GOOD CATCH CALIFORNIA
Your Fish Advisor

Health Advisory and Guidelines for Eating Fish from Lake Cuyamaca (San Diego County)

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

LIST OF CONTRIBUTORS

Office of Environmental Health Hazard Assessment

Project Leads

Shannon R. Murphy, Ph.D.
Susan A. Klasing, Ph.D.

Primary Reviewers

Lori Chumney, M.S.
Huyen Tran Pham, M.P.H.
Wesley Smith, Ph.D.

Final Reviewers

Elaine Khan, Ph.D., Pesticide and Environmental Toxicology Branch Chief
Vincent Cogliano, Ph.D., Deputy Director for Scientific Programs
David Edwards, Ph.D., Chief Deputy Director

Director

Lauren Zeise, Ph.D.

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For further information, contact:

Pesticide and Environmental Toxicology Branch
Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

1001 I Street, P.O. Box 4010
Sacramento, CA 95812-4010
Telephone: (916) 324-7572
Email address: fish@oehha.ca.gov

1515 Clay Street, 16th Floor
Oakland, CA 94612
Telephone: (510) 622-3170

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
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.

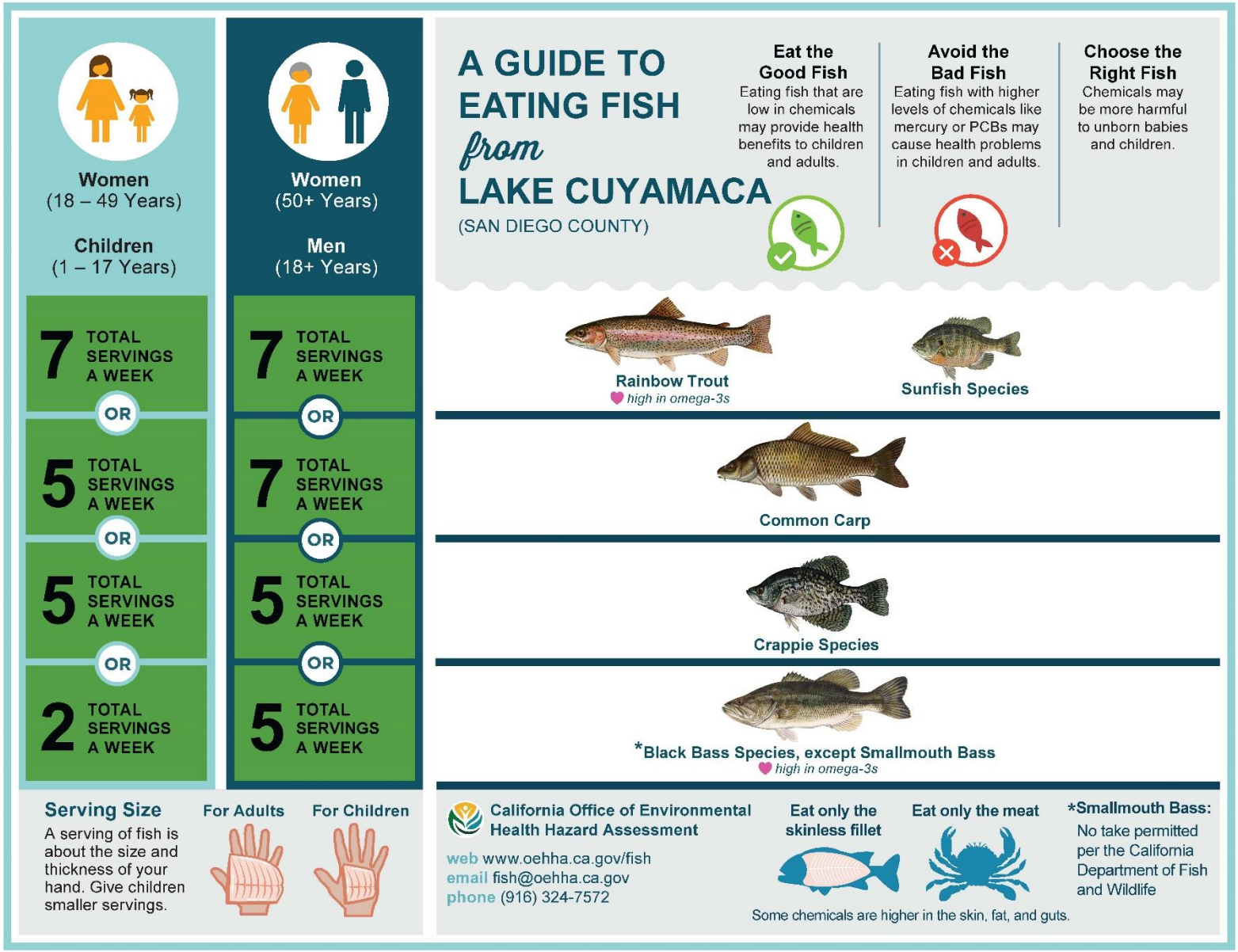
The health advisories are published in the California Department of Fish and Wildlife's (CDFW) Inland and Ocean Sport Fishing Regulations in their respective sections on public health advisories.[2]

This report presents guidelines for eating fish from Lake Cuyamaca 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.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES


A GUIDE TO EATING FISH from LAKE CUYAMACA
(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.
Women (18 – 49 Years)
Children (1 – 17 Years)
Women (50+ Years)
Men (18+ Years)
7 TOTAL SERVINGS A WEEK
OR
5 TOTAL SERVINGS A WEEK
OR
5 TOTAL SERVINGS A WEEK
OR
2 TOTAL SERVINGS A WEEK
7 TOTAL SERVINGS A WEEK
OR
7 TOTAL SERVINGS A WEEK
OR
5 TOTAL SERVINGS A WEEK
OR
5 TOTAL SERVINGS A WEEK
Rainbow Trout
high in omega-3s
Sunfish Species
Common Carp
Crappie Species
*Black Bass Species, except Smallmouth Bass
high in omega-3s
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.
*Smallmouth Bass:
No take permitted per the California Department of Fish and Wildlife

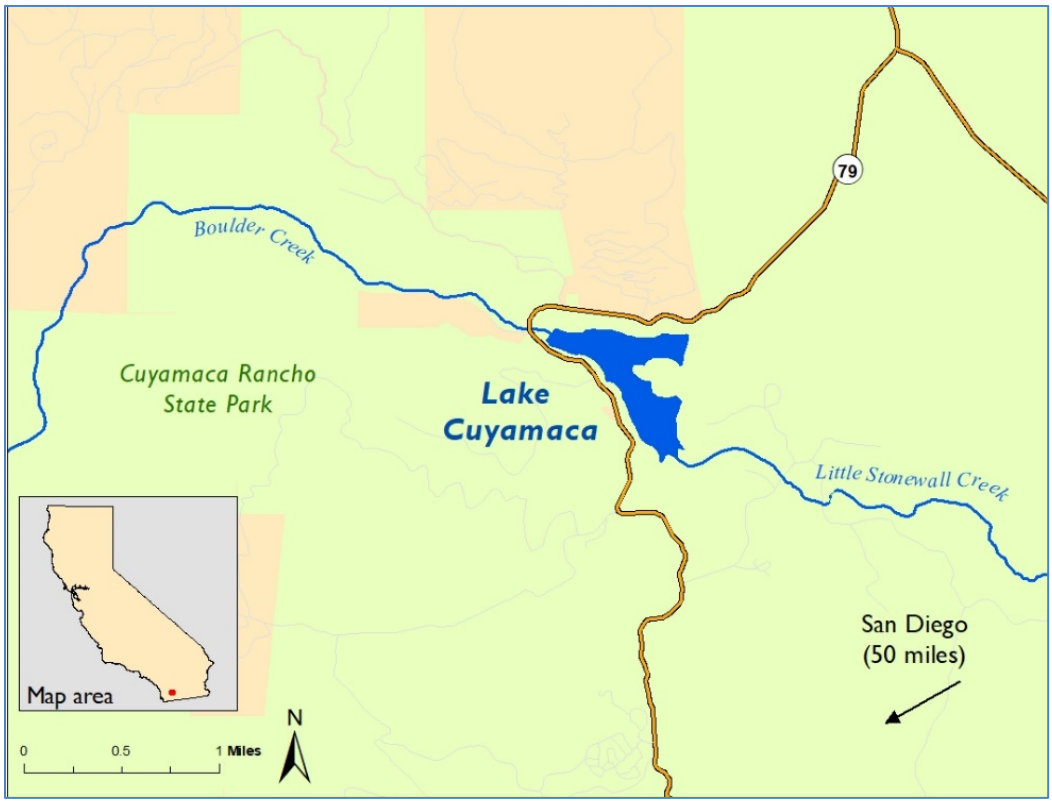
INTRODUCTION

This report presents guidelines for eating black bass species, Common Carp, crappie species, Rainbow Trout, and sunfish species caught from Lake Cuyamaca. Consumption advice is based on levels of mercury (Hg) and selenium (Se) found in these species.

LOCATION

Lake Cuyamaca is located in San Diego County about 50 miles northeast of San Diego, CA (Figure 1). Lake Cuyamaca is part of the Cuyamaca Rancho State Park and was formed in 1887 by construction of an earthen dam on Boulder Creek.[3] Helix Water District owns and operates the dam and the 8,195-acre feet lake as a municipal drinking water source. The California Department of Fish and Wildlife (CDFW), in cooperation with the Lake Cuyamaca Recreation and Park District, periodically plants trout at Lake Cuyamaca.

FIGURE 1. LOCATION OF LAKE CUYAMACA



[3] Information regarding Lake Cuyamaca was obtained from the Lake Cuyamaca Recreation and Park District at https://www.lakecuyamaca.net/, Helix Water District at https://www.hwd.com/257/Water-Storage, and California State Parks at https://stateparks.com/cuyamaca_state_park_in_california.html.

APPROACH USED

The Office of Environmental Health Hazard Assessment (OEHHA) used the results from two monitoring studies described in this report to develop the Lake Cuyamaca 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, 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 known as methylmercury – which can pass into and build up in fish. High levels of

[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.

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 Lake Cuyamaca and used in advisory development were analyzed for mercury and selenium. Some fish were analyzed for PCBs 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 Lake Cuyamaca are based on the chemicals detected in the fish collected for the two 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.

Regional Water Quality Control Boards (RWB 9), 2015

The State Water Resources Control Board (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 Regional Water Quality Control Boards (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 lakes and reservoirs within their regional boundaries.[5] RWB 9 (San Diego) collected Black Crappie from Lake Cuyamaca in 2015 to analyze for mercury, PCBs, selenium, and legacy pesticides (chlordanes, DDTs, and dieldrin).

Monitoring of Contaminants in Fish from California Lakes and Reservoirs (SWAMP), 2016

The Surface Water Ambient Monitoring Program (SWAMP), operated by the SWRCB, monitors water quality in California's surface waters.[6] The purpose of the study was to supplement long-term monitoring data that document the bioaccumulation impacts of chemical contaminants on the beneficial uses of California waters. The study focused on water bodies that provide beneficial uses through fishing and had either not been previously sampled or were previously sampled, but needed data gaps filled to determine impairment or develop consumption advisories (Davis et al., 2022). In 2016, SWAMP collected Black Crappie, Bluegill, Common Carp, Green Sunfish, Largemouth Bass, and Rainbow Trout from Lake Cuyamaca, which were analyzed for mercury and selenium. Common Carp were also analyzed for PCBs.

FISH SAMPLED FROM LAKE CUYAMACA

The fish sampling data used in this advisory were retrieved from the California Environmental Data Exchange Network (CEDEN),[7] 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, 2022). A summary of all fish species evaluated for this advisory is shown in Table 1, including the name of the

[5] 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,

[6] Further information on SWAMP studies can be found online at: https://www.waterboards.ca.gov/water_issues/programs/swamp/lakes_study.html.

[7] Online at: http://ceden.waterboards.ca.gov/AdvancedQueryTool.

species, number of samples collected, total number of fish, project name, year sampled, and contaminants analyzed.

TABLE 1. FISH SAMPLES EVALUATED FOR THE LAKE CUYAMACA ADVISORY

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed
Black Crappie	*Pomoxis nigromaculatus*	1	7	RWB9	2015	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se
		2	8	SWAMP	2016	Hg, Se
Bluegill	*Lepomis macrochirus*	2	10	SWAMP	2016	Hg, Se
Common Carp	*Cyprinus carpio*	2	10	SWAMP	2016	Hg, Se
		1	5	SWAMP	2016	PCBs
Green Sunfish	*Lepomis cyanellus*	2	10	SWAMP	2016	Hg, Se
Largemouth Bass	*Micropterus salmoides*	8	8	SWAMP	2016	Hg
		1	5	SWAMP	2016	Se
Rainbow Trout	*Oncorhynchus mykiss*	2	10	SWAMP	2016	Hg, Se

Samples were analyzed as skinless fillets.

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, and PCBs (51 congeners).[8] Among the chemicals analyzed in fish tissue samples from Lake Cuyamaca, only mercury and selenium levels were sufficiently high to impact consumption advice.

All fish samples were prepared as skinless fillets and 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.

[8] 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 and analysis protocol available online at https://oehha.ca.gov/media/downloads/fish/report/fishadvisorysamplinganalysisprotocolreport2022.pdf.

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). 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,[9] as well as mercury concentrations in each fish species. The DMA method detection limit (MDL)[10] for total mercury was reported at 4 parts per billion (ppb). The reporting limit (RL)[11] was 12 ppb.

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 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 all species collected from Lake Cuyamaca 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. The MDL and the RL for total selenium were reported at 150 or 960 and 400 or 2,000 ppb, respectively, depending on the study. Table 3 shows the averages and ranges for total length, as well as selenium concentrations in each fish species.

Concentrations of chlordanes, dieldrin, DDTs, 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.

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[9] 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.

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

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

TABLE 2. MERCURY CONCENTRATIONS IN FISH FROM LAKE CUYAMACA

Species from Lake Cuyamaca	Number of Samples[a]	Total Number of Fish	Mean[b] Total Length (mm)	Range of Total Lengths[c] (mm)	Mercury (ppb)	
					Mean[b]	Range[c]
Black Crappie	3	15	196	172 – 226	22	13 – 32
Common Carp	2	10	599	533 – 665	37	34 – 40
Largemouth Bass	8	8	382	311 – 440	112	46 – 166
Rainbow Trout	2	10	342	304 – 354	15	15 – 15
Sunfish species	4	20	123	101 – 170	25	18 – 31
Bluegill	2	10	131	111 – 170	23	18 – 31
Green Sunfish	2	10	115	101 – 150	27	25 – 29

[a]Samples were prepared as skinless fillets
[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

TABLE 3. SELENIUM CONCENTRATIONS IN FISH FROM LAKE CUYAMACA

Species from Lake Cuyamaca	Number of Samples[a]	Total Number of Fish	Mean[b] Total Length (mm)	Range of Total Lengths[c] (mm)	Selenium (ppb)	
					Mean[b]	Range[c]
Black Crappie	3	15	196	172 – 226	1,305	420 – 2,220
Common Carp	2	10	559	533 – 665	560	350 – 770
Largemouth Bass	1	5	373	360 – 385	530	n/a
Rainbow Trout	2	10	342	304 – 354	410	250 – 570
Sunfish species	4	20	123	101 – 170	837	730 – 930
Bluegill	2	10	131	111 – 170	760	730 – 760
Green Sunfish	2	10	115	101 – 150	914	890 – 930

[a]Samples were prepared as skinless fillets
[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 LAKE CUYAMACA

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[12] per week. Young children need less, depending on their age and calorie needs."[13] 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 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 Environmental Protection Agency (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

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

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 was assessed in Black Crappie (mercury, DDTs, and PCBs) and Common Carp (mercury and PCBs) but did not affect advice for these species. Advice for all species in this advisory was based solely on mercury or selenium concentrations.

OEHHA recommends that individuals strive to meet the US dietary guidelines' seafood consumption recommendations,[14] 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

[14] Online at: https://www.dietaryguidelines.gov/.

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[15] 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 LAKE CUYAMACA

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 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 Lake Cuyamaca, the sample size criterion was met for mercury for all species sampled except Largemouth Bass. Only eight individual Largemouth Bass measuring at least 305 mm in total length[16] were analyzed for mercury. Although this is fewer than the preferred number of samples, the data were included because the number of samples analyzed is only one less than the minimum, Largemouth Bass is a common species found in Lake Cuyamaca,[17] and advice based on mercury concentrations in this

[15] Fish species within the same genus are most closely related, and family is the next level of relationship.
[16] Per CDFW regulations, there is no minimum length for legal take of Largemouth Bass from Lake Cuyamaca. To develop sufficiently health-protective advice, OEHHA included only those samples that met the minimum total length (305 mm) generally applied statewide for legal take of black bass species. Online at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=209090&inline.
[17] Lake Cuyamaca Recreation and Park District online at: https://www.lakecuyamaca.net/types-of-fish.

species at Lake Cuyamaca recommends more servings per week for both the sensitive and general populations than the advice for black bass species provided in the OEHHA statewide advisory for lakes and reservoirs without site-specific advice.[18] Additionally, a single composite sample of five Largemouth Bass was analyzed for selenium. Although this sample contained fewer than nine fish, OEHHA considered and included the selenium data in this report because selenium is the primary contaminant upon which advice is based for some other species found in Lake Cuyamaca. However, advice for black bass species from Lake Cuyamaca is based on mercury because it provides the most health-protective guidance for the sensitive population and the general population.

There were not sufficient data to evaluate other species that may be found in this water body. For fish species found in Lake Cuyamaca that are not included in this advisory, OEHHA recommends following the statewide advisory for lakes and reservoirs without site-specific advice.[19]

The following advice is based solely on mercury or selenium 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 and Spotted Bass. Smallmouth Bass are not legal to take from Lake Cuyamaca per CDFW regulations.[20]

The mean mercury and selenium concentrations in Largemouth Bass from Lake Cuyamaca were 112 and 530 ppb, respectively. OEHHA recommends a maximum of two servings a week of black bass species from Lake Cuyamaca for the sensitive population, and a maximum of five servings a week for the general population, based on mercury.

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[18] https://oehha.ca.gov/advisories/statewide-advisory-eating-fish-californias-lakes-and-reservoirs-without-site-specific.
[19] Ibid.
[20] CDFW regulations, online at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=209090&inline.

COMMON CARP

The mean mercury and selenium concentrations in Common Carp from Lake Cuyamaca were 37 and 560 ppb, respectively. OEHHA recommends a maximum of five servings a week of Common Carp for the sensitive population, based on mercury, and a maximum of seven servings a week for the general population, based on mercury or selenium.

CRAPPIE SPECIES (BLACK CRAPPIE)

OEHHA groups Black and White Crappie because they have similar diets and may hybridize when they are co-located, making them difficult to distinguish (Dunham et al., 1994; Kelly and Baumhoer, 2014). Further, statewide analysis of Black and White Crappie data shows similar mean mercury concentrations. Therefore, OEHHA extends the consumption advice for Black Crappie to White Crappie.

The mean mercury and selenium concentrations in Black Crappie from Lake Cuyamaca were 22 and 1,305 ppb, respectively. OEHHA recommends a maximum of five servings a week of crappie species for both the sensitive population and the general population, based on selenium.

RAINBOW TROUT

The mean mercury and selenium concentrations in Rainbow Trout from Lake Cuyamaca were 15 and 410 ppb, respectively. OEHHA recommends a maximum of seven servings per week of Rainbow Trout for both the sensitive population and the general population, based on mercury or selenium.

SUNFISH SPECIES (BLUEGILL, GREEN SUNFISH)

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. Selenium concentrations in sunfish species in this region of California are generally similar within the same water body. Therefore, OEHHA extends the consumption advice for Bluegill and Green Sunfish to other sunfish species, including Pumpkinseed and Redear Sunfish.

The mean mercury and selenium concentrations in sunfish species from Lake Cuyamaca were 25 ppb and 837 ppb, respectively. Mercury concentrations for individual sunfish species were as follows: Bluegill, 23 ppb; and Green Sunfish, 27 ppb. selenium concentrations for individual sunfish species were as follows: Bluegill, 760 ppb; and Green Sunfish, 914 ppb. OEHHA recommends a maximum of seven servings

a week of sunfish species for both the sensitive population and the general population, based on the concentration of mercury or selenium.

RECOMMENDED MAXIMUM NUMBER OF SERVINGS

The recommended maximum numbers of servings per week for fish from Lake Cuyamaca are shown in Table 4.

TABLE 4. RECOMMENDED MAXIMUM NUMBER OF SERVINGS PER WEEK FOR FISH FROM LAKE CUYAMACA

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	2	5
Common Carp	5	7
Crappie Species	5	5
Rainbow Trout	7	7
Sunfish Species	7	7

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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[21] 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.

[21] 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.