

**HEALTH ADVISORY AND
GUIDELINES
FOR EATING FISH FROM
LITTLE ROCK RESERVOIR
(LOS ANGELES COUNTY)**

March 2014



**California Environmental Protection Agency
Office of Environmental Health Hazard Assessment**

LIST OF CONTRIBUTORS

Authors

Lori Lim, Ph.D.
Huyen Tran Pham, M.P.H.
Robert K. Brodberg, Ph.D.

Reviewer

Margy Gassel, Ph.D.

Final Reviewers

Anna Fan, Ph.D.
Lauren Zeise, Ph.D.
Allan Hirsch

Director

George V. Alexeeff, Ph.D.

ACKNOWLEDGEMENT

Developing fish consumption advisories depends on sampling and analysis of fish. The Office of Environmental Health Hazard Assessment (OEHHA) acknowledges the contribution of information and data from the following entities: Lahontan Regional Water Quality Control Board (RWB-6), State Water Resources Control Board, as well as the California Department of Fish and Wildlife and its Moss Landing Marine Laboratories and Water Pollution Control Laboratory. In particular, OEHHA would like to thank Mr. Thomas J. Suk of RWB-6 for planning and overseeing fish sampling and analysis to provide comprehensive data for advisory development. The chemical data were obtained directly from Mr. Suk and from the California Environmental Data Exchange Network (<http://www.ceden.us/AdvancedQueryTool>).

For further information about this report, contact:

Pesticide and Environmental Toxicology Branch
Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

1001 I Street, P.O. Box 4010
Sacramento, California 95812-4010
Telephone: (916) 327-7319

1515 Clay Street, 16th Floor
Oakland, California 94612
Telephone: (510) 622-3170

LIST OF ABBREVIATIONS

ATL	Advisory Tissue Level
CDFW	California Department of Fish and Wildlife
DDT(s)	dichlorodiphenyltrichloroethane (DDT) (and its metabolites dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE))
MDL	method detection limit
mm	millimeter
OEHHA	Office of Environmental Health Hazard Assessment
PCBs	polychlorinated biphenyls (as congeners)
ppb	parts per billion
RWB-6	Lahontan Regional Water Quality Control Board
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
USEPA	U.S. Environmental Protection Agency

PREFACE

The Office of Environmental Health Hazard Assessment (OEHHA), a department within the California Environmental Protection Agency, is responsible for evaluating potential public health risks from chemical contamination of sport fish. This task includes issuing health 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; and
 - 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 booklets under the "Public Health Advisory on Fish Consumption" section.

This report presents guidelines for eating fish from Little Rock Reservoir in Los Angeles County, California. It provides background information and a description of how the guidelines were developed. The resulting advice is summarized in the illustrations after the Table of Contents.

Table of Contents

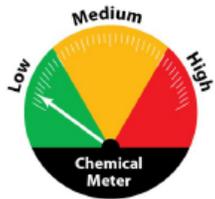
A Healthy Guide to Eating Fish from Little Rock Reservoir	1
INTRODUCTION.....	3
CHEMICALS OF POTENTIAL CONCERN	4
DATA SOURCES.....	5
Surface Water Ambient Monitoring Program (SWAMP).....	6
Lahontan Regional Water Quality Control Board	6
CHEMICAL CONCENTRATIONS	6
Chemical Analysis	6
Concentration Calculation.....	7
DEVELOPMENT OF GUIDELINES FOR EATING FISH FROM LITTLE ROCK RESERVOIR	8
General information.....	8
Consumption Advice for Fish from Little Rock Reservoir	9
Bass, Largemouth.....	9
Carp.....	9
Catfish, White	10
Crappie, Bluegill, Green Sunfish	10
Trout, Rainbow	10
REFERENCES.....	11
APPENDIX I. Advisory Tissue Levels.....	13

List of Figure and Tables

Figure 1. Location of Little Rock Reservoir in California.....	3
Table 1. Fish Samples from Little Rock Reservoir	5
Table 2. Method Detection Limits (in parts per billion, ppb).....	7
Table 3. Mercury Concentrations in Fish from Little Rock Reservoir.....	7
Table 4. PCB Concentrations in Fish from Little Rock Reservoir	8
Table 5. Recommended Maximum Number of Servings per Week.....	10

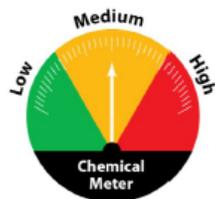
A Healthy Guide to Eating Fish from Little Rock Reservoir

Women 18-45 years and children 1-17 years



No fish in this group

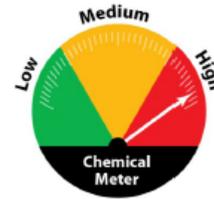
♥ = High in Omega-3s



Bluegill or green sunfish

Crappie

Rainbow trout ♥



Largemouth bass

Catfish

Carp

2 servings a week

Eat only the skinless fillet.
PCBs are in the fat and skin of the fish.



- Remove and throw away the skin before cooking.
- Cook thoroughly and allow the juices to drain away.

1 serving a week

What is a serving?



For Adults For Children

The recommended serving is the size and thickness of your hand. Give children smaller servings.

Do not eat

♥ 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.

What is the concern?

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

A Healthy Guide to Eating Fish from Little Rock Reservoir

Women over 45 years and men



 = High in Omega-3s

3 servings a week

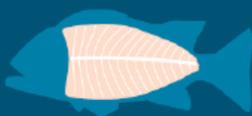
OR

2 servings a week

OR

1 serving a week

Eat only the skinless fillet.
PCBs are in the fat and skin of the fish.



- Remove and throw away the skin before cooking.
- Cook thoroughly and allow the juices to drain away.

What is a serving?



For Adults For Children

The recommended serving is the size and thickness of your hand. 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.

What is the concern?

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

INTRODUCTION

This report presents guidelines for eating fish from Little Rock Reservoir, located in Los Angeles County. The recommended advice is the maximum number of servings per week for each fish species evaluated.

Situated near the northern edge of the Angeles National Forest, Little Rock Reservoir is located between the cities of Palmdale and Littlerock. It was formed by the construction of the Little Rock Dam in 1924. The reservoir stands at 3,405 feet above sea level and covers a surface area of 150 acres¹. Run off from the nearby San Gabriel Mountains flows into Little Rock Creek and feeds into the southern end of the reservoir. The reservoir serves as one of the sources of drinking water for the cities of Palmdale and Littlerock². In addition, it is a popular recreational spot for activities such as fishing, camping, and boating.

FIGURE 1. LOCATION OF LITTLE ROCK RESERVOIR IN CALIFORNIA.



¹ <http://www.lakelubbers.com/littlerock-reservoir-1731/>

² <http://palmdalewater.org/WaterSource.aspx>
http://www.littlerock-ca.us/littlerock_creek_irrigation_dist.htm

Commonly caught fish in the reservoir include rainbow trout, carp, largemouth bass, catfish, and bluegill³. The California Department of Fish and Wildlife (CDFW) occasionally stocks the lake with trout. CDFW has established a minimum legal length of 12 inches for largemouth bass; only fish 12 or more inches can be kept by the angler (CDFW 2013-2014).

In 2010, the statewide lakes survey from the Surface Water Ambient Monitoring Program (SWAMP) of the State Water Resources Control Board (SWRCB) reported finding high mercury concentrations in bass and carp sampled at Little Rock Reservoir (Davis et al., 2010). The Lahontan Regional Water Quality Control Board (RWB-6), which oversees the region where this lake is located, conducted a follow-up study in 2013 to characterize the extent of the contamination in bass and other fish species. The source of the chemicals that have accumulated in fish tissue in this water body is unknown.

OEHHA used the results from SWAMP and the RWB-6 follow-up study to develop the advisory for Little Rock Reservoir. The basic OEHHA process to develop consumption advice involves these steps:

1. Select the chemical data and fish species to be evaluated.
2. Calculate average (mean) chemical concentrations and other descriptive statistics as appropriate for each fish species.
3. Compare the chemical concentrations with the OEHHA Advisory Tissue Levels (ATLs) for each chemical of concern.

OEHHA developed ATLs (Appendix I) that are acceptable exposure levels of specific contaminants in fish tissue based on toxicity of each chemical for a range of consumption rates. The development of the ATLs included consideration of health benefits linked to eating fish (Klasing and Brodberg, 2008).

CHEMICALS OF POTENTIAL CONCERN

Fish samples from Little Rock Reservoir have been analyzed for mercury (as a measure of methylmercury), polychlorinated biphenyl congeners⁴ (PCBs), and the persistent pesticides dieldrin, chlordane, and dichlorodiphenyltrichloroethane and its metabolites (DDTs).

Mercury, a metal, is widely found in nature in rock and soil. Its presence in the aquatic environment is the result of mining activities and releases into the environment from

³ <http://www.lakelubbers.com/littlerock-reservoir-1731/>

⁴ Congeners are related compounds with similar chemical forms. Of the 209 possible PCB congeners, 54 are generally reported.

industrial sources, including the burning of fossil fuels and solid wastes. Under the proper conditions, mercury in the sediment is transformed by bacteria to the more toxic organic form, methylmercury. Methylmercury is then absorbed by fish when they eat small aquatic organisms. Depending on how much methylmercury is in the fish people eat, changes in the brain may occur, especially in fetuses and children as they grow.

PCBs are man-made chemicals previously used in electrical transformers, plastics, and lubricating oils. While PCBs were banned for use in the 1970s, they persist in the environment because they do not break down easily and can accumulate in fish. Depending on the exposure level, PCBs can cause cancer and other adverse effects in humans.

Chlordanes, DDTs, and dieldrin are persistent pesticides that were banned from use many years ago but have been found in some fish in certain water bodies in California. Depending on the exposure level, these chemicals may cause cancer or other adverse effects on the nervous system in humans. Detailed discussion of the toxicity of these chemicals is presented in Klasing and Brodberg (2008).

DATA SOURCES

The guidelines for eating fish from Little Rock Reservoir were based on chemical analyses of fish samples by the monitoring projects described in this section. These projects had adequate documentation of sample collection, fish preparation, chemical analyses, and quality assurance, and detection limits below levels of health concern. Table 1 shows the common and scientific names of fish species, the projects under which the samples used for this report were collected, and the years of sampling.

TABLE 1. FISH SAMPLES FROM LITTLE ROCK RESERVOIR

Common Name	Scientific Name		Project	Year Sampled
	Family	Genus		
Bass, largemouth	Centrarchidae	<i>Micropterus</i>	Lakes Survey RWB-6 Study	2008 2013
Carp	Cyprinidae	<i>Cyprinus</i>	Lakes Survey RWB-6 Study	2008 2013
Catfish, white	Ictaluridae	<i>Ameiurus</i>	RWB-6 Study	2013
Crappie, black	Centrarchidae	<i>Pomoxis</i>	RWB-6 Study	2013
Sunfish, bluegill	Centrarchidae	<i>Lepomis</i>	RWB-6 Study	2013
Sunfish, green	Centrarchidae	<i>Lepomis</i>	RWB-6 Study	2013
Trout, rainbow	Salmonidae	<i>Onchorhynchus</i>	RWB-6 Study	2013

Abbreviations: Lake Survey=Surface Water Ambient Monitoring Program Lakes survey, RWB-6=Lahontan Regional Water Quality Control Board

SURFACE WATER AMBIENT MONITORING PROGRAM (SWAMP)

A statewide survey of inland water bodies was conducted by SWAMP, which sampled fish from 272 of California's more than 9,000 lakes and reservoirs from 2007 to 2008 (Davis et al., 2010). Of the surveyed lakes, 222 were targeted for sampling as popular fishing lakes and an additional 50 were selected using a random sampling draw to provide a statistical statewide assessment. In 2008, largemouth bass and carp were collected from Little Rock Reservoir, designated as a targeted lake in this survey. Samples were analyzed for mercury and PCBs. Persistent pesticides were measured in one carp sample.

LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD (RWB-6)

The RWB-6 conducted a follow-up study in 2013 to collect representative fish samples from Little Rock Reservoir. In addition to bass and carp, the following fish were collected from this lake: white catfish, black crappie, bluegill, green sunfish, and rainbow trout. Samples were analyzed for mercury and PCBs.

CHEMICAL CONCENTRATIONS

CHEMICAL ANALYSIS

Fish samples were prepared as skinless fillets for analysis of mercury, PCBs, and persistent pesticides. They were analyzed as individual fish or as composite samples from a species. Composite samples are prepared from equal amounts of tissues from several individual fish, all of the same species. Composite sampling is usually done for samples to be analyzed for organics to reduce the cost of analyses. The analytical result from a composite sample represents an average concentration. All results were reported in wet weight.

For total mercury, the samples were analyzed by atomic absorption spectrometry. PCBs and persistent pesticides were analyzed using gas chromatography. PCBs (54 congeners for each sample) were measured in all fish species, except for green sunfish and rainbow trout. Only a single sample of carp (5-fish composite) was analyzed for persistent pesticides. The specific chemicals were: PCB congeners; total DDTs including o,p' and p,p' DDT, o,p' and p,p' dichlorodiphenyl-dichloroethane (DDD), and o,p' and p,p' dichlorodiphenyl-dichloroethylene (DDE); total chlordanes including cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane; and dieldrin. The method detection limits (MDLs) are listed in Table 2.

TABLE 2. METHOD DETECTION LIMITS (IN PARTS PER BILLION, PPB)

Chemicals	SWAMP	RWB-6
Mercury	12	4
PCBs	0.3	0.3
Chlordanes	0.46	NA
DDTs	0.21	NA
Dieldrin	0.42	NA

Highest MDLs are indicated. NA=not analyzed.

CONCENTRATION CALCULATION

Results selected for consideration of consumption advice were from samples that met the CDFW’s legal size requirements (largemouth bass) or OEHHA’s criteria for minimum “edible” size. OEHHA used species size at maturity and professional judgment to set minimum edible sizes (Gassel and Brodberg, 2005). Fish sampled were measured as total length (in millimeters, or mm).⁵ For composite samples, the total length of the smallest fish in the sample was at least 75 percent of the length of the largest fish in the composite.

OEHHA used the arithmetic mean (average) concentrations of selected samples for each chemical as the representative mean chemical concentration to estimate human exposure. The means were computed (weighted) by taking into account the number of fish in each composite sample. For the calculation of mercury concentrations in fish tissue, OEHHA assumed all total mercury detected was methylmercury, the more toxic form that is present in fish, because nearly all mercury present in fish is methylmercury (Wiener et al., 2007). Table 3 shows the weighted means of total fish length and mercury concentration for each fish species collected from Little Rock Reservoir.

TABLE 3. MERCURY CONCENTRATIONS IN FISH FROM LITTLE ROCK RESERVOIR

Fish Species	Number of Samples	Total Number of Fish^a	Mean Total Length (mm)	Mean Mercury (ppb)	Range of Mercury (ppb)
Bass, largemouth	19	19	393	762	454-992
Carp	12	20	519	441	366-571
Catfish, white	12	12	372	453	244-734
Crappie, black	10	10	187	268	227-368
Sunfish, bluegill	10	10	191	303	257-385
Sunfish, green	10	10	166	256	145-394
Trout, rainbow	7	7	388	217	107-361

^a/ The number of fish can be greater than the number of samples because some samples are composites consisting of more than one fish for the chemical analysis.

⁵ Total length refers to the length from the tip of the snout to the tip of the longer lobe of the caudal fin.

For PCBs, chlordanes, and DDTs, each of the concentrations presented was the sum of the detected parent compound, congeners, and metabolites, where applicable. Since the MDLs or RLs were relatively low, ≤ 1 part per billion (ppb), individual congeners or metabolites with concentrations reported as non-detects were assumed to have no residue. This is a standard method of handling non-detect samples for PCBs and other chemicals with multiple congeners or metabolites when detection levels are adequate (U.S. Environmental Protection Agency, USEPA, 2000a). Table 4 shows the weighted means of total length and mean chemical concentrations of PCBs for each species. Persistent pesticides in one sample of 5-carp composite were: 3 ppb chlordanes, 1 ppb DDTs, and below detection limit for dieldrin.

TABLE 4. PCB CONCENTRATIONS IN FISH FROM LITTLE ROCK RESERVOIR

Fish Species	Number of Samples	Number of Fish ^a	Mean Total Length (mm)	Mean PCBs (ppb)	Range of PCBs (ppb)
Bass, largemouth	1	10	352	2	NA
Carp	2	15	526	22	8-30
Catfish, white	2	10	390	21	6-25
Crappie, black	1	10	187	<0.3	NA
Sunfish, bluegill	1	8	199	2	NA
Sunfish, green	0	NA	NA	NA	NA
Trout, rainbow	0	NA	NA	NA	NA

^a/ The number of fish (in parenthesis) can be greater than the number of samples because some samples are composites consisting of more than one fish for the chemical analysis. NA=Not applicable because no or only one sample was analyzed for PCBs.

DEVELOPMENT OF GUIDELINES FOR EATING FISH FROM LITTLE ROCK RESERVOIR

GENERAL INFORMATION

Consumption advice was developed for fish species that meet OEHHA's criterion for sufficient samples (at least nine fish) to represent the population in the water body (Gassel and Brodberg, 2005). When appropriate, fish species were combined as a single group based on their taxonomy (i.e., they are in the same Family and/or genus).

The recommended fish consumption frequency (number of servings of fish per week) was determined for each fish species or group by comparing the chemical's mean concentration to the ATLS. For exposure to methylmercury in fish, there are two sets of ATLS because of age-related toxicity (Klasing and Brodberg, 2008). The fetus and

children are more sensitive to the toxic effects of methylmercury. Thus, the ATLs for women who might become pregnant (typically 18 to 45 years of age) and children are lower than for women over 45 years and men. The lower ATL values provide protection to allow for the normal growth and development of the brain and nervous system of unborn babies and children. A complete description of the process of developing ATLs can be found in Klasing and Brodberg (2008). A list of applicable ATLs is in Appendix I.

The consumption advice for a fish species is initially based on the chemical with the lowest allowable number of fish servings per week. When both mercury and PCBs are detected in the fish tissues, a co-exposure assessment of potential additive toxicity is conducted for the sensitive population using multiple chemical exposure methodology (USEPA, 1989 and 2000b), based on the concern for developmental neurotoxicity.

OEHHA's advisory process and ATLs also consider the health benefits from fish consumption. There is considerable evidence and scientific consensus that fish consumption is an important part of a healthy well-balanced diet and provides many health benefits (American Heart Association, 2014; Klasing and Brodberg, 2008; Institute of Medicine, 2007; Kris-Etherton et al., 2002). Fish is a significant source of the specific omega-3 fatty acids, docosahexaenoic acid and eicosapentaenoic acid, associated with these beneficial effects (U.S. Department of Agriculture, 2014; Weaver et al., 2008).

CONSUMPTION ADVICE FOR FISH FROM LITTLE ROCK RESERVOIR

After evaluating the chemical concentrations in these fish species, OEHHA used mercury or PCB concentration as the basis for advice for eating fish from Little Rock Reservoir. While there were limited data, the concentrations of the tested pesticides were close to or lower than the ATL threshold value for daily consumption (Klasing and Brodberg, 2008). These were not considered further for developing consumption advice. Co-exposure assessment results are mentioned only when it caused a reduction in the consumption frequency compared to the consideration of PCB or mercury concentration independently. The recommended maximum number of servings per week for each fish species with sufficient data is presented in Table 5, following the discussion.

BASS, LARGEMOUTH

Only the results from largemouth bass of legal size (≥ 12 inches, or ≥ 305 mm) could be used to develop the consumption advice. The mean concentrations were 762 ppb for mercury and 2 ppb for PCBs. The advice for the sensitive population is not to eat bass because of very high mean mercury concentration. For women over 45 years and men, the advice is one serving per week.

CARP

In carp, the mean concentrations were 441 ppb for mercury and 22 ppb for PCBs. For the sensitive population, the advice is not to eat carp because of concerns regarding co-

exposure to mercury and PCBs. For women over 45 years and men, the advice is one serving per week, determined by mercury concentration.

CATFISH, WHITE

The mean concentrations in white catfish were 453 ppb for mercury and 21 ppb for PCBs. The advice for the sensitive population is not to eat white catfish because of high mean mercury concentration. For women over 45 years and men, the advice is one serving per week, determined by mercury concentration.

CRAPPIE, BLUEGILL, GREEN SUNFISH

Crappie, bluegill, and green sunfish have similar mean mercury concentrations (256 to 303 ppb). Crappie and bluegill also have low PCBs. There were no PCB data for green sunfish. For each of these fish species, the advice is one serving per week for the sensitive population and two servings per week for women over 45 years and men.

TROUT, RAINBOW

The mean mercury concentration was 217 ppb in rainbow trout. OEHHA decided to develop advice for rainbow trout even though there were only 7 samples, fewer than the 9-fish criterion. During the planning of the RWB-6 study, OEHHA indicated that 7 fish would be sufficient if this fish was not common during sampling. The mean level in rainbow trout was the lowest of all tested species in this reservoir; this is the typical pattern seen in other water bodies where OEHHA has developed advisories. For Little Rock Reservoir, the advice is one serving per week for the sensitive population and three servings per week for women over 45 years and men.

The following table (Table 5) presents the advice developed for fish species found at Little Rock Reservoir.

TABLE 5. RECOMMENDED MAXIMUM NUMBER OF SERVINGS PER WEEK

Fish Species	Women 18–45 Years and Children 1 to 17 Years	Women over 45 Years and Men
Bass, largemouth	0	1
Carp	0	1
Catfish, white	0	1
Crappie, black	1	2
Sunfish, bluegill	1	2
Sunfish, green	1	2
Trout, rainbow	1	3

REFERENCES

American Heart Association (2014). Fish and omega-3 fatty acids.
<http://www.americanheart.org/presenter.jhtml?identifier=4632>

CDFW (2013-2014). Freshwater Sport Fishing Regulations. Fish and Game Commission, Department of Fish and Wildlife, Natural Resources Agency, Sacramento, CA.
<http://www.dfg.ca.gov/regulations/FreshFish-Mar2013/>

Davis, J.A., A.R. Melwani, S.N. Bezalel, J.A. Hunt, G. Ichikawa, A. Bonnema, W.A. Heim, D. Crane, S. Swensen, C. Lamerdin, and M. Stephenson (2010). Contaminants in fish from California lakes and reservoirs, 2007-2008: Summary report on a two-year screening survey. A report of the Surface Water Ambient Monitoring Program (SWAMP). California State Water Resources Control Board, Sacramento, CA.
http://www.swrcb.ca.gov/water_issues/programs/swamp/docs/lakes_study/fish_calif_lakesres.pdf

Gassel, M. and R.K. Brodberg (2005). General protocol for sport fish sampling and analysis. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, CA.
<http://oehha.ca.gov/fish/pdf/fishsampling121406.pdf>

Institute of Medicine (2007). Seafood choices, balancing benefits and risks. Committee on Nutrient Relationships in Seafood: Selections to Balance Benefits and Risks Food and Nutrition Board. The National Academies Press, Washington, D.C.

Klasing, S. and R.K. Brodberg (2008). Development of fish contaminant goals and Advisory Tissue Levels for common contaminants in California sport fish: Chlordane, DDTs, dieldrin, methylmercury, PCBs, selenium, and toxaphene. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, CA.
<http://www.oehha.ca.gov/fish/gtllsv/pdf/FCGsATLs27June2008.pdf>

Kris-Etherton, P.M., W.S. Harris, and L.J. Appel (2002). Fish consumption, fish oil, omega-3 fatty acids, and cardiovascular disease. *Circulation* 106:2747-2757.

U. S. Department of Agriculture (2014). USDA National Nutrient Database for Standard Reference, Release 26.
www.ndb.nal.usda.gov

USEPA (1989). Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) Interim Final. EPA/5401-89/002, December 1989. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.
Online at: <http://www.epa.gov/oswer/riskassessment/ragse/index.htm>

USEPA (2000a). Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Vol.1. Fish Sampling and Analysis. 3rd Ed. EPA 823-B00-007.

USEPA (2000b). Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Vol.2. Risk Assessment and fish consumption limits. 3rd Ed. EPA 823-B00-008.

Weaver, K.L., P. Ivester, J.A. Chilton, M.D. Wilson, P. Pandey, and F.H. Chilton (2008). The content of favorable and unfavorable polyunsaturated fatty acids found in commonly eaten fish. *J. American Dietetic Association* 108:1178-1185.

Wiener, J.G.; R.A. Bodaly; S.S. Brown; M. Lucotte; M.C. Newman; D.B. Porcella; R.J. Reash; and E.B. Swain (2007). Monitoring and evaluating trends in methylmercury accumulation in aquatic biota. Chapter 4 in Ecosystem Responses to Mercury Contamination: Indicators of Change (R.C. Harris, D. P. Krabbenhoft, R.P. Mason, M.W. Murray, R.J. Reash, and T. Saltman, editors). SETAC Press, Pensacola, Florida.

APPENDIX I. ADVISORY TISSUE LEVELS

Advisory Tissue Levels (ATLs) guide the development of advice for people eating sport fish. ATLs show maximum numbers of recommended fish servings that correspond to the chemical levels found in fish. OEHHA uses ATLs to provide advice to prevent consumers from being exposed to:

- More than the average daily reference dose⁶ 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 USEPA (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 Little Rock Reservoir are followed, exposure to chemicals in fish from this lake would be at or below the average daily reference dose or the cancer risk probability of one in 10,000.

Number of servings per week ^a	Advisory Tissue Levels (ATLs, in ppb)		
	Methylmercury		PCBs
	Women 18 to 45 years and children 1 to 17 years	Women over 45 years and men	
0	>440	>1,310	>120
1	>150-440	>440-1,310	>42-120
2	>70-150	>220-440	>21-42
3	>55-70	>160-220	>16-21
4	>44-55	>130-160	>13-16
5	>36-44	>109-130	>10-13
6	>31-36	>94-109	>9-10
7	≤ 31	≤ 94	≤ 9

^{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. When residue data are compared to this table they should also first be rounded to the second significant digit.

⁶ 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.