OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

GOOD CATCH CALIFORNIA
Your Fish Advisor

Health Advisory and Guidelines for Eating Fish from New Bullards Bar Reservoir (Yuba County)

July 2017

Fish, Ecotoxicology, and Water Section
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ACKNOWLEDGMENTS

Developing fish consumption advisories depends on sampling and analysis of fish. The Office of Environmental Health Hazard Assessment (OEHHA) acknowledges the contribution of information from the following entities: the State Water Resources Control Board (SWRCB), the Yuba County Water Agency, the California Department of Fish and Wildlife and its analytical resources, the Moss Landing Marine Laboratories, and the Water Pollution Control Laboratory. Data were obtained from the California Environmental Data Exchange Network (http://www.ceden.us/AdvancedQueryTool) and the Yuba County Water Agency Technical Memorandum 2-4 Report (YCWA, 2012). The map was created using ArcMap (10.3) from Environmental Systems Resource Institute (ESRI, Redlands, California).

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LIST OF ACRONYMS AND ABBREVIATIONS

ATL	Advisory Tissue Level
CDFW	California Department of Fish and Wildlife
cfs	cubic feet per second
DDT(s)	dichlorodiphenyltrichloroethane (DDT) and its metabolites dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE)
DHA	docosahexanoic acid
EPA	eicosapentaenoic acid
FDA	Food and Drug Administration
FERC	Federal Energy Regulatory Commission
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
Se	selenium
SWAMP	Surface Water Ambient Monitoring Program

TSMP	Toxic Substances Monitoring Program
USDA	United States Department of Agriculture
USDHHS	United States Department of Health and Human Services
US EPA	United States Environmental Protection Agency
YCWA	Yuba County Water 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 New Bullards Bar Reservoir in Yuba 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 New Bullards Bar Reservoir

Women 18 - 45 years and Children 1 - 17 years

Kokanee Salmon

Sunfish species

Rainbow Trout

Black Bass species

Carp

2 total servings a week | **Do not eat**

Women 46 years and older and Men 18 years and older

Kokanee Salmon

Sunfish species

Rainbow Trout

Black Bass species

Carp

5 total servings a week of Kokanee Salmon or sunfish species or 6 total servings a week of Rainbow Trout OR **1 total serving a week**

What is a serving?

For Adults **For Children**

A serving is about the size and thickness of your hand for fish fillets. Give children smaller servings.

Why eat fish?

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.

= Fish high in omega-3s

What is the concern?

Some fish have high levels of mercury. Mercury can harm the brain, especially in unborn babies and children.

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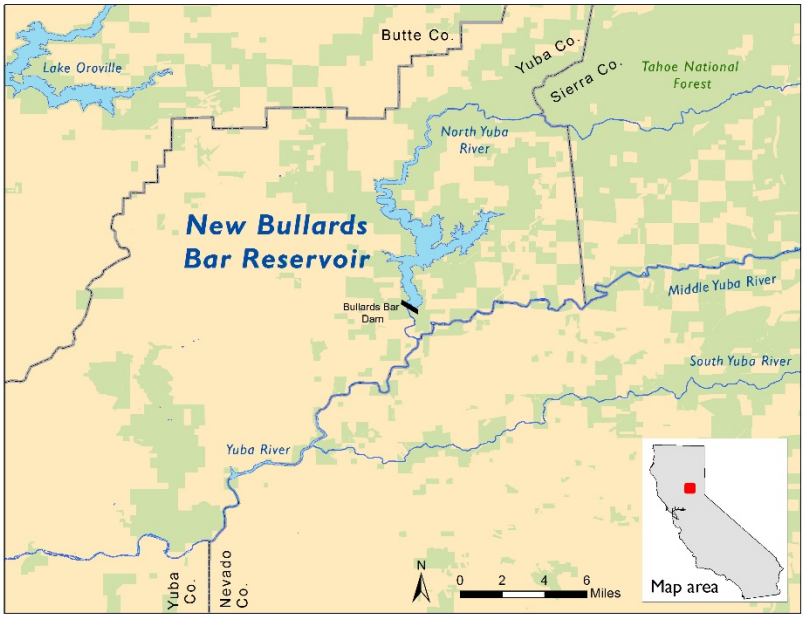
INTRODUCTION

This report presents guidelines for eating fish from New Bullards Bar Reservoir (Figure 1) in Yuba County, California. New Bullards Bar Reservoir is located about 30 miles northeast of Yuba City, CA.

LOCATION

New Bullards Bar Reservoir is a reservoir operated by the Yuba County Water Agency. Completed in 1970, the New Bullards Bar Dam is a concrete arch dam on the North Yuba River in the Tahoe National Forest. The reservoir has a usable capacity of more than 933,000 acre-feet and serves as a source of hydroelectric power via the Fish Release and New Colgate powerhouses, and contributes to flood control, irrigation and recreational activities in the greater Yuba River watershed.[1,2]

FIGURE 1. LOCATION OF NEW BULLARDS BAR RESERVOIR



[1] Yuba City Water Agency Relicensing Website: Yuba River Development Project FERC No. 2246. Available at: http://www.ycwa-relicensing.com/default.aspx and http://www.ycwa-relicensing.com/Project%20Maps%20Schematics%20and%20Fact%20Sheets/YCWA%20Relicensing%20Fact%20Sheet%20and%20Flow%20Schematic.pdf.

[2] State Water Resources Control Board: FERC Project 2246, Yuba River Development Project. Available online at: http://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/yubariver_ferc2246.shtml.

APPROACH USED

The Office of Environmental Health Hazard Assessment (OEHHA) used the results from four monitoring studies described in this report to develop the New Bullards Bar Reservoir 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[3]) 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

[3] 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.

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). A list of the ATLs used in this report is presented in Appendix I.

All fish species collected from New Bullards Bar Reservoir and used in the development of this advisory were analyzed for mercury (as a measure of methylmercury). Kokanee Salmon, Rainbow Trout and Smallmouth Bass collected for the YCWA study (see next page) were also analyzed for selenium. Additionally, one composite of Largemouth Bass was analyzed for PCBs, PBDEs, selenium, 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. Mercury was the only contaminant with sufficient levels to affect consumption levels of all species from New Bullards Bar Reservoir; data for other contaminants are not shown in this report.

DATA SOURCES

The guidelines for eating fish from New Bullards Bar Reservoir 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 composite of multiple fish for which contaminant data were 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[4] (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, California Department of Public Health, 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. Fish samples were collected from 146 popular sport fishing locations in the Delta watershed. Bluegill, Common Carp, Largemouth Bass, and Smallmouth Bass were collected from New Bullards Bar Reservoir in 2006; fillets were analyzed for total mercury.

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

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. The program collected Largemouth Bass from New Bullards Bar Reservoir in 2008 and analyzed them for mercury, chlordanes, DDTs, dieldrin, 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).

[4] 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.

Toxic Substances Monitoring Program (TSMP)

The TSMP (1976-2003) was a state water quality-monitoring program managed by SWRCB (SWRCB, 2013). Its objective was to provide statewide information on the occurrence of toxic substances by monitoring water bodies with known or suspected water quality impairment. CDFW, then known as the California Department of Fish and Game, collected Common Carp (1990) from New Bullards Bar Reservoir, as part of the program. All fish samples were analyzed for mercury.

Yuba County Water Agency (YCWA) Yuba River Development Project Federal Energy Regulatory Commission (FERC) Project No. 2246

The YCWA manages the New Bullards Bar Reservoir, which serves as both a major hydroelectric energy source and popular recreational site in Yuba County. YCWA designed and conducted a fish tissue sampling study as part of their water quality management program to accomplish two objectives: 1) to determine mercury and other chemical concentrations in sportfish caught in this reservoir, and 2) generate adequate data to develop safe eating guidelines. YCWA staff collected Kokanee Salmon, Rainbow Trout and Smallmouth Bass in 2011 from New Bullards Bar Reservoir (YCWA, 2012). Fish samples were analyzed for mercury and selenium.

FISH SAMPLED FROM NEW BULLARDS BAR RESERVOIR

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, and from the YCWA Bioaccumulation Technical Memorandum (YCWA, 2012). 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, number of samples collected, total number of fish, project name, year sampled, and contaminants analyzed.

TABLE 1. FISH SAMPLES EVALUATED FOR NEW BULLARDS BAR RESERVOIR

Common Name	Scientific Name	Number of Samples	Total Number of Fish	Project	Year Collected	Contaminants Analyzed
Black Bass species						
Largemouth Bass	*Micropterus salmoides*	1	1	FMP	2006	Hg
		18	18	SWAMP	2008	Hg
		1	15	SWAMP	2008	chlordanes, DDTs, dieldrin, PBDEs, PCBs, Se
Smallmouth Bass	*Micropterus dolomieu*	12	12	FMP	2006	Hg
		9	9	YCWA	2011	Hg, Se
Carp						
Common Carp	*Cyprinus carpio*	1[a]	6	TSMP[a]	1990	Hg
		11	11	FMP	2006	Hg
Kokanee Salmon						
Kokanee Salmon	*Oncorhynchus nerka*	10	10	YCWA	2011	Hg, Se
Rainbow Trout						
Rainbow Trout	*Oncorhynchus mykiss*	10	10	YCWA	2011	Hg, Se
Sunfish species						
Bluegill	*Lepomis macrochirus*	10	10	FMP	2006	Hg

Hg = Mercury
DDTs = dichlorodiphenyltrichloroethane (DDT) and its metabolites
dichlorodiphenyldichloroethane (DDD)
dichlorodiphenyldichloroethylene (DDE)
PBDEs = polybrominated diphenyl ethers
PCBs = polychlorinated biphenyls
Se = Selenium
[a]Study report did not specify whether skin was removed from fillets prior to tissue analysis.

CHEMICAL CONCENTRATIONS

As shown in Table 1, all samples were analyzed for total mercury. Largemouth Bass were also analyzed for PCBs (54-55 congeners[5]), chlordanes, DDTs, dieldrin, PBDEs, and selenium. Smallmouth bass, Kokanee Salmon, and Rainbow trout were also analyzed for selenium. All fish samples were prepared as skinless fillets, except for the TSMP study where the fillet preparation method for Common Carp was not recorded. 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 New Bullards Bar Reservoir 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 all 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[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 both reported at 12 parts per billion (ppb).

PBDES, PCBS, AND PESTICIDES

One composite sample of Largemouth Bass 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

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

low, ≤ 0.5 and ≤ 5 ppb, respectively, 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). Concentrations of PCBs, chlordanes, DDTs, dieldrin, and PBDEs were not sufficiently high to alter consumption advice and are not shown.

SELENIUM

The CDFW MLML analyzed the SWAMP 2008 (Largemouth Bass) and YCWA 2011 (Kokanee Salmon, Rainbow Trout, Smallmouth Bass) samples collected from New Bullards Bar Reservoir for selenium, 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 RL for total selenium were reported at 150 and 400 ppb, respectively. The selenium concentrations were not sufficiently high to alter consumption advice and are not shown.

TABLE 2. MERCURY CONCENTRATIONS IN FISH FROM NEW BULLARDS BAR RESERVOIR

Species from New Bullards Bar	Number of Samples	Total Number of Fish	Mean* Total Length (mm)	Range of Total Lengths** (mm)	Mercury (ppb)	
					Mean*	Range**
Black Bass species***	40	40	333	305 – 490	468	145 – 807
Largemouth	19	19	338	305 – 490	357	145 – 608
Smallmouth	21	21	328	305 – 370	569	421 – 807
Bluegill	10	10	141	128 – 152	115	85 – 165
Common Carp	12	17	446	405 – 572	554	340 – 832
Kokanee Salmon	10	10	267	252 – 298	112	75 – 167
Rainbow Trout	10	10	307	282 – 339	105	68 – 143

*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 species") for the purpose of developing consumption advice.

DEVELOPMENT OF GUIDELINES FOR EATING FISH FROM NEW BULLARDS BAR RESERVOIR

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 US 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 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

[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).

normal growth and development of the brain and nervous system of unborn babies and children.

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).

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 New Bullards Bar Reservoir, the concentrations of chlordanes, DDTs, dieldrin, PBDEs, and PCBs were only measured in one composite of Largemouth Bass 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[10] 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.

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

CONSUMPTION ADVICE FOR FISH FROM NEW BULLARDS BAR RESERVOIR

OEHHA's advisory protocol requires at least nine fish of a species or species group (e.g., black bass 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 population in the water body. For New Bullards Bar Reservoir, the sample size criterion was met for the following species: Largemouth Bass, Smallmouth Bass), Bluegill, Common Carp, Kokanee Salmon, and Rainbow Trout. There were not sufficient data to evaluate other species that may be found in this water body.

BLACK BASS (LARGEMOUTH AND SMALLMOUTH)

The mean mercury concentration in black bass species, combined, from New Bullards Bar Reservoir was 468 ppb. The mercury levels in individual black bass species were 357 ppb (Largemouth Bass) and 569 ppb (Smallmouth Bass), respectively. OEHHA recommends no consumption of black bass species 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.

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

COMMON CARP

The mean mercury concentration in Common Carp from New Bullards Bar Reservoir was 554 ppb. OEHHA recommends no consumption of Common Carp 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.

KOKANEE SALMON

The mean mercury concentration in Kokanee Salmon from New Bullards Bar Reservoir was 112 ppb. OEHHA recommends a maximum of two servings a week of Kokanee Salmon 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.

Rainbow Trout

The mean mercury concentration in Rainbow Trout from New Bullards Bar Reservoir was 105 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 six servings a week for the general population (women 46 years and older, and men 18 years and older), based on mercury.

Sunfish Species (Bluegill)

The mean mercury concentration in Bluegill from New Bullards Bar Reservoir was 115 ppb. OEHHA recommends a maximum of two servings a week 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.

OEHHA evaluated mercury concentrations in sunfish 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 Bluegill to other sunfish species, including Redear Sunfish and Green Sunfish.

RECOMMENDED MAXIMUM NUMBER OF SERVINGS

The recommended maximum numbers of servings per week for fish from New Bullards Bar Reservoir is shown in Table 3.

TABLE 3. RECOMMENDED MAXIMUM NUMBER OF SERVINGS PER WEEK FOR FISH FROM NEW BULLARDS BAR RESERVOIR

Fish Species	Women 18-45 years and Children 1-17 years	Women 46 years and older and Men 18 years and older
Black Bass species	0	1
Carp	0	1
Kokanee Salmon	2	5
Rainbow Trout	2	6
Sunfish species	2	5

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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 New Bullards Bar Reservoir are followed, exposure to chemicals in fish from New Bullards Bar Reservoir 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.