OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

GOOD CATCH CALIFORNIA
Your Fish Advisor

Health Advisory and Guidelines for Eating Fish from Lake Del Valle (Alameda County)

May 2018

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

Authors

Lori A. Chumney, M.S.
Huyen Tran Pham, M.P.H.

Primary Reviewers

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

Final Reviewers

David Ting, Ph.D., Branch Chief
David Siegel, Ph.D., Assistant to the Deputy Director
Allan Hirsch, 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

1515 Clay Street, 16th Floor
Oakland, California 94612
Telephone: (510) 622-3170
Email address: fish@oehha.ca.gov

1001 I Street, P.O. Box 4010
Sacramento, CA 95812-4010
Telephone: (916) 324-7572

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)
DHA	docosahexaenoic acid
EBRPD	East Bay Regional Park District
EPA	eicosapentaenoic acid
FDA	Food and Drug Administration
Hg	mercury
MDL	method detection limit
MLML	Moss Landing Marine Laboratories
mm	millimeters
OEHHA	Office of Environmental Health Hazard Assessment
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
ppb	parts per billion
RL	reporting limit
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 Del Valle in Alameda 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 List of Figures and Tables.

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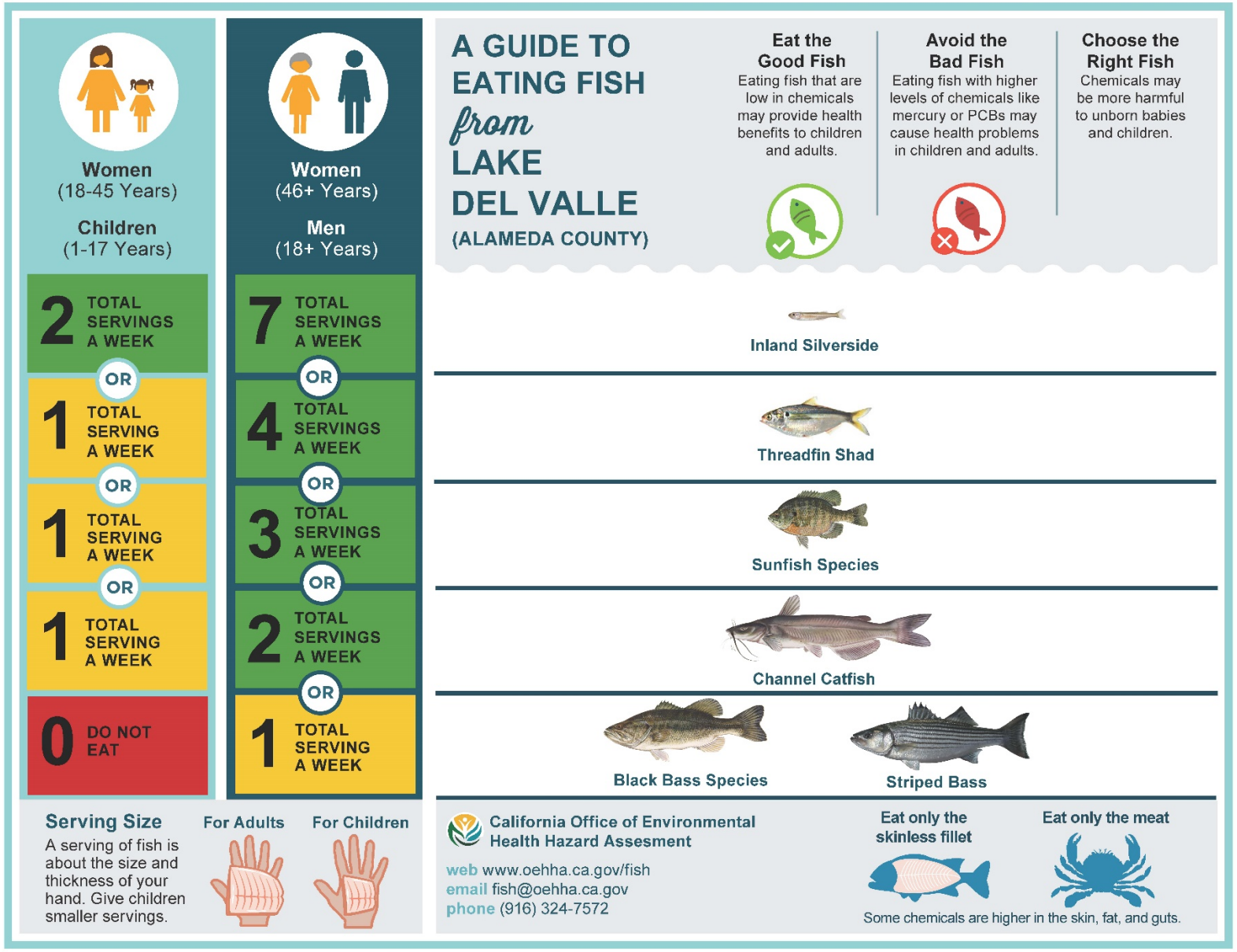

A GUIDE TO EATING FISH from LAKE DEL VALLE (ALAMEDA COUNTY)
Eat the Good Fish
Eating fish that are low in chemicals may provide health benefits to children and adults.
Avoid the Bad Fish
Eating fish with higher levels of chemicals like mercury or PCBs may cause health problems in children and adults.
Choose the Right Fish
Chemicals may be more harmful to unborn babies and children.
Women (18-45 Years)
Children (1-17 Years)
Women (46+ Years)
Men (18+ Years)
2 TOTAL SERVINGS A WEEK
OR
1 TOTAL SERVING A WEEK
OR
1 TOTAL SERVING A WEEK
OR
1 TOTAL SERVING A WEEK
0 DO NOT EAT
7 TOTAL SERVINGS A WEEK
OR
4 TOTAL SERVINGS A WEEK
OR
3 TOTAL SERVINGS A WEEK
OR
2 TOTAL SERVINGS A WEEK
OR
1 TOTAL SERVING A WEEK
Inland Silverside
Threadfin Shad
Sunfish Species
Channel Catfish
Black Bass Species
Striped Bass
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 Assesment
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.

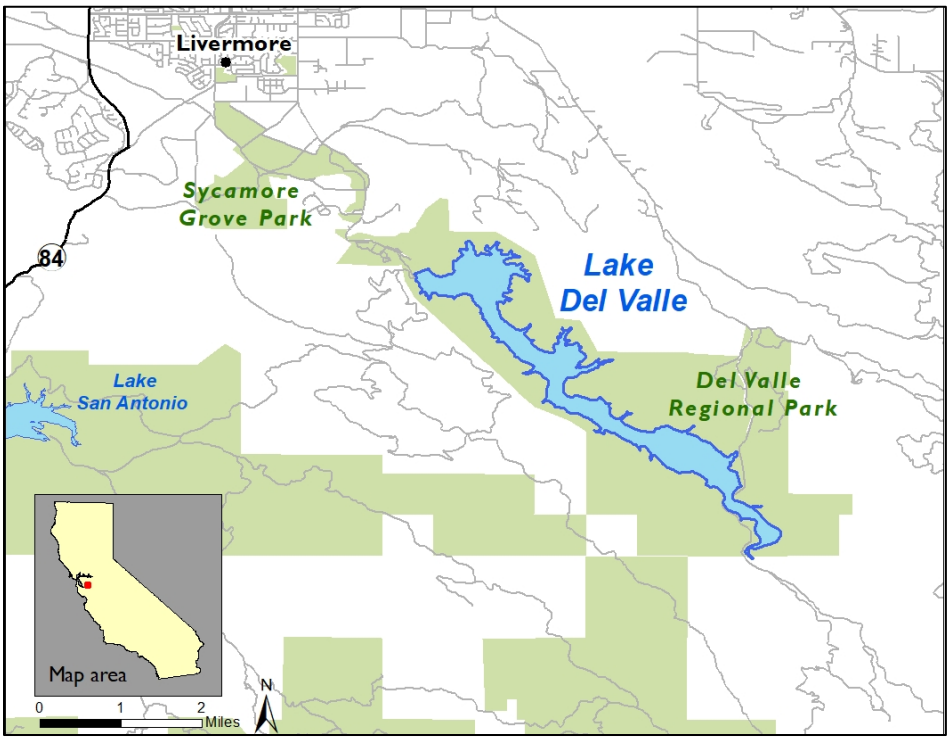
INTRODUCTION

This report presents an update for eating fish from Lake Del Valle (Figure 1) in Alameda County. The previous fish consumption advisory was developed in 2009 and included advice for black bass species, Channel Catfish and sunfish species. Adequate data are available to update the previous advisory to include Inland Silverside, Striped Bass, and Threadfin Shad.

LOCATION

Lake Del Valle is located about 10 miles south of Livermore, CA, on the east side of San Francisco Bay. It was created in 1968 by construction of the Del Valle Dam for water storage, flood protection, and recreational purposes. Lake Del Valle has 16 miles of shoreline with a storage capacity of 77,100 acre-feet. The East Bay Regional Park District (EBRPD) manages Del Valle Regional Park, including the lake. EBRPD, in cooperation with the California Department of Fish and Wildlife, plants Rainbow Trout from fall through spring, and Channel Catfish in summer. [1]

FIGURE 1. LOCATION OF LAKE DEL VALLE



[1] Information regarding Lake Del Valle was obtained from the East Bay Regional Park District and the Zone 7 Water Agency websites. Online at: http://www.ebparks.org/parks/del_valle and http://www.zone7water.com/36-public/content/48-del-valle-reservoir

APPROACH USED

The Office of Environmental Health Hazard Assessment (OEHHA) used the results from three monitoring studies described in this report to develop the Lake Del Valle 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 the 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 (Hg), followed by polychlorinated biphenyls (PCBs) and, in a few cases, selenium (Se) 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 Del Valle and used in advisory development were analyzed for mercury (as a measure of methylmercury). Channel Catfish were additionally analyzed for the legacy pesticides (chlordanes, DDTs (DDT and its metabolites dichlorodiphenyldichloroethane [DDD] and dichlorodiphenyldichloroethylene [DDE]), dieldrin, toxaphene) as well as PBDEs, PCBs, and selenium.

DATA SOURCES

The guidelines for eating fish from Lake Del Valle 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 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.

East Bay Regional Park District (EBRPD) Del Valle Food Web Study: Implications for Mercury Control

The EBRPD collected Inland Silverside, Largemouth Bass, Smallmouth Bass, Striped Bass, and Threadfin Shad from Lake Del Valle in 2016-2017 to study the food web as part of the pilot phase for the Statewide Mercury Control Program for Reservoirs.[3]

Surface Water Ambient Water Monitoring Program (SWAMP): Contaminants in Fish From California Lakes and Reservoirs, 2007-2008

The SWAMP, operated by the State Water Resources Control Board (SWRCB) in cooperation with Regional Water Quality Control Board staff, monitors water quality in California's surface waters. As part of a SWAMP statewide sampling effort to survey contaminants in sport fish found in California lakes and reservoirs, the program collected Channel Catfish and Largemouth Bass from Lake Del Valle in 2008 to analyze mercury in both species, and chlordanes, DDTs, dieldrin, PBDEs, PCBs, and selenium in Channel Catfish (SWRCB, 2010).

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. California Department of Fish and Wildlife (CDFW) staff, then known as the California Department of Fish and Game, collected Bluegill, Channel Catfish, Largemouth Bass, and Redear Sunfish from Lake Del Valle in 2001, as part of the program. All fish samples were analyzed for mercury. Additionally, Channel Catfish were analyzed for chlordanes, DDTs, dieldrin, and toxaphene.

FISH SAMPLED FROM LAKE DEL VALLE

The fish sampling data used in this advisory were obtained from the East Bay Regional Park District and 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).

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[3] Information on the State Water Resources Control Board's Statewide Mercury Control Program for Reservoirs can be found at https://www.waterboards.ca.gov/water_issues/programs/mercury/reservoirs/

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 LAKE DEL VALLE ADVISORY

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed
Bluegill	*Lepomis macrochirus*	3	12	TSMP[a]	2001	Hg
Channel Catfish	*Ictalurus punctatus*	3	9	TSMP[a]	2001	Chlordanes, DDTs, Dieldrin, Hg, Toxaphene
		1	5	SWAMP	2008	Chlordanes, DDTs, Dieldrin, PBDEs, PCBs, Se
		2	10	SWAMP	2008	Hg
Inland Silverside	*Menidia beryllina*	1	11	EBRPD[b]	2017	Hg
Largemouth Bass	*Micropterus salmoides*	3	9	TSMP[a]	2001	Hg
		7	7	SWAMP	2008	Hg
		8	8	EBRPD	2016	Hg
Redear Sunfish	*Lepomis microlophus*	3	9	TSMP[a]	2001	Hg
Smallmouth Bass	*Micropterus dolomieu*	2	2	EBRPD	2016	Hg
Striped Bass	*Morone saxatilis*	5	5	EBRPD	2016	Hg
		4	4	EBRPD	2017	Hg
Threadfin Shad	*Dorosoma petenense*	1	10	EBRPD[b]	2017	Hg

[a] Study report did not specify whether skin was removed from fillets prior to tissue analysis.
[b] 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, DDTs, dieldrin, PBDEs, PCBs (54 congeners[4]), and toxaphene. Among the chemicals analyzed in fish tissue samples from Lake Del Valle, only mercury levels were sufficiently high to impact consumption advice. For this reason, levels of other contaminants are not shown in this report.

All fish samples were prepared as skinless fillets, except for the TSMP study where the fillet preparation method for Bluegill, Channel Catfish, Largemouth Bass, and Redear Sunfish was not recorded, and the EBRPD study where Inland Silverside and Threadfin Shad were analyzed as whole bodies due to their small size. 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. Ideally, for composite samples, the total length of the smallest fish in a composite sample is at least 75% of the length of the largest fish in the sample (US EPA, 2000a). This information is not available for samples collected in the TSMP or EBRPD programs; however, OEHHA assumes that the data complies with the 75% rule. Where reported, all composite samples from Lake Del Valle 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[5], as well as mercury concentrations in each fish species. The DMA method detection limits (MDL)[6] and the reporting limits (RL)[7] for total mercury were reported at 3, 4 or 12 and 9 or 12 parts per billion (ppb),

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

respectively. Although mercury was detected at commonly found concentrations in the TSMP study, the MDL and RL for mercury were not reported.

PCBs, PBDEs, and Pesticides

Channel Catfish samples were analyzed for PCBs, PBDEs, and the legacy pesticides (chlordanes, DDTs, dieldrin, and toxaphene). 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 at ≤ 5 ppb (except for the three composite samples of Channel Catfish analyzed for toxaphene which were reported at 20 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 CDFW MLML analyzed Channel Catfish collected from Lake Del Valle 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 method detection limit (MDL) and the reporting limit (RL) for total selenium were reported at 150 and 400 ppb, respectively.

TABLE 2. MERCURY CONCENTRATIONS IN FISH FROM LAKE DEL VALLE

Species from Lake Del Valle	Number of Samples	Total Number of Fish	Mean* Total Length (mm)	Range of Total Lengths** (mm)	Mercury (ppb)	
					Mean*	Range**
Channel Catfish	5	19	496	450-601	249	129-393
Inland Silverside	1	11	n/a	n/a	82	n/a
Striped Bass	9	9	518	454-570	1118	759-1490
Threadfin Shad	1	10	n/a	n/a	151	n/a
Black Bass Species	20	26	390	306-571	751	340-1280
Largemouth Bass	18	24	396	306-571	760	340-1280
Smallmouth Bass	2	2	323	309-336	645	498-791
Sunfish Species	6	21	202	145-272	209	178-268
Bluegill	3	12	163	145-183	213	178-268
Redear Sunfish	3	9	253	233-272	205	178-223

*Means are an arithmetic average of individual values and/or a weighted average of composites.
**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 DEL VALLE

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 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[8] "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 United States Food and Drug Administration (FDA) and the United States 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).

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.

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.

[8] "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).

For each fish species in this advisory, OEHHA compared the mean mercury concentration 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 Del Valle advisory, the concentrations of chlordanes, DDTs, dieldrin, PBDEs, and PCBs were only measured in Channel Catfish and all chemicals were below the corresponding ATL values for daily consumption. Thus, the potential effect of multiple chemical exposures was not evaluated. 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, while also adhering to federal and OEHHA recommendations to limit the consumption of fish with higher contaminant levels. The advice discussed in the following section represents the maximum recommended number of servings per week for different fish species. People should eat no more than the recommended number of servings for each fish species or species group. OEHHA's consumption advice for a particular fish species can be extended to other closely related fish species[9] 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 DEL VALLE

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

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

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 Del Valle, the sample size criterion was met for the following species: Bluegill, Channel Catfish, Inland Silverside, Largemouth Bass, Smallmouth Bass, Redear Sunfish, Striped Bass, and Threadfin Shad. There were not sufficient data to evaluate other species that may be found in this water body.

Black Bass Species (Largemouth Bass, Smallmouth Bass)

The mean combined mercury concentration in black bass species from Lake Del Valle was 751 ppb. The mercury levels in individual black bass species were 760 ppb (Largemouth Bass) and 645 ppb (Smallmouth Bass), respectively. Based on the concentration of mercury in these species, OEHHA recommends no consumption of black bass species from Lake Del Valle 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).

OEHHA has 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 and Smallmouth Bass to other black bass species, including Redeye and Spotted Bass.

Channel Catfish

The mean mercury concentration in Channel Catfish from Lake Del Valle was 249 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 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 Del Valle was 82 ppb. OEHHA recommends a maximum of two 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

The mean mercury concentration in Striped Bass from Lake Del Valle was 1118 ppb. OEHHA recommends no consumption of Striped Bass 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.

Sunfish Species (Bluegill, Redear Sunfish)

The mean mercury concentration in sunfish species from Lake Del Valle was 209 ppb. The mercury levels in individual sunfish species were 213 ppb (Bluegill) and 205 ppb (Redear Sunfish), respectively. Based on the concentration of mercury in these sunfish species, OEHHA recommends a maximum of one serving a week of sunfish species 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.

OEHHA has evaluated mercury concentrations in sunfish species in many water bodies in California and has found a similar range of mercury concentrations when two or more of these species were caught from the same water body. Therefore, OEHHA extends the consumption advice for sunfish species (Bluegill, Redear Sunfish) to other sunfish species, including Green Sunfish and Pumpkinseed.

Threadfin Shad

The mean mercury concentration in Threadfin Shad from Lake Del Valle was 151 ppb. OEHHA recommends a maximum of one serving a week of Threadfin Shad for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of four servings a week for the general population (women 46 years and older, and men 18 years and older), based on mercury.

RECOMMENDED MAXIMUM NUMBER OF SERVINGS

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

TABLE 3. RECOMMENDED MAXIMUM NUMBER OF SERVINGS PER WEEK FOR FISH FROM LAKE DEL VALLE

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	0	1
Channel Catfish	1	2
Inland Silverside	2	7
Striped Bass	0	1
Sunfish Species	1	3
Threadfin Shad	1	4

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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[10] 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 Del Valle are followed, exposure to chemicals in fish from Lake Del Valle 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.

[10] 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.