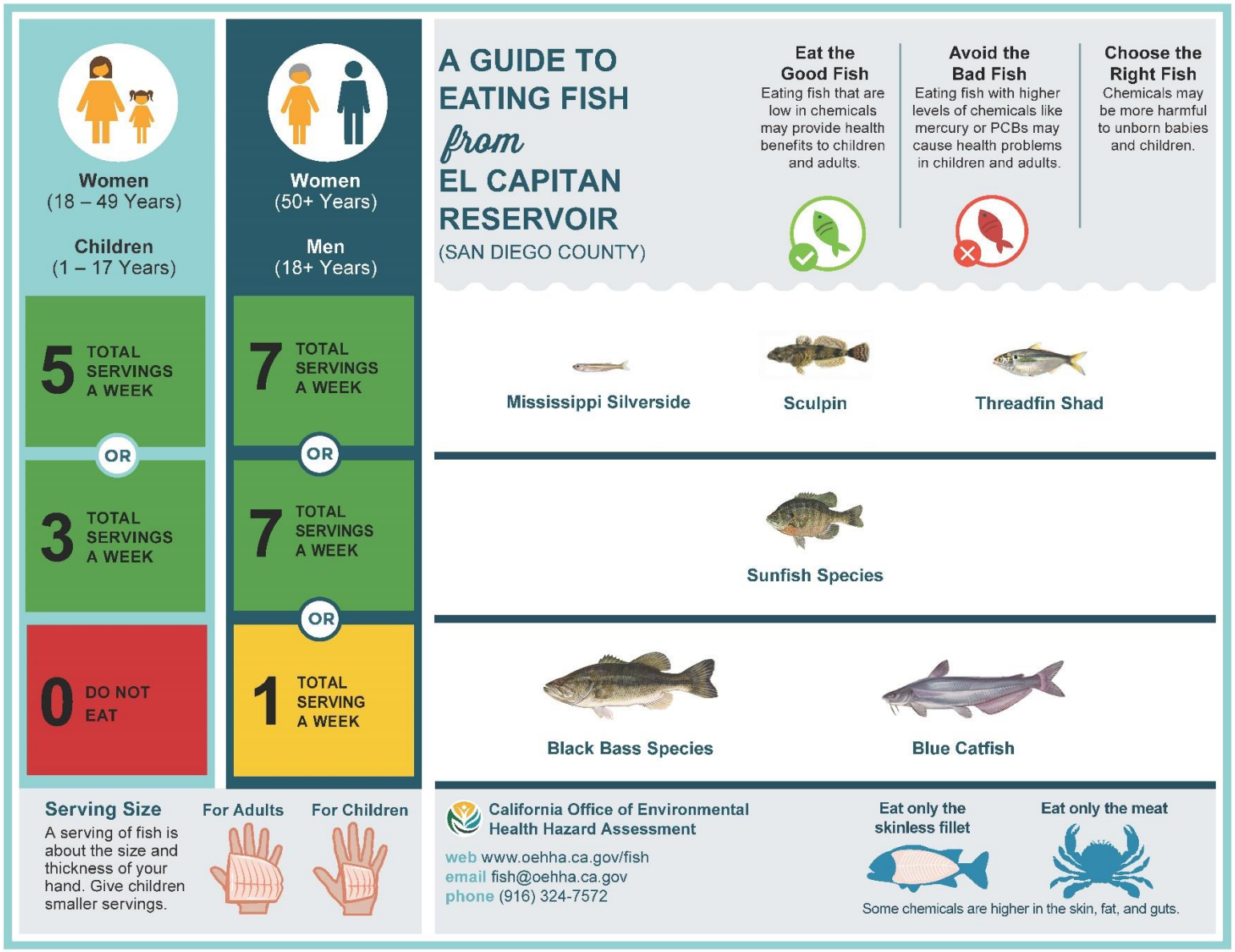

Women
(18 – 49 Years)
Children
(1 – 17 Years)
5 TOTAL SERVINGS A WEEK
OR
3 TOTAL SERVINGS A WEEK
0 DO NOT EAT
Women
(50+ Years)
Men
(18+ Years)
7 TOTAL SERVINGS A WEEK
OR
7 TOTAL SERVINGS A WEEK
OR
1 TOTAL SERVING A WEEK
A GUIDE TO EATING FISH from EL CAPITAN RESERVOIR
(SAN DIEGO COUNTY)
Eat the Good 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.
Mississippi Silverside
Sculpin
Threadfin Shad
Sunfish Species
Black Bass Species
Blue Catfish
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.

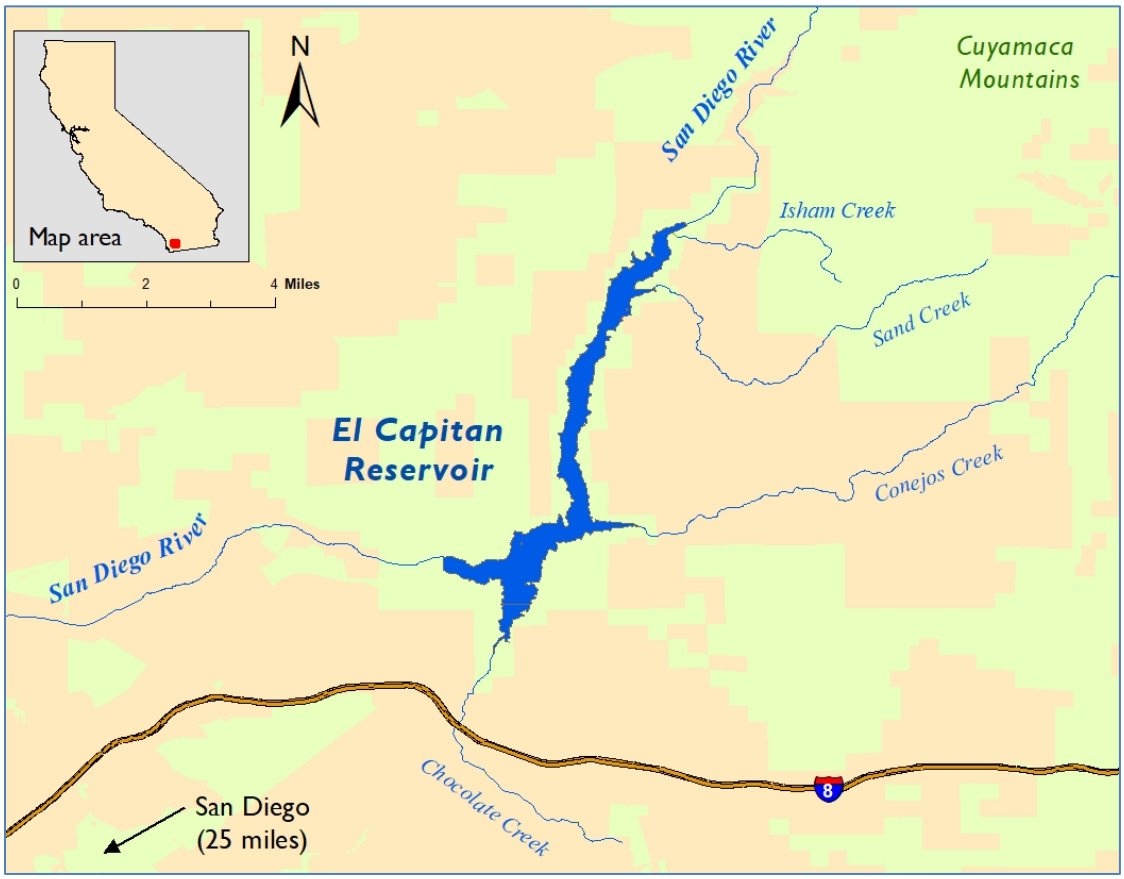
INTRODUCTION

This report presents guidelines for eating black bass species, Blue Catfish, Mississippi Silverside, sculpin, sunfish species, and Threadfin Shad from El Capitan Reservoir (Figure 1). Consumption advice is based on levels of mercury (Hg) found in these species.

LOCATION

El Capitan Reservoir is located about 25 miles northeast of San Diego, CA, in the Cuyamaca Mountains. This reservoir, situated along the San Diego River, was formed in 1935 by the creation of El Capitan Dam. At capacity, the reservoir has 1,562 surface acres and offers 22 shoreline miles. The City of San Diego owns and operates El Capitan Reservoir.[3]

FIGURE 1. LOCATION OF EL CAPITAN RESERVOIR



[3] Information obtained from the City of San Diego, online at: https://www.sandiego.gov/reservoirs-lakes/el-capitan-reservoir#undefined.

APPROACH USED

The Office of Environmental Health Hazard Assessment (OEHHA) used the results from three monitoring studies described in this report to develop the El Capitan Reservoir 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)[4] 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 includes consideration of health benefits associated with including fish in the diet (OEHHA, 2008). The ATLs should not be interpreted as static "bright lines," but as 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, because of their toxicity and their ability to accumulate in fish tissue, are of potential concern for people who eat fish. The majority of fish consumption advisories in California are issued because of mercury, followed by polychlorinated biphenyls (PCBs) and, in a few cases, selenium (Se), polybrominated diphenyl ethers (PBDEs), or some legacy pesticides (pesticides that are no longer used but remain in the environment).

Mercury is an 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

[4] Means are an arithmetic average of individual values and/or composites weighted by number of fish. 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.

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, whose brains are still developing.

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 an element 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.

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.

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

A detailed discussion of the toxicity of these chemicals is 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 El Capitan Reservoir and used in advisory development were analyzed for mercury and selenium. Largemouth Bass were also analyzed for PCBs, PBDEs, and legacy pesticides as indicated in Table 1. Fish species that do not typically accumulate PCBs or other organic chemicals were not analyzed for these contaminants.

DATA SOURCES

The guidelines for eating fish from El Capitan Reservoir are based on the chemicals detected in the fish collected for the three 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 data to this advisory are described below.

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

The Surface Water Ambient Monitoring Program (SWAMP), operated by the State Water Resources Control Board (SWRCB) in cooperation with the San Diego Regional Water Quality Control Board (RWB9), monitors water quality in California's surface waters. This survey of inland water bodies was the State's largest survey of chemical contaminants in sport fish. The survey sampled popular fishing sites at 272 lakes and reservoirs from 2007 to 2008 (SWRCB, 2010). The SWRCB used the data from this survey to characterize statewide water quality conditions. The program collected Largemouth Bass from El Capitan Reservoir in 2008, which were analyzed for mercury, PBDEs, PCBs, selenium, and legacy pesticides.

Long-Term Monitoring of Bass Lakes and Reservoirs in California, 2015–ongoing (SWAMP)

This monitoring study is a multi-year effort initiated in 2015 to document the status and trends related to contamination in sport fish from California lakes and reservoirs where bass species reside. In 2021, the program collected Blue Catfish, Bluegill, Largemouth Bass, Mississippi Silverside, sculpin, and Threadfin Shad from El Capitan Reservoir, which were analyzed for mercury and selenium.[5]

US EPA National Lake Fish Tissue Study (NLFTS)

In the late 1990s, US Environmental Protection Agency (US EPA) initiated a national screening-level survey of chemical residues in fish tissue from lakes and reservoirs in the lower 48 states (US EPA, 2013). Working with state, Tribal, and federal partner agencies, samplers collected fish from 500 lakes and reservoirs, selected randomly, over a four-year period (2000–2003). El Capitan Reservoir was one of the 19 lakes sampled in California. The program collected Largemouth Bass in 2002 and samples were analyzed for mercury.

FISH SAMPLED FROM EL CAPITAN RESERVOIR

The fish sampling data used in this advisory were retrieved from the California Environmental Data Exchange Network (CEDEN),[6] the state's repository for

[5] Information on SWAMP's Long-Term Monitoring Surveys can be found online at: https://www.waterboards.ca.gov/water_issues/programs/swamp/lakes_study.html.
[6] Online at: http://ceden.waterboards.ca.gov/AdvancedQueryTool.

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, 2022). A summary of all fish species evaluated for 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 EL CAPITAN RESERVOIR ADVISORY

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed
Blue Catfish	*Ictalurus furcatus*	8	8	SWAMP	2021	Hg
		2	8	SWAMP	2021	Se
Bluegill	*Lepomis macrochirus*	2	10	SWAMP	2021	Hg, Se
Largemouth Bass	*Micropterus salmoides*	10	10	SWAMP	2021	Hg
		1	10	SWAMP	2021	Se
		16	16	SWAMP	2008	Hg
		1	10	SWAMP	2008	Chlordanes, DDTs, Dieldrin, PBDEs, PCBs, Se
		1	5	NLFTS	2002	Hg
Mississippi Silverside[a]	*Menidia audens*	1	10	SWAMP	2021	Hg, Se
Sculpin[a]	*Cottus spp.*	1	10	SWAMP	2021	Hg, Se
Threadfin Shad[a]	*Dorosoma petenense*	1	10	SWAMP	2021	Hg, Se

Samples were analyzed as skinless fillets, with the following exceptions:
[a] Samples were analyzed as whole organisms, including head, skin, internal organs, muscle, and bones

CHEMICAL CONCENTRATIONS

As shown in Table 1, samples were analyzed for one or more of the following: total mercury, selenium, chlordanes (5 congeners), DDTs (6 congeners), dieldrin, PBDEs (7 congeners), and PCBs (54 congeners).[7] Among the chemicals analyzed in fish tissue samples from El Capitan Reservoir, only mercury levels were sufficiently high to impact consumption advice.

All fish samples were prepared as skinless fillets, except for Mississippi Silverside, sculpin, and Threadfin Shad, which were prepared whole bodied due to their small size. Samples were analyzed as individual fish or composites.

For this advisory, OEHHA used the weighted (by the number of individual fish) average (arithmetic mean) 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 Marine Pollution Studies Laboratory at Moss Landing Marine Laboratories (MPSL). 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). Table 2 shows the averages and ranges for total length,[8] as well as mercury concentrations in each fish species. The DMA method detection limits (MDLs)[9] for total mercury were reported at 3 or 12 parts per billion (ppb), depending on the study. The reporting limits (RLs)[10] were 9, 10, or 12 ppb, depending on the study. Although mercury was detected at a commonly found concentration in the NLFTS study, the MDL and RL for mercury were not reported.

PCBS, PBDES, AND PESTICIDES

Pesticides, PBDEs, and PCBs in either individual fish or composite samples 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

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[7] Congeners are related compounds with similar chemical forms. Five and six congeners are typically analyzed for chlordanes and DDTs, respectively. Of the 209 possible PBDE and PCB congeners, 6–7 and 48–54 are generally analyzed, respectively. See the OEHHA (2022) Sampling Protocol available online at https://oehha.ca.gov/media/downloads/fish/report/fishadvisorysamplinganalysisprotocolreport2022.pdf.

[8] 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.

[9] The MDL is the lowest quantity of a chemical that can be distinguished (as greater than zero) in a sample.

[10] The RL is the lowest quantity of a chemical that can be accurately quantified in a sample.

sum of the detected parent compound, congeners, or metabolites, where applicable. Because the MDLs or RLs were relatively low (≤ 5 ppb), 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).

SELENIUM

The MPSL analyzed species collected from El Capitan Reservoir for selenium as composite 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 MDL for total selenium was reported at 150 or 230 ppb, and the RL was reported at 400 or 700 ppb. Table 3 shows the averages and ranges for total length, as well as selenium concentrations in each fish species.

Concentrations of chlordanes, dieldrin, DDTs, PBDEs, and PCBs were lower than the corresponding ATL threshold values for daily consumption (OEHHA, 2008 and 2011). With the exception of assessing for multiple chemical exposures, these chemicals were therefore not considered further for developing consumption advice and are not shown in this report.

TABLE 2. MERCURY CONCENTRATIONS IN FISH FROM EL CAPITAN RESERVOIR

Species from El Capitan Reservoir[a]	Number of Samples	Total Number of Fish	Mean[b] Total Length (mm)	Range of Total Lengths[c] (mm)	Mercury (ppb)	
					Mean[b]	Range[c]
Blue Catfish	8	8	916	795 – 1,070	1,189	707 – 1,990
Bluegill	2	10	185	165 – 214	70	62 – 77
Largemouth Bass	27	31	385	321 – 524	508	210 – 798
Mississippi Silverside	1	10	67	64 – 75	43	n/a
Sculpin	1	10	75	46 – 84	41	n/a
Threadfin Shad	1	10	76	56 – 95	39	n/a

[a] Samples were prepared as skinless fillets, except as noted in the footnotes to Table 1
[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
n/a = not applicable due to a single sample

TABLE 3. SELENIUM CONCENTRATIONS IN FISH FROM EL CAPITAN RESERVOIR

Species from El Capitan Reservoir[a]	Number of Samples	Total Number of Fish	Mean[b] Total Length (mm)	Range of Total Lengths[c] (mm)	Se (ppb)	
					Mean[b]	Range[c]
Blue Catfish	2	8	916	795 – 1,070	290	260 – 320
Bluegill	2	10	185	165 – 214	820	640 – 1,000
Largemouth Bass	2	20	374	321 – 524	1,010	1,000 – 1,020
Mississippi Silverside	1	10	67	64 – 75	680	n/a
Sculpin	1	10	75	46 – 84	700	n/a
Threadfin Shad	1	10	76	56 – 95	900	n/a

[a] Samples were prepared as skinless fillets, except as noted in the footnotes to Table 1
[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
n/a = not applicable due to a single sample

DEVELOPMENT OF GUIDELINES FOR EATING FISH FROM EL CAPITAN RESERVOIR

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[11] per week. Young children need less, depending on their age and calorie needs."[12] According to the "Dietary Guidelines for Americans, 2020 – 2025" (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 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

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

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 18–49 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 the Appendix.

For each fish species in this advisory, OEHHA compared the mean chemical concentrations detected in the fillet to the corresponding ATLs to establish the maximum number of servings per week that can be safely consumed (see Appendix). 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 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, multiple chemical exposure methodology involving hazard index calculations is employed. This may result in advising fewer servings 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 (mercury and PCBs) was not assessed in Largemouth Bass, the only species for which PCBs were analyzed, because no consumption is recommended for the sensitive population based solely on mercury. Advice for all species in this advisory was based solely on mercury concentrations.

OEHHA recommends that individuals strive to meet the US dietary guidelines' seafood consumption recommendations,[13] 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. When noted, OEHHA's consumption advice for a particular fish species can be extended to other closely related fish species[14] known to accumulate similar levels of contaminants.

Consumption advice should not be combined. That is, if a person chooses to eat a serving of 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 serving of fish from the "two-servings-per-week" category, they can combine fish species from that category, or eat one serving of 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 EL CAPITAN RESERVOIR

OEHHA's sampling and analysis protocol (OEHHA 2022) requires that a minimum of nine edible-size fish of a species that may be legally caught are collected and analyzed from small- and medium-sized lakes and reservoirs before an advisory can be developed. Additional fish beyond this number will increase confidence that the sample dataset is representative of the fish species population in the water body (OEHHA, 2022). The majority of fish consumption advisories in California are based on mercury, which is typically analyzed in individual fish, rather than as composites. Mercury analysis is relatively inexpensive and mercury concentrations in fish are more likely to be positively correlated with fish size than other contaminants. Thus, individual analysis

[13] Online at: https://www.dietaryguidelines.gov/.
[14] Fish species within the same genus are most closely related, and family is the next level of relationship.

allows for advice to be based on fish size, when appropriate. Other contaminants, such as PCBs, pesticides, and selenium, may also impact advice. These contaminants are often analyzed as a composite of a smaller subset of fish (usually at least five individuals) as a cost-saving mechanism, a common practice that is considered acceptable. In some cases, an exception is made regarding the minimum sample size. This is particularly true if the advice is based on a chemical other than mercury where sample size is often limited, and/or if doing so leads to more health-protective advice than would otherwise be provided.

For El Capitan Reservoir, the sample size criterion for mercury was met for all species except Blue Catfish, for which data on only eight individuals were available. Advice for this species was included despite the slightly reduced sample size because of the high level of mercury in this species. There were not sufficient data to evaluate other species that may be found in this water body. For fish species found in El Capitan Reservoir that are not included in this advisory, OEHHA recommends following the statewide advisory for lakes and reservoirs without site-specific advice.[15]

The following advice is based solely on mercury concentrations. The sensitive population is defined as women ages 18 to 49 years and children ages 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)

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. Therefore, OEHHA extends the consumption advice for Largemouth Bass to other black bass species, including Redeye, Smallmouth, and Spotted Bass.

Based on the mean mercury concentration of 508 ppb in Largemouth Bass, OEHHA recommends no consumption of black bass species from El Capitan Reservoir for the sensitive population, and a maximum of one serving a week for the general population.

[15] Online at: https://oehha.ca.gov/advisories/statewide-advisory-eating-fish-californias-lakes-and-reservoirs-without-site-specific.

Blue Catfish

Based on the mean mercury concentration of 1,189 ppb in Blue Catfish from El Capitan Reservoir, OEHHA recommends no consumption for the sensitive population, and a maximum of one serving a week for the general population.

Mississippi Silverside

Based on the mean mercury concentration of 43 ppb in Mississippi Silverside from El Capitan Reservoir, OEHHA recommends a maximum of five servings a week for the sensitive population, and a maximum of seven servings a week for the general population.

Sculpin

Based on the mean mercury concentration of 41 ppb in sculpin from El Capitan Reservoir, OEHHA recommends a maximum of five servings a week for the sensitive population, and a maximum of seven servings a week for the general population.

Sunfish Species (Bluegill)

OEHHA groups sunfish species due to a known ability to hybridize (Avise and Smith, 1974) and extensive dietary overlap (Kirby, 1982), which suggests a similar contaminant uptake. OEHHA has evaluated mercury concentrations in sunfish species from 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. Therefore, OEHHA extends the consumption advice for Bluegill to other sunfish species, including Green Sunfish, Pumpkinseed, and Redear Sunfish.

Based on the mean mercury concentration of 70 ppb in sunfish species from El Capitan Reservoir, OEHHA recommends a maximum of three servings a week for the sensitive population, and a maximum of seven servings a week for the general population.

Threadfin Shad

Based on the mean mercury concentration of 39 ppb in Threadfin Shad from El Capitan Reservoir, OEHHA recommends a maximum of five servings a week for the sensitive population, and a maximum of seven servings a week for the general population.

RECOMMENDED MAXIMUM NUMBER OF SERVINGS

The recommended maximum numbers of servings per week for fish from El Capitan Reservoir are shown in Table 4.

TABLE 4. RECOMMENDED MAXIMUM NUMBER OF SERVINGS PER WEEK FOR FISH FROM EL CAPITAN RESERVOIR

Species from El Capitan Reservoir	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
Blue Catfish	0	1
Mississippi Silverside	5	7
Sculpin	5	7
Sunfish Species	3	7
Threadfin Shad	5	7

REFERENCES

American Heart Association. 2016. Fish and Omega-3 Fatty Acids. Online at: http://www.heart.org/HEARTORG/HealthyLiving/HealthyEating/HealthyDietGoals/Fish-and-Omega-3-Fatty-Acids_UCM_303248_Article.jsp#.Wl57BnlG2Uk.

Avise, J.C. and M.H. Smith. 1974. Biochemical Genetics of Sunfish II. Genic Similarity between Hybridizing Species. The American Naturalist. 108 (962). Online at: https://www.journals.uchicago.edu/doi/pdf/10.1086/282926.

Bloom, N.S. 1992. On the chemical form of mercury in edible fish and marine invertebrate tissue. Can. J. Fish. Aquat. Sci. 49(5):1010–1017.

FDA/US EPA. 2017. Eating Fish: What pregnant women and parents should know. Advice by FDA and US EPA/January, 2017. Online at: https://www.fda.gov/food/consumers/advice-about-eating-fish.

Institute of Medicine. 2007. Seafood choices, balancing benefits and risks. Committee on Nutrient Relationships in Seafood: Selections to Balance Benefits and Risks. Institute of Medicine, Food and Nutrition Board. The National Academies Press, Washington, D.C.

Kirby, J.M. 1982. Prey Utilization among Four Sympatric Species of Sunfish. Proc. PA. Acad. of Sci. 56(2):147–150. Online at: https://www.jstor.org/stable/44111415.

Kris-Etherton, P.M., W.S. Harris, and L.J. Appel. 2002. Fish consumption, fish oil, omega-3 fatty acids, and cardiovascular disease. Circ. 106:2747–2757.

Long, J.M. and W.L. Fisher. 2000. Inter-Annual and Size-Related Differences in the Diets of Three Sympatric Black Bass in an Oklahoma Reservoir. J. Freshw. Ecol. 15(4): 465–474. Online at: https://www.tandfonline.com/doi/abs/10.1080/02705060.2000.9663768.

OEHHA. 2008. Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, Dieldrin, Methylmercury, PCBs, Selenium, and Toxaphene. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, California. Online at: http://oehha.ca.gov/media/downloads/fish/report/atlmhgandothers2008c.pdf.

OEHHA. 2011. Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Polybrominated diphenyl ethers (PBDEs). Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, California. Online at: http://oehha.ca.gov/media/downloads/fish/report/pbdes052311.pdf.

OEHHA. 2022. General Protocol for Sport Fish Sampling and Analysis. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, California. Online at: https://oehha.ca.gov/media/downloads/fish/report/fishadvisorysamplinganalysisprotocolreport2022.pdf.

Oken, E., R.O. Wright, K.P. Kleinman, D. Bellinger, C.J. Amarasiriwardena, H. Hu, J.W. Rich-Edwards, and M.W. Gillman. 2005. Maternal fish consumption, hair mercury, and infant cognition in a U.S. cohort. Environ. Health Perspect. 113(10):1376–1380.

Oken, E., J.S. Radesky, R.O. Wright, D. Bellinger, C.J. Amarasiriwardena, K.P. Kleinman, H. Hu, J.W. Rich-Edwards, and M.W. Gillman. 2008. Maternal fish intake during pregnancy, blood mercury levels, and infant cognition at age 3 years in a U.S. cohort. Am. J. Epidemiol. 167(10):1171–1181.

Pierce, P.C., and M.J. Van Den Avyle. 1997. Hybridization between Introduced Spotted Bass and Smallmouth Bass in Reservoirs. Trans. Am. Fish. Soc. 126(6):939–947. Available online at: https://www.tandfonline.com/doi/abs/10.1577/1548-8659%281997%29126%3C0939%3AHBISBA%3E2.3.CO%3B2.

SWRCB. 2010. Contaminants in Fish from California Lakes and Reservoirs, 2007–2008: Summary Report on a Two-Year Screening Survey. State Water Resources Control Board, California Environmental Protection Agency, Sacramento, California. Online at: http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/lakes_study/lake_survey_yr2_no_app.pdf.

Thongda, W., M. Lewis, H. Zhao, B. Bowen, D.J. Lutz-Carrillo, B.K. Peoples, and E. Peatman. 2020. Species-diagnostic SNP markers for the black basses (*Micropterus spp.*): a new tool for black bass conservation and management. *Cons. Genet. Resour.* 12:319–328. Available at: https://link.springer.com/article/10.1007%2Fs12686-019-01109-8.

USDA/USDHHS. 2020. Dietary Guidelines for Americans, 2020–2025. 9th Edition. U.S. Department of Health and Human Services and U.S. Department of Agriculture. Online at: https://www.dietaryguidelines.gov/.

US EPA. 1989. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A) Interim Final. EPA/5401-89/002, December 1989. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Online at: https://rais.ornl.gov/documents/HHEMA.pdf.

US EPA. 2000a. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 1. Fish Sampling and Analysis, 3rd Edition. EPA 823-B00-007. Office of Water, U.S. Environmental Protection Agency, Washington, D.C.

US EPA. 2000b. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 2. Risk Assessment and Fish Consumption Limits, 3rd Edition. EPA 823-B-00-007. Office of Water, U.S. Environmental Protection Agency, Washington, D.C.

US EPA. 2013. National Study of Chemical Residues in Lake Fish Tissue. Environmental Monitoring & Assessment Program. Office of Water, US Environmental Protection Agency, Washington, D.C. Online at: https://www.epa.gov/fish-tech/national-lake-fish-tissue-study.

Weaver, K.L., P. Ivester, J.A. Chilton, M.D. Wilson, P. Pandey, and F.H. Chilton. 2008. The content of favorable and unfavorable polyunsaturated fatty acids found in commonly eaten fish. J. American Dietetic Assoc. 108:1178–1185.

APPENDIX. ADVISORY TISSUE LEVELS

Advisory Tissue Levels (ATLs; OEHHA, 2008 and 2011) 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[16] 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 that 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	≤ 1,000	>1,000–1,200	>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.

[16] 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.