OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

GOOD CATCH CALIFORNIA
Your Fish Advisor

Health Advisory and Guidelines for Eating Fish from Lake Almanor (Plumas County)

November 2017

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

ATL	Advisory Tissue Level
CDFW	California Department of Fish and Wildlife
DDT(s)	dichlorodiphenyltrichloroethane (DDT) and its metabolites dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE)
DHA	docosahexaenoic acid
DWR	Department of Water Resources
EPA	eicosapentaenoic acid
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
RWB5	Regional Water Board 5
RL	reporting limit
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 Lake Almanor in Plumas 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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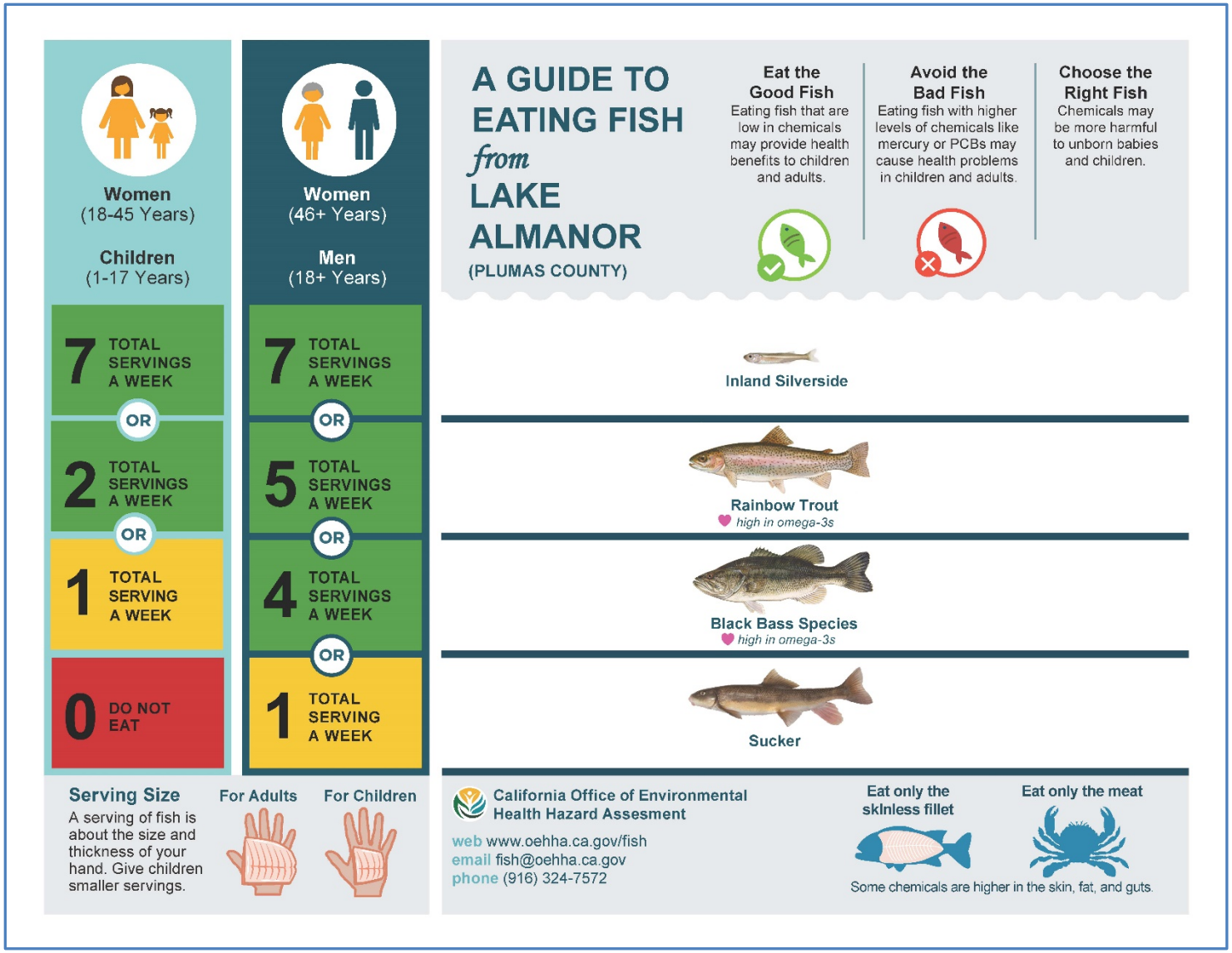
A GUIDE TO EATING FISH from LAKE ALMANOR
(PLUMAS COUNTY)
Eat the Good Fish
Eating fish that are low in chemicals may provide health benefits to children and adults.
Avoid the Bad Fish
Eating fish with higher levels of chemicals like mercury or PCBs may cause health problems in children and adults.
Choose the Right Fish
Chemicals may be more harmful to unborn babies and children.
Women (18-45 Years)
Children (1-17 Years)
7 TOTAL SERVINGS A WEEK
OR
2 TOTAL SERVINGS A WEEK
OR
1 TOTAL SERVING A WEEK
0 DO NOT EAT
Women (46+ Years)
Men (18+ Years)
7 TOTAL SERVINGS A WEEK
OR
5 TOTAL SERVINGS A WEEK
OR
4 TOTAL SERVINGS A WEEK
OR
1 TOTAL SERVING A WEEK
Inland Silverside
Rainbow Trout
high in omega-3s
Black Bass Species
high in omega-3s
Sucker
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 guidelines for eating fish from Lake Almanor (Figure 1) in Plumas County near the town of Chester.

LOCATION

Lake Almanor is formed by the Canyon Dam (also known as the Lake Almanor Dam) on the North Fork of the Feather River. The current dam that forms the lake was constructed in 1927 and provides a capacity of 1.3 million acre-feet. Lake Almanor is 13 miles long and 6 miles wide.[1]

FIGURE 1. LOCATION OF LAKE ALMANOR

[1] Information regarding Lake Almanor was obtained from Pacific Gas and Energy Currents. Online at: http://www.pgecurrents.com/2012/08/01/lake-almanor-offers-scenery-and-more-where-the-sierra-nevada-meet-the-cascades/

APPROACH USED

The Office of Environmental Health Hazard Assessment (OEHHA) used the results from four monitoring studies described in this report to develop the Lake Almanor 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, 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 Almanor used in advisory development were analyzed for mercury (as a measure of methylmercury). Smallmouth Bass from Lake Almanor were also analyzed for chlordanes, DDTs, dieldrin, PBDEs, and PCBs.

DATA SOURCES

The guidelines for eating fish from Lake Almanor are based on the chemicals detected in the fish collected for the four 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.

Department of Water Resources (DWR): Mercury Contamination in Fish from Northern California Lakes and Reservoirs

This study was conducted to provide an initial overview of mercury contamination in northern California lakes and reservoirs. DWR collected fish from 20 lakes and reservoirs in northern California during the spring and summer of 2000 and 2001 (DWR, 2007). Smallmouth Bass were collected in 2000 from Lake Almanor and analyzed for mercury.

Fish Mercury Project (FMP)

The FMP was a three-year (2005 to 2007) sampling program funded by CALFED[3] (SFEI, 2009). Monitoring of sport fish from Central Valley water bodies was planned and conducted by staff at the California Department of Fish and Wildlife (CDFW), OEHHA, the California Department of Public Health, the University of California, 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. Rainbow Trout, Sacramento Sucker, and Smallmouth Bass were collected in Lake Almanor and analyzed for total mercury.

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

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

[3] 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.

SURFACE WATER AMBIENT MONITORING PROGRAM (SWAMP): SURVEY OF MERCURY EXPOSURE AND RISK IN WILDLIFE IN CALIFORNIA LAKES AND RESERVOIRS, 2012

SWAMP conducted a bird, prey fish, and sport fish sampling survey at lakes and reservoirs throughout California to estimate mercury concentrations in birds and other wildlife based on mercury levels in fish at different trophic levels. Results of this study are intended to help risk managers understand mercury exposure for wildlife and develop Total Maximum Daily Loads for impaired water bodies. This program sampled Rainbow Trout and Inland Silverside from Lake Almanor in 2012.

FISH SAMPLED FROM LAKE ALMANOR

The fish sampling data used in this advisory was retrieved from the California Environmental Data Exchange Network (CEDEN). Samples were excluded that are 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 evaluated for this advisoryis 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 LAKE ALMANOR

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed
Inland Silverside	*Menidia beryllina*	10	10	SWAMP[a]	2012	Hg
Rainbow Trout	*Oncorhynchus mykiss*	13	13	FMP	2006	Hg
		10	10	SWAMP	2012	Hg
Sacramento Sucker	*Catostomus occidentalis*	5	5	FMP	2006	Hg
Smallmouth Bass	*Micropterus dolomieu*	2	6	DWR	2000	Hg
		6	6	FMP	2006	Hg
		34	34	SWAMP	2008	Hg
		1	18	SWAMP	2008	Chlordanes, DDTs, Dieldrin, PBDEs, PCBs, Se

[a] Samples were analyzed as whole organisms, including head, skin, internal organs, muscle, and bones.

CHEMICAL CONCENTRATIONS

As shown in Table 1, all samples were analyzed for total mercury, and smallmouth bass were further analyzed for chlordanes, DDTs, dieldrin, PBDEs, PCBs (54-55 congeners[4]), and selenium. Among the chemicals analyzed in fish tissue samples from Lake Almanor, 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 used in the analyses, except Inland Silverside, were prepared as skinless fillets. Inland Silverside are a small prey fish which are typically analyzed whole because of their small size. Samples were analyzed as individual fish or composites as indicated in Table 1.

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). All composite samples from this water body 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.

Samples were analyzed for total mercury, either as individual fish or composite samples. Two composite samples from the DWR study were analyzed by either cold vapor atomic absorption spectroscopy or inductively coupled plasma mass spectrometry (DWR, 2007). All other samples were analyzed with a Direct Mercury Analyzer. The DMA method is an integration of 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[5] as well as mercury concentrations in each fish species. The DMA method detection limit (MDL)[6] and the reporting limit (RL)[7] for total mercury were reported at 12 and 12 or 36 parts per billion (ppb), respectively. The MDL and RL was not reported for the methods employed in the DWR study.

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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.

TABLE 2. MERCURY CONCENTRATIONS IN FISH FROM LAKE ALMANOR

Species	Number of Samples	Total Number of Fish	Total Length (mm)		Mercury (ppb)	
			Mean*	Range**	Mean	Range
Inland Silverside	10	10	47	34-53	18	12-26
Rainbow Trout	23	23	448	257-526	113	45-485
Sacramento Sucker	5	5	565	516-604	825	114-1230
Smallmouth Bass	42	46	301	204-443	158	45-817

*Means are an arithmetic average of individual values and/or a weighted average of composites.
**Range of individuals and/or range of the composites.

DEVELOPMENT OF GUIDELINES FOR EATING FISH FROM LAKE ALMANOR

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[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 US Food and Drug

[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).

Administration (FDA) and 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).

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 concentration detected in the fillet to the corresponding ATL 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 Lake Almanor, the concentrations of chlordanes, DDTs, dieldrin, PBDEs, PCBs, and selenium were below the corresponding ATL values for daily consumption. Thus, the

potential effect of multiple chemical exposures was not assessed. 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 advice on consuming 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 ALMANOR

OEHHA's advisory protocol requires at least nine fish of a species to be collected from a water body before an advisory can be developed for the primary contaminant of concern. This is to ensure the sample dataset is representative of the fish species population in the water body. In some cases, an exception is made for species that are commonly caught and consumed from a given water body but where available data may be limited. Advice for Sacramento Sucker (n=5) was provided for Lake Almanor, despite the relatively small sample size, because of the high level of mercury detected in this species. The sample size criterion was met for Rainbow Trout, Inland Silverside, and Smallmouth Bass in Lake Almanor. There were not sufficient data to evaluate other species that may be found in this water body.

BLACK BASS SPECIES (SMALLMOUTH BASS)

The mean mercury level in Smallmouth Bass from Lake Almanor was 158 ppb. OEHHA recommends a maximum of one serving a week of black bass species for the sensitive population (women 18 to 45 years and children 1 to 17 years) and a maximum of four servings a week for the general population (women 46 years and older, and men 18 years and older), based on mercury.

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

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

Inland Silverside

The mean mercury level in Inland Silverside from Lake Almanor was 18 ppb. OEHHA recommends a maximum of seven servings a week of Inland Silverside for 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.

Rainbow Trout

The mean mercury in Rainbow Trout[10] from Lake Almanor was 113 ppb. OEHHA recommends a maximum of two servings a week of Rainbow Trout for the sensitive population (women 18 to 45 years and children 1 to 17 years) and a maximum of five servings a week for the general population (women 46 years and older, and men 18 years and older), based on mercury.

Sacramento Sucker

The mean mercury level in Sacramento Sucker from Lake Almanor was 825 ppb. OEHHA recommends no consumption of Sacramento Sucker 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.

[10] CDFW regulations state, “a steelhead trout is defined as any rainbow trout greater than 16 inches in length found in anadromous waters.” Lake Almanor is not an anadramous water body; therefore, advice for these species is combined.

RECOMMENDED MAXIMUM NUMBER OF SERVINGS

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

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

Fish Species	Women 18-45 years and Children 1-17 years	Women 46 years and older and Men 18 years and older
Black Bass Species	1	4
Inland Silverside	7	7
Rainbow Trout	2	5
Sacramento Sucker	0	1

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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[11] 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 Almanor are followed, exposure to chemicals in fish from this 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 18-45 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.

[11] 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.