



# Health Advisory and Guidelines for Eating Fish from Jenkinson Lake (El Dorado County)

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## LIST OF ACRONYMS AND ABBREVIATIONS

ATL	Advisory Tissue Level
CDFW	California Department of Fish and Wildlife
DDT(s)	dichlorodiphenyltrichloroethane (DDT) and its metabolites dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE)
DHA	docosahexanoic acid
EPA	eicosapentaenoic acid
DWR	Department of Water Resources, California
FDA	Food and Drug Administration
FMP	Fish Mercury Project
Hg	mercury
MDL	method detection limit
MLML	Moss Landing Marine Laboratories
mm	millimeters
n	sample size
OEHHA	Office of Environmental Health Hazard Assessment
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
ppb	parts per billion
RL	reporting limit
SWAMP	Surface Water Ambient 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 task 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 the Jenkinson Lake in El Dorado 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 Jenkinson Lake

### Women 18 - 45 years and Children 1 - 17 years

 <span style="color: #e91e63;">♥</span> Rainbow Trout	 Sunfish Species	 <span style="color: #e91e63;">♥</span> Black Bass Species		
7 total servings a week	OR	3 total servings a week	OR	1 total serving a week

### Women 46 years and older and Men 18 years and older

 <span style="color: #e91e63;">♥</span> Rainbow Trout	 Sunfish Species	 <span style="color: #e91e63;">♥</span> Black Bass Species
7 total servings a week	OR	2 total servings a week

<h4>What is a serving?</h4> <div style="text-align: center;">  </div> <p><b>For Adults</b>      <b>For Children</b></p> <p>A serving is about the size and thickness of your hand for fish fillets. Give children smaller servings.</p>	<h4>Why eat fish?</h4> <p>Eating fish is good for your health. Fish have omega-3s that can reduce your risk for heart disease and improve how the brain develops in unborn babies and children.</p> <p><span style="color: #e91e63;">♥</span> = Fish high in omega-3s</p>	<h4>What is the concern?</h4> <p>Some fish have high levels of mercury or PCBs. Mercury can harm the brain, especially in unborn babies and children. PCBs can cause cancer.</p>
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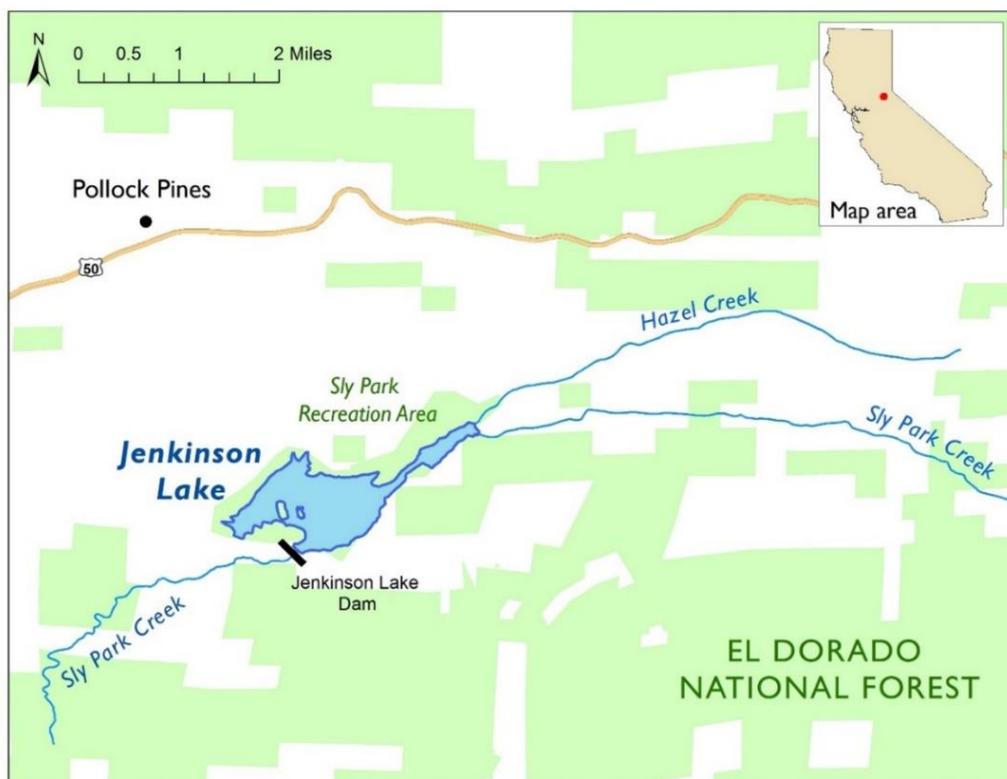
## INTRODUCTION

This report presents guidelines for eating fish from Jenkinson Lake (Figure 1) in El Dorado County, California. Jenkinson Lake (also known as Sly Park Lake) is located about two miles south of Highway 50, near Pollock Pines, CA.

## LOCATION

Jenkinson Lake is a man-made reservoir operated by the El Dorado Irrigation District. The Lake extends from the Cold Canyon Tributary of Sly Park Creek to the Jenkinson Lake Dam and is fed by Sly Park Creek and Hazel Creek.<sup>1</sup> Construction of Jenkinson Lake and subsequent water storage began in 1954. Jenkinson Lake is a popular fishing destination for trout and bass (Stienstra, 2012). Rainbow Trout fingerlings are planted by the California Department of Fish and Wildlife. Largemouth and Smallmouth bass, and other members of the sunfish family can also be caught in the Lake.<sup>2</sup>

FIGURE 1. LOCATION OF JENKINSON LAKE



<sup>1</sup> El Dorado Irrigation District, Watershed Sanitary Survey Update 2013. February 2014. Available at: <http://www.eid.org/home/showdocument?id=4029>

<sup>2</sup> El Dorado Irrigation District Recreation. Available online at: <http://www.eid.org/recreation/sly-park-recreation-area-at-jenkinson-lake/sly-park-fishing-with-faq-s>

## APPROACH USED

The Office of Environmental Health Hazard Assessment (OEHHA) used the results from two monitoring studies described in this report to develop the Jenkinson Lake 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<sup>3</sup>) and other descriptive statistics of the contaminant data, as appropriate, for a chemical of potential concern for the selected fish species.
- 4) Comparison of the chemical concentrations with the OEHHA Advisory Tissue Levels (ATLs) for each chemical of potential concern.
- 5) Development of final advice based on a thorough review of the data and best professional judgment relating to the benefits and risks of consuming a particular fish species.

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

## CHEMICALS OF POTENTIAL CONCERN

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

Mercury is a natural element found in some rock and soil. Human activities, such as burning coal and the historic use of mercury to mine gold, also add mercury to the

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<sup>3</sup> 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.

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 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.

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 Jenkinson Lake and used in advisory development were analyzed for mercury (as a measure of methylmercury). Additionally, one composite of rainbow trout was analyzed for PCBs, PBDEs, and the legacy pesticides (chlordanes, dieldrin, and DDTs [DDT and its metabolites]). Fish species that do not normally accumulate PCBs or other organic chemicals may not be analyzed for those contaminants in a particular monitoring study. In water bodies where a bottom feeding species, such as carp, is not available, rainbow trout are used as an indicator species of organic contamination. Mercury was the only contaminant with sufficient levels to affect consumption levels of rainbow trout from Jenkinson Lake; data for other contaminants are not shown in this report.

## DATA SOURCES

The guidelines for eating fish from Jenkinson Lake 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 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 composite of multiple fish for which contaminant data was reported. “Sampling” or “sampled” refers to the act of collecting fish for chemical analysis.

### FISH MERCURY PROJECT (FMP)

The FMP was a three-year (2005 to 2007) sampling program funded by CALFED<sup>4</sup> (SFEI, 2009). Monitoring of sport fish from Central Valley water bodies was planned and conducted by staff at CDFW, OEHHA, California Department of Public Health, University of California at Davis, and the San Francisco Estuary Institute. More than 4,000 fish and 31 sport fish species were collected under the project objective to characterize spatial and temporal trends in mercury in fishery resources. Fish samples were collected from 146 popular sport fishing locations in the Delta watershed. Largemouth Bass, Pumpkinseed, and Redear Sunfish were collected from Jenkinson Lake in 2005; fillets were analyzed for total mercury. Largemouth Bass, Rainbow Trout, and Redear Sunfish were also collected in 2006 and fillets were analyzed for total mercury.

### CONTAMINANTS IN FISH FROM CALIFORNIA LAKES AND RESERVOIRS, 2007-2008 (SWAMP)

The Surface Water Ambient Monitoring Program (SWAMP), operated by SWRCB in cooperation with Regional Water Quality Control Board staff, monitors water quality in California’s surface waters. The program collected Rainbow Trout, Largemouth Bass and Smallmouth Bass from Jenkinson Lake in 2008 for mercury analysis as part of a SWAMP statewide sampling effort to survey contaminants in sport fish found in California lakes and reservoirs (SWRCB, 2010). Rainbow Trout were also evaluated for PCBs, chlordanes, DDTs, dieldrin, and PBDEs.

### FISH SAMPLED FROM JENKINSON LAKE

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

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<sup>4</sup> The CALFED Bay Delta Program was a state and federal partnership to improve water quality, increase water supply, as well as support ecosystem restoration and levee improvement in the San Francisco Bay-Delta.

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

TABLE 1. FISH SAMPLES EVALUATED FOR JENKINSON LAKE

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed*
Black Bass						
Largemouth Bass	<i>Micropterus salmoides</i>	6	6	FMP	2005-2006	Hg
		3	3	SWAMP	2008	Hg
Smallmouth Bass	<i>Micropterus dolomieu</i>	1	1	SWAMP	2008	Hg
Rainbow Trout						
Rainbow Trout	<i>Oncorhynchus mykiss</i>	11	11	FMP	2006	Hg
		2	10	SWAMP	2008	Hg
		1	5	SWAMP	2008	Chlordanes, DDTs, Dieldrin, PBDEs, PCBs
Sunfish						
Pumpkinseed	<i>Lepomis gibbosus</i>	4	4	FMP	2005	Hg
Redear	<i>Lepomis microlophus</i>	1	1	FMP	2005	Hg
		4	4	FMP	2006	Hg

Hg = Mercury

DDTs = dichlorodiphenyltrichloroethane (DDT) and its metabolites

dichlorodiphenyldichloroethane (DDD)

dichlorodiphenyldichloroethylene (DDE)

PBDEs = polybrominated diphenyl ethers

PCBs = polychlorinated biphenyls

## CHEMICAL CONCENTRATIONS

As shown in Table 1, all samples were analyzed for total mercury. Rainbow Trout were also analyzed for PCBs (54-55 congeners<sup>5</sup>), chlordanes, DDTs, dieldrin, and PBDEs. All fish samples were prepared as skinless fillets. Samples were analyzed as individual fish or composites.

Composites were prepared from equal amounts of tissue from several similarly sized individual fish of a species. For composite samples, the total length of the smallest fish in a composite sample must be at least 75% of the length of the largest fish in the sample (US EPA, 2000a). All composite samples for Jenkinson Lake 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, either as individual fish or composite samples, using a direct mercury analyzer (DMA) or flow injection mercury system (FIMS) at the CDFW Moss Landing Marine Laboratories (MLML). The DMA method utilizes thermal decomposition and atomic absorption. OEHHA assumed all mercury detected was methylmercury; methylmercury 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<sup>6</sup> as well as mercury concentrations in each fish species. The DMA method detection limit (MDL)<sup>7</sup> and the reporting limit (RL)<sup>8</sup> for total mercury were both reported at 12-18 parts per billion (ppb).

## PBDES, PCBs, AND PESTICIDES

One composite sample of Rainbow Trout was analyzed for PCBs, legacy pesticides (chlordanes, DDTs and dieldrin), and PBDEs by gas chromatography at the CDFW Water Pollution Control Laboratory. For PCBs, PBDEs, chlordanes, and DDTs, 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,  $\leq 0.5$  and  $\leq 5$  ppb, respectively, individual congeners or metabolites with concentrations reported as non-detects were assumed to be zero. This is a standard

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<sup>5</sup> Congeners are related compounds with similar chemical forms. Of the 209 possible PCB congeners, 54-55 are generally reported.

<sup>6</sup> 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.

<sup>7</sup> The MDL is the lowest quantity of a chemical that can be distinguished (as greater than zero) in a sample.

<sup>8</sup> The RL is the lowest quantity of a chemical that can be accurately quantified in a sample.

method of handling non-detect values for PCBs and other chemicals with multiple congeners or metabolites in a given sample when detection levels are adequate (US EPA, 2000a). Concentrations of PCBs, chlordanes, DDTs, dieldrin, and PBDEs were not sufficiently high to alter consumption advice and are not shown.

TABLE 2. MERCURY CONCENTRATIONS IN FISH FROM JENKINSON LAKE

Species from Jenkinson Lake	Number of Samples	Total Number of Fish	Mean* Total Length (mm)	Range of Total Lengths** (mm)	Mercury (ppb)	
					Mean*	Range**
Black Bass Group***	10	10	397	307 - 508	227	109 - 633
Largemouth	9	9	396	307 - 508	182	109 - 251
Smallmouth	1	1	407	n/a	633	n/a
Sunfish Group***	9	9	193	135 - 282	63	43 - 92
Pumpkinseed	4	4	157	135 - 176	60	57 - 64
Redear	5	5	223	151 - 282	66	43 - 92
Rainbow Trout	13	21	282	234 - 376	31	27 - 40

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

\*\*Range of individuals and/or range of the composites.

\*\*\*Largemouth Bass and Smallmouth Bass were combined ("Black Bass Group") and Pumpkinseed and Redear Sunfish were combined ("Sunfish Group") for the purpose of developing consumption advice.

n/a = not applicable due to a single sample

## DEVELOPMENT OF GUIDELINES FOR EATING FISH FROM JENKINSON LAKE

The OEHHA fish advisory process considers the health benefits of fish consumption as well as the risk from exposure to the chemical contaminants found in fish. Benefits are included in the advisory process because there is considerable evidence and scientific consensus that fish should be part of a healthy, well-balanced diet. Fish contain many nutrients that are important for general health and, in particular, help promote optimal growth and development of babies and young children, and may reduce the incidence of heart disease in adults (FDA/US EPA, 2017; American Heart Association, 2014; OEHHA, 2008; Institute of Medicine, 2007; Kris-Etherton et al., 2002). Fish are a significant source of the specific omega-3 fatty acids, docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) thought to be associated with these beneficial health effects (USDA/USDHHS, 2015; Weaver et al., 2008).

The 2015-2020 U.S. Dietary Guidelines recommend that 1) the general population "consume eight or more ounces per week (less for young children)" of a variety of

seafood<sup>9</sup> “for the total package of nutrients that seafood provides, including its EPA and DHA content” and 2) “women who are pregnant or breastfeeding should consume at least eight and up to twelve ounces of a variety of seafood per week from choices that are lower in methylmercury” (USDA/USDHHS, 2015). The particular fish that people eat is an important factor in determining the net beneficial effects of fish consumption. For example, studies have shown that children of mothers who ate low-mercury fish during pregnancy scored better on cognitive tests compared to children of mothers who did not eat fish or ate high-mercury fish (Oken et al., 2005 and 2008). Accordingly, because of the high mercury content of certain fish species, the FDA and US EPA recommend that women who are pregnant (or might become pregnant) or breastfeeding, and young children avoid consuming shark, swordfish, tilefish (Gulf of Mexico), bigeye tuna, marlin, orange roughy, and king mackerel (FDA/US EPA, 2017).

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

There are two sets of ATLS for methylmercury in fish because of the age-related toxicity of this chemical (OEHHA, 2008). The fetus and children are more sensitive to the toxic effects of methylmercury. Thus, the ATLS for the sensitive population, including women who might become pregnant (typically 18 to 45 years of age) and children 1-17 years, are lower than those for women 46 years and older, and men 18 years and older. The lower ATL values for the sensitive population provide additional protection to allow for normal growth and development of the brain and nervous system of unborn babies and children. Detailed discussion about the toxicity of common fish contaminants and health benefits of fish consumption, as well as derivation of the ATLS, are provided in “Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, dieldrin, methylmercury, PCBs, selenium, and toxaphene” (OEHHA, 2008) and “Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Polybrominated Diphenyl Ethers (PBDEs)” (OEHHA, 2011). A list of the ATLS used in this report is presented in Appendix I.

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

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<sup>9</sup> “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).

Rainbow Trout were also analyzed for chlordanes, DDTs, PBDEs, PCBs, and dieldrin, and the mean concentrations of these chemicals were lower than the corresponding ATL threshold values for daily consumption (OEHHA, 2008). These chemicals were therefore not considered further for developing consumption advice.

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 Jenkinson Lake Advisory, the concentrations of chlordanes, DDTs, dieldrin, PBDEs, and PCBs were only measured in one composite of rainbow trout and were below the corresponding ATL values for daily consumption. Thus, the potential effect of multiple chemical exposures was not evaluated for this species. Advice for all species in this advisory was based on mercury concentrations.

OEHHA recommends that individuals strive to meet the US Dietary Guidelines seafood consumption recommendations, while also adhering to federal and OEHHA recommendations to limit the consumption of fish with higher contaminant levels. The advice discussed in the following section represents the maximum recommended number of servings per week for different fish species. People should eat no more than the recommended number of servings for each fish species or species group. OEHHA's advice on consuming a particular fish species can be extended to other closely related fish species<sup>10</sup> 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 JENKINSON LAKE

OEHHA's advisory protocol requires at least nine fish of a species or species group (e.g., sunfish) to be collected from a water body before an advisory can be developed

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<sup>10</sup> Fish species within the same genus are most closely related, and Family is the next level of relationship.

for the primary contaminant of concern. This is to ensure the sample dataset is representative of the population in the water body. For Jenkinson Lake, the sample size criterion was met for the following species: Black bass species (Largemouth and Smallmouth), Rainbow trout, and Sunfish species (Pumpkinseed and Redear Sunfish). There were not sufficient data to evaluate other species that may be found in these water bodies.

### BLACK BASS (LARGEMOUTH AND SMALLMOUTH)

The mean mercury concentration in black bass species, combined, from Jenkinson Lake was 227 ppb. The mercury levels in individual black bass species were 182 ppb (Largemouth Bass) and 633 ppb (Smallmouth Bass), respectively. OEHHA recommends a maximum of one serving a week of black bass species for the sensitive population (women 18 to 45 years and children 1 to 17 years), and a maximum of two servings a week for the general population (women 46 years and older, and men 18 years and older), based on an exposure to mercury.

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

### RAINBOW TROUT

The mean mercury concentration in Rainbow Trout from Jenkinson Lake was 31 ppb. OEHHA recommends a maximum of seven servings a week of Rainbow Trout for both the sensitive population (women 18 to 45 years and children 1 to 17 years) and the general population (women 46 years and older, and men 18 years and older), based on mercury.

### SUNFISH SPECIES (PUMPKINSEED AND REDEAR SUNFISH)

Small sunfish species, such as Pumpkinseed and Redear, generally have similar contaminant levels and are thus evaluated as a group. The mean mercury concentration in sunfish species, combined, from Jenkinson Lake was 63 ppb. The mean mercury concentrations in individual sunfish species were 60 ppb (Pumpkinseed) and 66 ppb (Redear Sunfish), respectively. OEHHA recommends a maximum of three servings a week of sunfish species 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.

**RECOMMENDED MAXIMUM NUMBER OF SERVINGS**

The recommended maximum numbers of servings per week for fish from the Jenkinson Lake is shown in Table 3.

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

<b>Fish Species</b>	<b>Women 18-45 years and Children 1-17 years</b>	<b>Women 46 years and older and Men 18 years and older</b>
Black Bass Species	1	2
Rainbow Trout	7	7
Sunfish Species	3	7

## REFERENCES

American Heart Association. 2014. Fish and Omega-3 Fatty Acids. Online at: <http://www.americanheart.org/presenter.jhtml?identifier=4632>.

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.

El Dorado Irrigation District. 2014. Watershed Sanitary Survey Update 2013: Jenkinson Lake and Middle Fork Cosumnes Watersheds. Online at: <http://www.eid.org/home/showdocument?id=4029>

FDA/USEPA. 2017. Eating Fish: What pregnant women and parents should know. Advice by FDA and USEPA/January, 2017. Online at: <http://www.fda.gov/downloads/Food/FoodborneIllnessContaminants/Metals/UCM537120.pdf>

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.

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.

OEHHA. 2005. General Protocol for Sport Fish Sampling and Analysis. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, California. Online at: <http://oehha.ca.gov/media/downloads/fish/document/fishsamplingprotocol2005.pdf>.

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 Diphenyls (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>

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.

SFEI. 2009. Fish Mercury Project. A collaborative effort of the San Francisco Estuary Institute, the University of California at Davis, the California Department of Fish and Game, the Moss Landing Marine Laboratory, the California Department of Health Services, and the California Protection Agency's Office of Environmental Health Hazard Assessment. Online at:  
<http://www.sfei.org/cmr/fishmercury/index.php#sthash.puWVjPvC.dpbs>.

Stienstra. 2012. California Fishing: The Complete Guide to Fishing on Lakes, Streams, Rivers, and the Coast. 9<sup>th</sup> Edition. Avalon Travel.

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](http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/lakes_study/lake_survey_yr2_no_app.pdf).

USDA/USDHHS. 2015. 2015-2020 Dietary Guidelines for Americans. 8<sup>th</sup> Edition. U.S. Government Printing Office, Washington, D.C. December. Online at:  
<http://health.gov/dietaryguidelines/2015/guidelines/>.

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. 3<sup>rd</sup> Ed. 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, 3<sup>rd</sup> Edition. EPA 823-B-00-007. Office of Water, U.S. Environmental Protection Agency, Washington, D.C.

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 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<sup>11</sup> 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 Jenkinson Lake are followed, exposure to chemicals in fish from Jenkinson Lake 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) <sup>a</sup> 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

<sup>a</sup> 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.

<sup>11</sup> 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.