OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

GOOD CATCH CALIFORNIA
Your Fish Advisor

Health Advisory and Guidelines for Eating Fish from Squaw Lake (Imperial County)

February 2019

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
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
PCBs	polychlorinated biphenyls
ppb	parts per billion
RL	reporting limit
RWB7	Regional Water Board 7 (Colorado River)
Se	selenium
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 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 Squaw Lake in Imperial 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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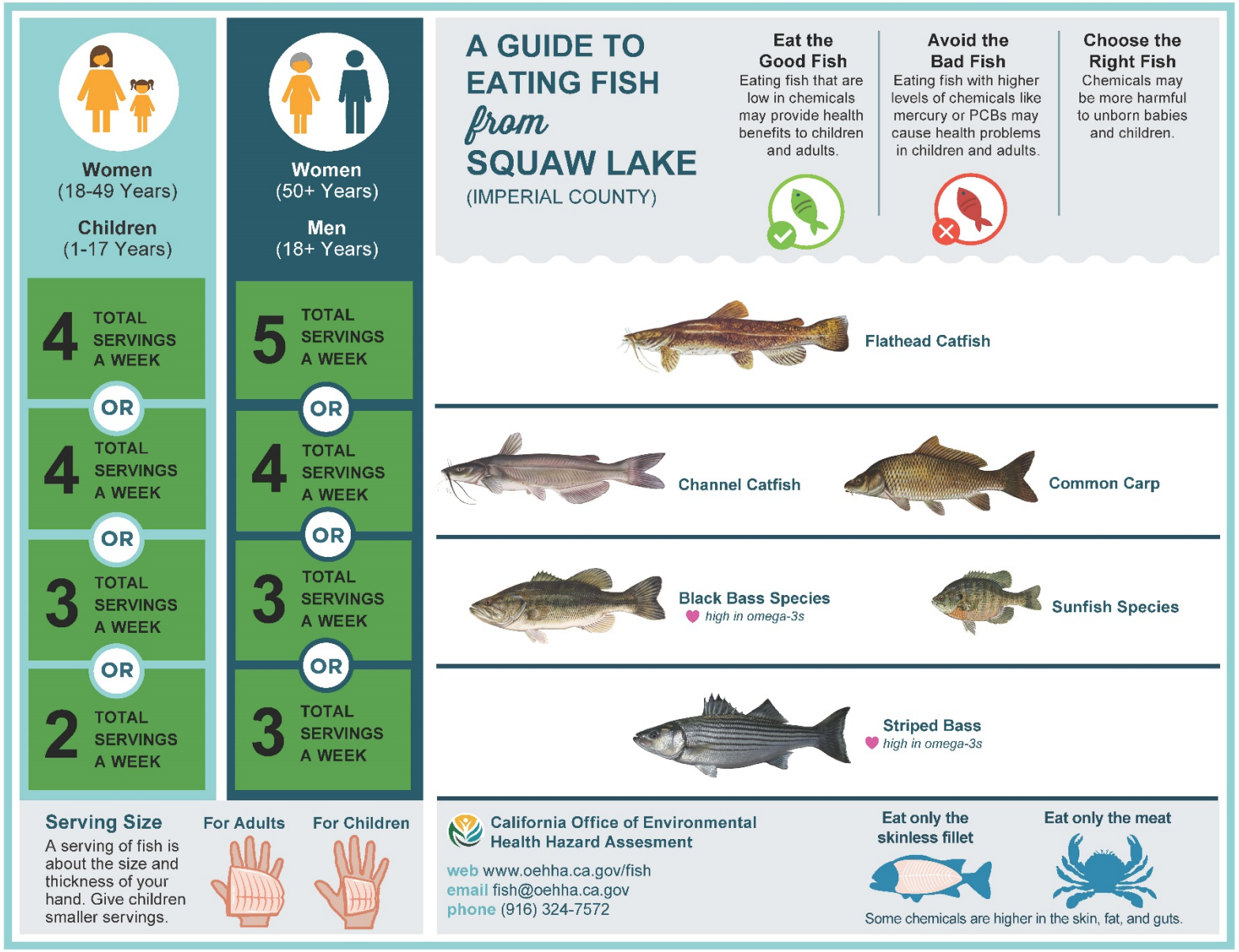

Women (18-49 Years)
Children (1-17 Years)
4 TOTAL SERVINGS A WEEK
OR
4 TOTAL SERVINGS A WEEK
OR
3 TOTAL SERVINGS A WEEK
OR
2 TOTAL SERVINGS A WEEK
Women (50+ Years)
Men (18+ Years)
5 TOTAL SERVINGS A WEEK
OR
4 TOTAL SERVINGS A WEEK
OR
3 TOTAL SERVINGS A WEEK
OR
3 TOTAL SERVINGS A WEEK
A GUIDE TO EATING FISH from SQUAW LAKE
(IMPERIAL 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.
Flathead Catfish
Channel Catfish
Common Carp
Black Bass Species
high in omega-3s
Sunfish Species
Striped Bass
high in omega-3s
Serving Size
A serving of fish is about the size and thickness of your hand. Give children smaller servings.
For Adults
For Children
California Office of Environmental Health Hazard 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.

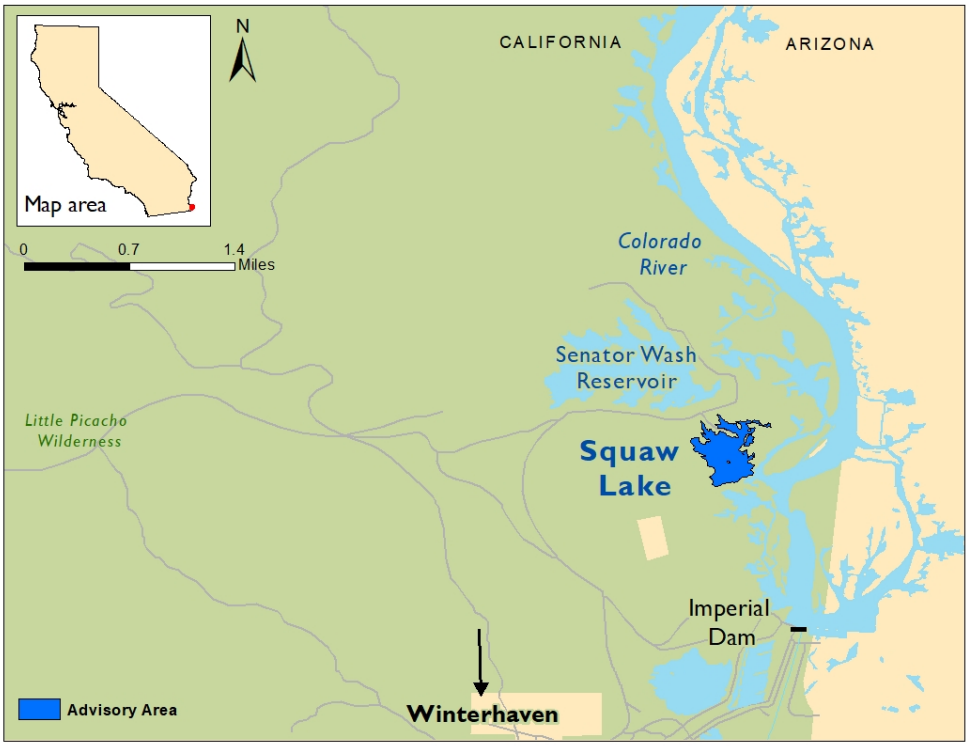
INTRODUCTION

This report presents guidelines for eating fish from Squaw Lake (Figure 1) in the southeast corner of Imperial County, near Winterhaven, CA.

LOCATION

Squaw Lake is adjacent to the Colorado River just north of the Imperial Dam, and is under the jurisdiction of the U.S. Bureau of Land Management.[1]

FIGURE 1. LOCATION OF SQUAW LAKE



[1] Information regarding Squaw Lake was obtained from the California State Parks Division of Boating and Waterways. Online at: http://www.dbw.ca.gov/BoatingFacilities/Details/1213.

APPROACH USED

The Office of Environmental Health Hazard Assessment (OEHHA) used the results from two monitoring studies described in this report to develop the Squaw 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[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.

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).

All fish species collected from Squaw Lake and used in advisory development were analyzed for mercury (as a measure of methylmercury) and selenium. Channel Catfish, Common Carp, Flathead Catfish, and Striped Bass were also analyzed for PCBs and the legacy pesticides chlordanes (cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane), DDTs (DDT and its metabolites dichlorodiphenyldichloroethane [DDD] and dichlorodiphenyldichloroethylene [DDE]), and dieldrin. Flathead Catfish and Striped Bass were further analyzed for toxaphene. Fish species that do not normally accumulate PCBs or other organic chemicals may not be analyzed for those contaminants in a particular monitoring study.

DATA SOURCES

The guidelines for eating fish from Squaw 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 a composite of multiple fish for which contaminant data were reported. "Sampling" or "sampled" refers to the act of collecting fish for chemical analysis.

Surface Water Ambient Monitoring Program, Sportfish Contamination in Lakes and Reservoirs (SWAMP)

The Surface Water Ambient Monitoring Program (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.[3] As part of a SWAMP statewide sampling effort to survey contaminants in sport fish found in California lakes and reservoirs, the program collected Bluegill, Channel Catfish, Common Carp, Flathead Catfish, Largemouth Bass, and Redear Sunfish from Squaw Lake in 2016 to analyze mercury and selenium (with the exception of Largemouth Bass, which was not analyzed for selenium).

Colorado River Regional Water Quality Control Board (RWB7), Monitoring Study

The Region 7 Water Board (RWB7)[4] staff, in cooperation with the SWRCB, monitors water quality in California's surface waters. In 2014, the program performed regional monitoring surveys of Squaw Lake to evaluate contaminants in commonly consumed sport fish and to collect information about contamination in the greater aquatic food web. The surveys collected Bluegill, Channel Catfish, Common Carp, Flathead Catfish, Largemouth Bass, Redear Sunfish, and Striped Bass from Squaw Lake. Fish samples were analyzed for one or more of the following contaminants: mercury, chlordanes, DDTs, dieldrin, PCBs, selenium, and toxaphene.

FISH SAMPLED FROM SQUAW LAKE

The fish sampling data used in this advisory were retrieved from 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). 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.

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[3] Information on the Surface Water Ambient Monitoring Program can be found online at: https://www.waterboards.ca.gov/water_issues/programs/swamp/.

[4] Information on the Colorado River Regional Water Quality Control Board can be found online at: https://www.waterboards.ca.gov/coloradoriver/.

TABLE 1. FISH SAMPLES EVALUATED FOR THE SQUAW LAKE ADVISORY

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed
Bluegill	*Lepomis macrochirus*	1	5	RWB7	2014	Hg, Se
		2	10	SWAMP	2016	Hg, Se
Channel Catfish	*Ictalurus punctatus*	1	2	RWB7	2014	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se
		2	10	SWAMP	2016	Hg, Se
Common Carp	*Cyprinus carpio*	1	5	RWB7	2014	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se
		1	5	SWAMP	2016	Hg, Se
Flathead Catfish	*Pylodictis olivaris*	1	5	RWB7	2014	Chlordanes, DDTs, Dieldrin, Hg, PCBs, Se, Toxaphene
		1	4	SWAMP	2016	Hg, Se
Largemouth Bass	*Micropterus salmoides*	8	8	RWB7	2014	Hg
		1	5	RWB7	2014	Se
		6	6	SWAMP	2016	Hg
Redear Sunfish	*Lepomis microlophus*	1	5	RWB7	2014	Hg, Se
		2	10	SWAMP	2016	Hg, Se
Striped Bass	*Morone saxatilis*	1	5	RWB7	2014	Chlordanes, DDTs, Dieldrin, PCBs, Toxaphene
		10	10	RWB7	2014	Hg, Se

CHEMICAL CONCENTRATIONS

As shown in Table 1, samples were analyzed for one or more of the following: total mercury, selenium, chlordanes, DDTs, dieldrin, PCBs (50 congeners[5]), and toxaphene. Among the chemicals analyzed in fish tissue samples from Squaw Lake, mercury, PCB and selenium levels were sufficiently high to impact consumption advice. All fish

[5] Congeners are related compounds with similar chemical forms. Of the 209 possible PCB congeners, 54-55 are generally reported.

samples were prepared as skinless fillets, and samples were analyzed as individual fish or composites.

For this advisory, OEHHA used the weighted (by the number of individual fish) 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[6], as well as mercury concentrations in each fish species. The DMA method detection limit (MDL)[7] and the reporting limit (RL)[8] for total mercury were reported at 4 and 12 parts per billion (ppb), respectively.

PCBs and Pesticides

Some composite samples were analyzed for PCBs, and the legacy pesticides (chlordanes, DDTs, dieldrin, and toxaphene). Pesticides and PCBs were analyzed by gas chromatography at the CDFW Water Pollution Control Laboratory. For chlordanes, DDTs, and PCBs, 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 (≤ 5 ppb), individual congeners or metabolites with concentrations reported as non-detects were assumed to be zero. This is a standard method of handling non-detect values for PCBs and other chemicals with multiple congeners or metabolites in a given sample when detection levels are adequate (US EPA, 2000a).

Selenium

The CDFW MLML analyzed species collected from Squaw Lake 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 MDL and the RL for total selenium were reported at 150 and 400 ppb, respectively.

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[6] 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.
[7] The MDL is the lowest quantity of a chemical that can be distinguished (as greater than zero) in a sample.
[8] The RL is the lowest quantity of a chemical that can be accurately quantified in a sample.

Concentrations of chlordanes, dieldrin, DDTs, and toxaphene were lower than the corresponding ATL threshold values for daily consumption (OEHHA, 2008 and 2011). These chemicals were therefore not considered further for developing consumption advice and are not shown in this report.

TABLE 2. MERCURY, PCB, AND SELENIUM CONCENTRATIONS IN FISH FROM SQUAW LAKE

Species from Squaw Lake	Number of Samples	Total Number of Fish	Mean* Total Length (mm)	Range of Total Lengths** (mm)	Mercury (ppb)	
					Mean*	Range**
Channel Catfish	3	12	475	355 - 585	55	31 - 70
Common Carp	2	10	572	483 - 622	12	10 - 13
Flathead Catfish	2	9	492	413 - 635	46	42 - 49
Largemouth Bass	14	14	406	331 - 530	65	20 - 182
Striped Bass	10	10	434	391 - 555	95	51 - 120
Sunfish Species	6	30	211	157 - 285	34	22 - 55
Bluegill	3	15	185	157 - 204	38	24 - 55
Redear Sunfish	3	15	237	198 - 285	29	22 - 44
					PCBs (ppb)	
Channel Catfish	1	2	437	383 - 490	14	n/a
Common Carp	1	5	578	567 - 603	2	n/a
Flathead Catfish	1	5	532	430 - 635	0	n/a
Striped Bass	1	5	414	391 - 464	0	n/a
					Selenium (ppb)	
Channel Catfish	3	12	475	355 - 585	749	640 - 1020
Common Carp	2	10	572	483 - 622	1540	1470 - 1610
Flathead Catfish	2	9	492	413 - 635	1213	1120 - 1330
Largemouth Bass	1	5	367	335 - 399	2280	n/a
Striped Bass	10	10	434	391 - 555	2047	1460 - 2510
Sunfish Species	6	30	211	157 - 285	1810	1430 - 2310
Bluegill	3	15	185	157 - 204	1790	1430 - 2310
Redear Sunfish	3	15	237	198 - 285	1830	1610 - 2010

*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 SQUAW 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, 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[9] "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 Administration (FDA) and the US Environmental Protection Agency (US EPA) recommend that women who are pregnant (or might become pregnant) or breastfeeding, and young children avoid consuming shark, swordfish, tilefish (Gulf of Mexico), bigeye tuna, marlin, orange roughy, and king mackerel (FDA/US EPA, 2017).

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

[9] "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).

effects of methylmercury. Thus, the ATLs for the sensitive population, including women who might become pregnant (typically 18 to 49 years of age) and children 1-17 years, are lower than those for women 50 years and older, and men 18 years and older. The lower ATL values for the sensitive population provide additional protection to allow for normal growth and development of the brain and nervous system of unborn babies and children. Detailed discussion about the toxicity of common fish contaminants and health benefits of fish consumption, as well as derivation of the ATLs, are provided in "Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, dieldrin, methylmercury, PCBs, selenium, and toxaphene" (OEHHA, 2008). 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 chemical 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). A serving size is considered to be 8 ounces, prior to cooking, or about the size and thickness of a hand for fish fillets. Children should be given smaller servings. For smaller fish species, several individuals may be required to yield a serving.

The consumption advice for a fish species is initially based on the chemical with the lowest allowable number of servings per week. Because some chemicals, such as mercury and PCBs, are known to have similar adverse effects, additivity of toxicity is assumed in such cases and may be assessed using multiple chemical exposure methodology (US EPA, 1989 and 2000b). If two or more chemicals with similar adverse effects are present in fish tissue 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. The potential effect of multiple chemical exposures (mercury and PCBs) was assessed in Channel Catfish and did not affect advice for this species. Because selenium has a different health endpoint than mercury and PCBs, it was excluded from the multiple chemical exposure analysis. Advice for all species in this advisory was based solely on mercury, PCBs, or selenium 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[10] known to accumulate similar levels of contaminants.

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

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 SQUAW LAKE

OEHHA’s advisory protocol requires that a minimum of nine edible-size fish of a species that may be legally caught are collected and analyzed from small- and medium-sized lakes and reservoirs before an advisory can be developed. Additional samples beyond this number will increase confidence that the sample dataset is representative of the fish species population in the water body (OEHHA, 2005). The majority of fish consumption advisories in California are based on mercury, which is typically analyzed in individual fish, rather than as composites. Mercury analysis is relatively inexpensive and mercury concentrations in fish are more likely to be positively correlated with fish size than other contaminants. Thus, individual analysis allows for advice to be based on fish size, when appropriate. Other contaminants, such as PCBs, pesticides, and selenium, may also impact advice. These contaminants are often analyzed as a composite of a smaller subset of fish (usually at least five individuals) as a cost-saving mechanism, a common practice that is considered acceptable. In some cases, an exception is made regarding the minimum sample size. This is particularly true if the advice is based on a chemical other than mercury where sample size is often limited, and/or if doing so leads to more health-protective advice than would otherwise be provided.

For Squaw Lake, the sample size criterion was met for mercury for all species. However, in several cases, the advice for a fish species was based on selenium or PCBs and fewer than nine fish were analyzed for that species. For example, only two Channel Catfish were analyzed for PCBs. Although this is much fewer than the preferred number of samples, the data were included because they reduced the number of recommended servings per week for this species for the general population from seven to four meals per week compared to the advice based on mercury or selenium and were thus more health protective. There were not sufficient data to evaluate other species that may be found in this water body.

BLACK BASS SPECIES (LARGEMOUTH BASS)

The mean mercury and selenium concentrations in Largemouth Bass from Squaw Lake were 65 and 2280 ppb, respectively. OEHHA recommends a maximum of three servings a week of black bass species from Squaw Lake for the sensitive population (women 18 to 49 years and children 1 to 17 years) based on mercury or selenium, and a maximum of three servings a week for the general population (women 50 years and older, and men 18 years and older), based on selenium.

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. Similar analyses have been performed on selenium levels in black bass species for a limited number of water bodies and concentrations were comparable between species. Therefore, OEHHA extends the consumption advice for Largemouth Bass to other black bass species, including Redeye, Smallmouth, and Spotted Bass.

CHANNEL CATFISH

The mean mercury, PCB, and selenium concentrations in Channel Catfish from Squaw Lake were 55, 14, and 749 ppb, respectively. OEHHA recommends a maximum of four servings a week of Channel Catfish for the sensitive population (women 18 to 49 years and children 1 to 17 years) based on mercury or PCBs, and a maximum of four servings a week for the general population (women 50 years and older, and men 18 years and older), based on PCBs. Selenium did not impact advice.

COMMON CARP

The mean mercury, PCB, and selenium concentrations in Common Carp from Squaw Lake were 12, 2, and 1540 ppb, respectively. Based on selenium concentrations, OEHHA recommends a maximum of four servings a week of Common Carp for both the sensitive population (women 18 to 49 years and children 1 to 17 years) and the general population (women 50 years and older, and men 18 years and older). Mercury and PCBs did not impact advice.

FLATHEAD CATFISH

The mean mercury, PCBs, and selenium concentrations in Flathead Catfish from Squaw Lake were 46, 0, and 1213 ppb, respectively. OEHHA recommends a maximum of four servings a week of Flathead Catfish for the sensitive population (women 18 to 49 years and children 1 to 17 years), based on mercury, and a maximum of five servings a week for the general population (women 50 years and older, and men 18 years and older), based on selenium. PCBs did not impact advice.

SUNFISH SPECIES (BLUEGILL, REDEAR SUNFISH)

The mean mercury and selenium concentrations in sunfish species from Squaw Lake were 34 ppb and 1810 ppb, respectively. Mercury and selenium concentrations for individual sunfish species were as follows, Bluegill (Hg: 38 ppb, Se: 1790 ppb) and Redear Sunfish (Hg: 29, Se: 1830 ppb). Based on the concentration of selenium in these sunfish species, OEHHA recommends a maximum of three servings a week of sunfish species for both the sensitive population (women 18 to 49 years and children 1 to 17 years) and the general population (women 50 years and older, and men 18 years and older).

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

Striped Bass

The mean mercury, PCBs, and selenium concentrations in Striped Bass from Squaw Lake were 95, 0, and 2047 ppb, respectively. OEHHA recommends a maximum of two servings a week of Striped Bass for the sensitive population (women 18 to 49 years and children 1 to 17 years), based on mercury, and a maximum of three servings a week for the general population (women 50 years and older, and men 18 years and older), based on selenium. PCBs did not impact advice.

RECOMMENDED MAXIMUM NUMBER OF SERVINGS

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

Table 3. Recommended Maximum Number of Servings per Week for Fish from Squaw Lake

Fish Species from Squaw Lake	Women 18–49 years and Children 1-17 years	Women 50 years and older and Men 18 years and older
Black Bass Species	3	3
Channel Catfish	4	4
Common Carp	4	4
Flathead Catfish	4	5
Sunfish Species	3	3
Striped Bass	2	3

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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 Squaw Lake are followed, exposure to chemicals in fish from Squaw 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)[a] and ATLs (in ppb)							
	7	6	5	4	3	2	1	0
Chlordanes	≤ 80	>80-90	>90-110	>110-140	>140-190	>190-280	>280-560	>560
DDTs	≤ 220	>220-260	>260-310	>310-390	>390-520	>520-1,000	>1,000-2,100	>2,100
Dieldrin	≤ 7	>7-8	>8-9	>9-11	>11-15	>15-23	>23-46	>46
MeHg (Women 18-49 and children 1-17)	≤ 31	>31-36	>36-44	>44-55	>55-70	>70-150	>150-440	>440
MeHg (Women > 49 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.