HEALTH ADVISORY

SAFE EATING GUIDELINES FOR FISH FROM TRINITY LAKE, LEWISTON LAKE, CARRVILLE POND, THE TRINITY RIVER UPSTREAM FROM TRINITY LAKE AND THE EAST FORK TRINITY RIVER (TRINITY COUNTY)

October 2005

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HEALTH ADVISORY:

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ACKNOWLEDGEMENTS

We would like to thank Jason T. May, Roger L. Hothem, and Charles N. Alpers (U.S. Geological Survey) for providing data and technical information for studies conducted in the Trinity River watershed that were used in this report. We would also like to acknowledge the State Water Resources Control Board for providing useful data through the Surface Water Ambient Monitoring Program. Additionally, we would like to thank Jack Linn and Larry Hanson of the California Department of Fish and Game for their technical expertise on fish in the Trinity River watershed region.

FOREWORD

This health advisory provides safe eating guidelines for consumption of various fish species taken from Trinity Lake (also known as Clair Engle Lake), Lewiston Lake, Carrville Pond, the Trinity River upstream of Trinity Lake, and the East Fork Trinity River in Trinity County. These guidelines were developed as a result of findings of high mercury levels in certain fish tested from some water bodies in this region and are provided to protect against possible adverse health effects from methylmercury as consumed from mercury-contaminated fish. Fish with low mercury levels considered safe to eat frequently are also noted in the guidelines. This report provides background information and a description of the data and criteria used to develop the guidelines.

To protect public health in the period while this technical support document was being prepared for public comment, Trinity County, in consultation with the Office of Environmental Health Hazard Assessment, issued an interim public health notification for fish from the affected area. This notification is included in Appendix 1. Once completed, the guidelines contained herein will become the final state advisory.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The United States Geological Survey (USGS) conducted a reconnaissance survey of mercury contamination in edible fish tissue from Trinity Lake and selected water bodies in the Trinity River watershed, an area possibly affected by historic gold and mercury mining. These data were evaluated by the Office of Environmental Health Hazard Assessment (OEHHA), together with fish samples collected in this region through the Surface Water Ambient Monitoring Program (SWAMP), in an effort to determine whether there may be potential adverse health effects associated with the consumption of sport fish from these water bodies.

Almost all fish contain detectable levels of mercury, more than 95 percent of which occurs as methylmercury, a highly toxic form of the element. Consumption of fish is the major route of exposure to methylmercury in the United States. The critical target of methylmercury toxicity is the nervous system, particularly in developing organisms such as the fetus and young children. Significant methylmercury toxicity can occur to the fetus during pregnancy even in the absence of symptoms in the mother. In 1985, the United States Environmental Protection Agency (U.S. EPA) set a reference dose (RfD, that is the daily exposure likely to be without significant risk of deleterious effects during a lifetime) for methylmercury of $3x10^{-4}$ mg/kg-day, based on central nervous system effects (ataxia and paresthesias) in adults. In 1995, and confirmed in 2001, this RfD was lowered to $1x10^{-4}$ mg/kg-day, based on developmental neurologic abnormalities in infants exposed *in utero*, using the Iraqi and Faroe Island data, respectively. OEHHA finds convincing evidence that the fetus is more sensitive than adults to the neurotoxic effects of mercury, but also recognizes that fish can play an important role in a healthy diet, particularly when it replaces other, higher fat sources of protein. Numerous human and animal studies have shown that fish oils have beneficial cardiovascular and neurological effects. Because it is important to protect the most sensitive population without unduly restricting fish consumption in others, OEHHA chooses to use both the current and previous U.S. EPA reference doses for two distinct population groups. In these guidelines, the current RfD based on effects in infants will be used for women of childbearing age and children aged 17 and younger. The previous RfD, based on effects in adults, will be used for women beyond their childbearing years and men.

In order to provide safe eating guidelines for various fish species, mean mercury concentrations in fish from a site or region are compared to OEHHA guidance tissue levels for methylmercury, which are designed so that individuals consuming no more than a preset number of meals should not exceed the RfD for this chemical. Safe eating guidelines identify those fish species with high mercury levels whose consumption should be restricted or avoided altogether (see the “Caution” table), as well as those low-mercury fish that may be consumed frequently (two or more times per week) as part of a healthy diet (see the “Best Choices” table). A statistically representative sample size was available to provide safe eating guidelines for largemouth bass, smallmouth bass, white catfish, brown trout, and rainbow trout from Trinity Lake, and rainbow trout from Lewiston Lake, Carrville Pond, the Trinity River upstream from Trinity Lake, and the East Fork Trinity River. Supporting data (such as mercury concentration for a closely related species at a similar trophic level) were used to develop additional consumption guidelines for Chinook salmon from Trinity Lake.

All individuals, especially women of childbearing age and children aged 17 and younger, are advised to follow the safe eating guidelines to ensure that their methylmercury ingestion does not exceed the reference dose. With the exception of ocean or river-run salmon or steelhead, which may be consumed more frequently, for other generally low mercury fish species not included in this evaluation, but potentially found in these water bodies (e.g., green sunfish, Kokanee salmon, brown and black bullhead), OEHHA advises that women of childbearing age and children aged 17 and younger follow the recent U.S. EPA and U.S. Food and Drug Administration (U.S. FDA) Joint Federal Advisory for Mercury in Fish. This advisory recommends that pregnant women or women who may become pregnant, nursing mothers and young children consume no more than one meal per week of locally caught fish, when no other advice is available, and eat no other fish that week. OEHHA recommends that children through age 17 also follow this advice because of continued nervous system development during adolescence. Meal sizes should be adjusted to body weight as described in the safe eating guidelines table.

For general advice on how to limit your exposure to chemical contaminants in sport fish (e.g., eating smaller fish of legal size), as well as a fact sheet on methylmercury in sport fish, see the California Sport Fish Consumption Advisories (http://www.oehha.ca.gov/fish.html) and Appendix 2. Advice for other California water bodies can be found online at: http://www.oehha.ca.gov/fish/so_cal/index.html. It should be noted that, unlike the case for many organic contaminants, various cooking and cleaning techniques will not reduce the methylmercury content of fish.

SAFE EATING GUIDELINES

FISH CONSUMPTION FROM TRINITY LAKE, LEWISTON LAKE, CARRVILLE POND, THE TRINITY RIVER UPSTREAM OF TRINITY LAKE, AND THE EAST FORK TRINITY RIVER

Fish are nutritious and should be part of a healthy, balanced diet. It is important, however, to choose your fish wisely. OEHHA recommends that you choose fish to eat that are low in mercury, including the following fish caught from Trinity Lake, Lewiston Lake, Carrville Pond, the Trinity River upstream of Trinity Lake, and the East Fork Trinity River.

BEST CHOICES **EAT UP TO 3 TIMES PER WEEK**
Women of childbearing age and children 17 years and younger:
All trout from Lewiston Lake, Carrville Pond, or the Trinity River upstream of Trinity Lake
Women beyond childbearing age and men:
All trout or white catfish from any listed site

Because some other types of fish from these water bodies contain higher levels of mercury, OEHHA provides the following recommendations that you can follow to reduce the risks from exposure to mercury in fish.

CAUTION **LIMIT CONSUMPTION TO NO MORE THAN:**	
Women of childbearing age and children 17 years and younger:	
Once a Month	Bass or Chinook (King) salmon from Trinity Lake (including rivers and creeks draining into Trinity Lake) ***or***
Once a Week	White catfish or trout from Trinity Lake and the East Fork Trinity River
Women beyond childbearing age and adult men:	
Once a Week	Bass or Chinook (King) salmon from Trinity Lake (including rivers and creeks draining into Trinity Lake)

CONTACT WITH THE WATER IS SAFE.
EAT SMALLER FISH OF LEGAL SIZE. Fish accumulate mercury as they grow.
SERVE SMALLER MEALS TO CHILDREN. Meal size is assumed to be 8 ounces for a 160-pound adult. If you weigh more or less than 160 pounds, add or subtract one ounce to your meal size, respectively, for each 20-pound difference in body weight.
DO NOT COMBINE FISH CONSUMPTION ADVICE. If you eat multiple species or catch fish from more than one area, the recommended guidelines for different species and locations should not be combined.
CONSIDER YOUR TOTAL FISH CONSUMPTION. Fish from many sources (including stores and restaurants) can contain elevated levels of mercury and other contaminants. If you eat commercial and/or sport fish with lower contaminant levels, you can safely eat more fish. The American Heart Association recommends that healthy adults eat at least two servings of fish per week. Commercial fish such as shrimp, king crab, scallops, farmed catfish, wild ocean salmon, oysters, tilapia, flounder, and sole generally contain some of the lowest levels of mercury, as do the local fish in the “Best Choices” table.
FISH FROM MANY OTHER WATER BODIES ARE KNOWN OR SUSPECTED TO HAVE ELEVATED MERCURY LEVELS. Not all water bodies in California have been tested. It is recommended that, with the exception of ocean or river-run salmon or steelhead, which may be eaten more frequently, generally low mercury fish from places without published guidelines should be eaten one meal per week or less.

TRINITY LAKE and the TRINITY RIVER WATERSHED SPORT FISH

Largemouth Bass *(Micropterus salmoides)*

Duane Raver, USFWS

Smallmouth Bass (*Micropterus dolomieu*)

Duane Raver, USFWS

White catfish *(Amereiurus catus)*

Duane Raver, USFWS

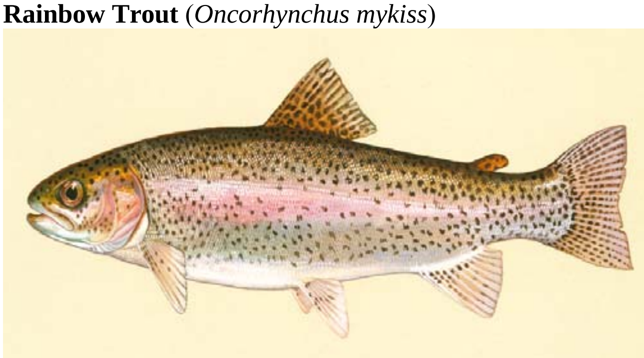
Chinook Salmon *(Oncorhynchus tshawytscha)*

Timothy Knepp, USFWS

Brown Trout (*Salmo trutta*)

Duane Raver, USFWS

Rainbow Trout (*Oncorhynchus mykiss*)



Duane Raver, USFWS

Note: Pictures are not to scale

INTRODUCTION

Mercury contamination of fish is a national problem that has resulted in the issuance of fish consumption advisories in most states, including California (U.S. EPA, 2003). Mercury enters the environment from the breakdown of minerals in rocks and leaching from old mine sites. It is also emitted into air from mining deposits, the burning of fossil fuels, and other industrial sources, as well as from volcanic emissions. Mercury contamination thus occurs as a result of both natural and anthropogenic sources and processes. Once mercury is released into the environment, it cycles through land, air, and water. The deposition of mercury in aquatic ecosystems is a concern for public and environmental health because microorganisms (bacteria and fungi) in the sediments can convert inorganic mercury into organic methylmercury, a particularly toxic form of mercury. Once formed, methylmercury accumulates or "biomagnifies" in the aquatic food chain, reaching the highest levels in fish and other organisms at the top of the food web.

Elevated levels of mercury associated with historic gold and mercury mining have been found in fish in numerous reservoirs and stream sites in northern California (see, e.g., May et al., 2000; Alpers et al., 2004). As a result, fish consumption advisories based on mercury contamination have been issued by the Office of Environmental Health Hazard Assessment (OEHHA) for various water bodies in Nevada, Placer, Yuba, Glenn, Tehama, Lake, Yolo, Colusa, Napa, Solano, and Santa Clara Counties. In a further effort to assess the status of mercury contamination in other California gold and mercury mining districts, the United States Geological Survey (USGS) collected sport fish from Trinity Lake (also known as Clair Engle Lake) and the Trinity River watershed region of Trinity County (including the Trinity River upstream and downstream from Trinity Lake, Coffee Creek, Canyon Creek, Eastman Creek, Eastman Dredge Ponds, Carrville Pond, Crow Creek, Tamarack Creek, the New River, and the East Fork Trinity River and its tributaries) in 2000 to 2002 (May et al., 2004; May et al., 2005). These data were evaluated together with mercury data from samples collected and analyzed from Trinity Lake and Lewiston Lake by the Toxic Substances Monitoring Program (TSMP), which is now included under the Surface Water Ambient Monitoring Program (SWAMP) of the State Water Resources Control Board. Sufficient numbers of legal/edible-sized fish were only available to make an evaluation for Trinity Lake, Lewiston Lake, Carrville Pond, the Trinity River upstream of Trinity Lake, and the East Fork Trinity River (see Figure 1). (Samples from Coffee Creek near the confluence of the Trinity River were included with the Trinity River upstream of Trinity Lake samples). To protect public health in the period while this technical support document was being prepared for public comment, Trinity County, in consultation with the Office of Environmental Health Hazard Assessment, issued an interim public health notification for fish from the affected area. This notification is included in Appendix 1. The safe eating guidelines included herein are based on the potential exposure to methylmercury through consumption of certain fish from these areas and seek to minimize the associated potential health risks of such exposure (see the "Caution" table). Although almost all sport and commercial fish contain measurable levels of mercury, exposure can be increased to unacceptable levels in areas where local mercury contamination is a problem. Safe eating guidelines also include information about fish with low levels of mercury considered safe to eat frequently (two or more times per week; see the "Best Choices" table).

OEHHA is the agency responsible for evaluating potential public health risks from chemical contamination of sport fish. This includes issuing 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, and the California Water Code Section 13177.5, to issue health advisories. Fish advisories developed by OEHHA are published in the California Sport Fishing Regulations and California Sport Fish Consumption Advisories. OEHHA now emphasizes "safe eating guidelines" as part of health advisories in an effort to inform consumers of healthy choices in fish consumption as well as those that should be avoided or restricted.

In evaluating the USGS and TSMP data, it was determined that some fish species in Trinity Lake and surrounding water bodies in the Trinity River watershed had sufficient levels of mercury that could be a concern for frequent sport fish consumers. Because final state fish consumption advice was not currently in place for these water bodies, development of a health advisory and the resulting safe eating guidelines was deemed appropriate.

BACKGROUND

The Trinity River watershed area is located in one of the most productive gold mining regions of California and has been the site of historic load, placer and dredge mining operations (Clark, 1998). Mercury was often used in these processes to aid in the recovery of gold (Hunerlach and Alpers, 2003) and, as a result, may have contaminated many of the local waterways. Additionally, the inactive Altoona Mercury Mine is located along the East Fork Trinity River and is reported to contribute significantly to the mercury content of Trinity Lake (May et al., 2004).

The Trinity region is also an important recreation area in the state, known for its excellent fishing (Stienstra, 2004). The state record smallmouth bass was caught from Trinity Lake in 1976 (CDFG, 2004). Bullhead, catfish, brown trout, rainbow trout, and largemouth bass can also be caught in the lake (Stienstra, 2004; Hanson, personal communication, 2004). Trinity Lake is overpopulated with a stunted and self-sustaining population of Kokanee salmon. Since 1997, Trinity Lake has been planted with approximately 25,000 Chinook (King) salmon annually. These inland Chinooks feed, in part, on resident Kokanee, and do not reproduce (Hanson, personal communication, 2004). Several rivers and creeks in the area are stocked with rainbow, brook or brown trout (Stienstra, 2004).

In an effort to assess mercury bioaccumulation in selected water bodies in the Trinity River watershed, USGS collected a total of seven sport fish species by electrofishing equipment or gill nets from 2000 to 2002 at 23 sites in the region, including Trinity Lake (May et al., 2004). Species collected included largemouth bass, smallmouth bass, white catfish, brown bullhead, green sunfish, rainbow trout, and brook trout. Fish were measured and weighed; boneless and skinless individual fillets were submitted to the Trace Element Research Laboratory (TERL). Mercury levels were determined by cold-vapor atomic absorption spectroscopy.

Additionally, a limited number of composite samples of black bullhead (n = two in one composite) and rainbow trout (n = 13 in two composites) were collected from Carrville Pond and the East Fork Trinity River by electrofishing equipment or gill nets as part of TSMP in 1990-1992. In 2002, brown trout (n = 15 in five composites), Chinook salmon (n = two), largemouth bass (n = 1), rainbow trout (n = 31 in eight composites), and smallmouth bass (n = 12 in eight composites) were collected and analyzed by TSMP using the same methods as described above. Fish were measured and weighed and made into composites using skin-off muscle fillet. Composite samples were homogenized at the California Department of Fish and Game (CDFG) Water Pollution Control Laboratory (1990-1992 data) or Moss Landing Marine Laboratories (2002 data) and analyzed for total mercury by cold vapor atomic absorption spectrophotometry (Rasmussen, 1995).

A number of organic contaminants, including chlordane, DDTs, and PCBs, were also measured in samples of brown trout, rainbow trout, white catfish, and smallmouth bass collected from Trinity Lake and surrounding water bodies by TSMP. Homogenized tissue was analyzed by gas chromatography, using mass spectrometry (GC/MS) for chlorinated hydrocarbon determination. Mean values of these chemicals for each species were below OEHHA's screening values (Brodberg and Pollock, 1999) used to determine whether further evaluation or site-specific advice should be considered. As such, only mercury data were considered for these guidelines.

It is not possible to determine in advance how many samples of each fish species from each site will be necessary in order to statistically interpret contamination data for safe eating guidelines. However, U.S. EPA does recommend a minimum of three replicate composite samples of three fish per composite (nine total fish) in order to begin assessing the magnitude of contamination at a site. U.S. EPA also recommends that at least two fish species be sampled per site. Although composite analysis is generally the most cost-efficient method of estimating the average concentration of chemicals in a fish species, individual sampling provides a better measure of the range and variability of contaminant levels in a fish population (U.S. EPA, 2000a). Using these guidelines, OEHHA believes that a minimum of three replicates of three fish per composite or, preferably, nine individual fish samples of multiple species from each site should be analyzed for this type of pilot study. Fish samples should be collected from multiple (legal/edible-) size classes. Following this sampling protocol will allow estimation of the range and variation of contaminant concentrations at a particular site and derivation of a representative mean concentration for use in developing fish consumption guidelines. More samples will provide a better estimate of the mean contaminant level in various fish species and are especially important for large water bodies.

Of the samples collected from Trinity Lake and selected water bodies in the Trinity River watershed, largemouth bass (n = 24), smallmouth bass (n = 23), white catfish (n = 28), brown trout (n = 15), and rainbow trout (n = 84) had sufficient sample size ($\geq$ 9 fish per species) of legal/edible size fish (see Table 1) to be considered representative of mercury levels in those species, thereby allowing adequate estimation of the health risks associated with their consumption. Interpretation of data for other fish when there is a limited sample size can be found in the guidelines for fish consumption section of this report.

METHYLMERCURY TOXICOLOGY

Mercury is a metal found naturally in rocks, soil, air, and water that can be concentrated to high levels in the aquatic food chain by a combination of natural processes and human activities (ATSDR, 1999). The toxicity of mercury to humans is greatly dependent on its chemical form (elemental, inorganic, or organic) and route of exposure (oral, dermal, or inhalation). Methylmercury (an organic form) is highly toxic and can pose a variety of human health risks (NAS/NRC, 2000). Of the total amount of mercury found in fish muscle tissue, methylmercury comprises more than 95 percent (ATSDR, 1999; Bloom, 1992). Because analysis of total mercury is less expensive than that for methylmercury, total mercury is usually analyzed for most fish studies. In this study, total mercury was measured and assumed to be 100 percent methylmercury for the purposes of risk assessment.

Fish consumption is the major route of exposure to methylmercury in the United States (ATSDR, 1999). As noted above, almost all fish contain detectable levels of methylmercury, which, when ingested, is almost completely absorbed from the gastrointestinal tract (Aberg et al., 1969; Myers et al., 2000). Once absorbed, methylmercury is distributed throughout the body, reaching the largest concentration in kidneys. Its ability to cross the placenta as well as the blood-brain barrier allows methylmercury to accumulate in the brain and fetus, which are known to be especially sensitive to the toxic effects of this chemical (ATSDR, 1999). In the body, methylmercury is slowly converted to inorganic mercury and excreted predominantly by the fecal (biliary) pathway. Methylmercury is also excreted in breast milk (ATSDR, 1999). The biological half-life of methylmercury is approximately 44-74 days in humans (Aberg, 1969; Smith et al., 1994), meaning that it takes approximately 44-74 days for one-half of a single ingested dose of methylmercury to be eliminated from the body.

Human toxicity of methylmercury has been well studied following several epidemics of human poisoning resulting from consumption of highly contaminated fish (Japan) or seed grain (Iraq, Guatemala, and Pakistan) (Elhassani, 1982-83). The first recorded mass methylmercury poisoning occurred in the 1950s and 1960s in Minamata, Japan, following the consumption of fish contaminated by industrial pollution (Marsh, 1987). The resulting illness was manifested largely by neurological signs and symptoms such as loss of sensation in the hands and feet, loss of gait coordination, slurred speech, sensory deficits including blindness, and mental disturbances (Bakir et al., 1973; Marsh, 1987). This syndrome was subsequently named Minamata Disease. A second outbreak of methylmercury poisoning occurred in Niigata, Japan, in the mid-1960s. In that case, contaminated fish were also the source of illness (Marsh, 1987). In all, more than 2,000 cases of methylmercury poisoning were reported in Japan, including more than 900 deaths (Mishima, 1992).

The largest outbreak of methylmercury poisoning occurred in Iraq in 1971-1972 and resulted from consumption of bread made from seed grain treated with a methylmercury fungicide (Bakir et al., 1973). This epidemic occurred over a relatively short term (several months) compared to the Japanese outbreak. The mean methylmercury concentration of wheat flour samples was found to be 9.1 micrograms per gram (μg/g). Over 6,500 people were hospitalized, with 459 fatalities. Signs and symptoms of methylmercury toxicity were similar to those reported in the Japanese epidemic.

Review of data collected during and subsequent to the Japan and Iraq outbreaks identified the critical target of methylmercury as the nervous system and the most sensitive subpopulation as the developing organism (U.S. EPA, 1997). During critical periods of prenatal and postnatal structural and functional development, the fetus and children are especially susceptible to the toxic effects of methylmercury (ATSDR, 1999; IRIS, 1995). When maternal methylmercury consumption is very high, as happened in Japan and Iraq, significant methylmercury toxicity can occur to the fetus during pregnancy, with only very mild or even in the absence of symptoms in the mother. In those cases, symptoms in children are often not recognized until development of cerebral palsy and/or mental retardation many months after birth (Harada, 1978; Marsh et al., 1980; Marsh et al., 1987; Matsumoto et al., 1964; Snyder, 1971).

The International Agency for Research on Cancer (IARC) has listed methylmercury compounds as possible human carcinogens, based on inadequate data in humans and limited evidence in experimental animals (increased incidence of tumors in mice exposed to methylmercury chloride) (IARC, 1993). U.S. EPA has also listed methylmercury as a possible human carcinogen (IRIS, 2001). OEHHA has administratively listed methylmercury compounds on the Proposition 65 list of chemicals known to the State of California to cause cancer. No estimate of the increased cancer risk from lifetime exposure has been developed for methylmercury.

DERIVATION OF REFERENCE DOSES FOR METHYLMERCURY

A reference dose (RfD) is an estimate of daily human exposure to a chemical that is likely to be without significant risk of adverse effects during a lifetime (including to sensitive population subgroups), expressed in units of mg/kg-day (IRIS, 1995). This estimate includes a safety factor to account for data uncertainty. The underlying assumption of a reference dose is that, unlike carcinogenic effects, there is a threshold dose below which certain toxic effects will not occur. The reference dose for a particular chemical is derived from review of relevant toxicological and epidemiological studies in animals and/or humans. These studies are used to determine a No-Observed-Adverse-Effect-Level (NOAEL; the highest dose at which no adverse effect is seen), a Lowest-Observed-Adverse-Effect-Level (LOAEL; the lowest dose at which any adverse effect is seen), or a benchmark dose level (BMDL; a statistical lower confidence limit of a dose that produces a certain percent change in the risk of an adverse effect) (IRIS, 1995). Based on these values and the application of uncertainty factors to account for incomplete data and sensitive subgroups of the population, a reference dose is then generated. Exposure to a level above the RfD does not mean that adverse effects will occur, only that the possibility of adverse effects occurring has increased (IRIS, 1993).

The first U.S. EPA RfD for methylmercury was developed in 1985 and set at $3x10^{-4}$ mg/kg-day (U.S. EPA, 1997). This RfD was based, in part, on a World Health Organization (WHO) report summarizing data obtained from several early epidemiological studies on the Iraqi and Japanese methylmercury poisoning outbreaks (WHO, 1976). WHO found that the earliest symptoms of methylmercury intoxication (paresthesias) were reported at blood and hair concentrations ranging from 200-500 μg/L and 50-125 μg/g, respectively, in adults. In cases where ingested mercury dose could be estimated (based, for example, mercury concentration in contaminated bread and number of loaves consumed daily), an empirical correlation between blood and/or hair mercury concentrations and onset of symptoms was obtained. From these studies, WHO determined that methylmercury exposure equivalent to long-term daily intake of 3-7 μg/kg body weight in adults was associated with an approximately 5 percent prevalence of paresthesias (WHO, 1976). U.S. EPA further cited a study by Clarkson et al. (1976) to support the range of blood mercury concentrations at which paresthesias were first observed in sensitive members of the adult population. This study found that a small percentage of Iraqi adults exposed to methylmercury-treated seed grain developed paresthesias at blood levels ranging from 240 to 480 μg/L. The low end of this range was considered to be a LOAEL and was estimated to be equivalent to a dosage of 3 μg/kg-day. U.S. EPA applied a 10-fold uncertainty factor to the LOAEL to reach what was expected to be the NOAEL. Because the LOAEL was observed in sensitive individuals in the population after chronic exposure, additional uncertainty factors were not considered necessary for exposed adults (U.S. EPA, 1997).

Although this RfD was derived based on effects in adults, even at that time researchers were aware that the fetus might be more sensitive to methylmercury (WHO, 1976). It was not until 1995, however, that U.S. EPA had sufficient data from Marsh et al. (1987) and Seafood Safety (1991) to develop an oral RfD based on methylmercury exposures during the prenatal stage of development (IRIS, 1995). Marsh et al. (1987) collected and summarized data from 81 mother and child pairs where the child had been exposed to methylmercury *in utero* during the Iraqi epidemic. Maximum mercury concentrations in maternal hair during gestation were correlated with clinical signs in the offspring such as cerebral palsy, altered muscle tone and deep tendon reflexes, and delayed developmental milestones that were observed over a period of several years after the poisoning. Clinical effects incidence tables included in the critique of the risk assessment for methylmercury conducted by U.S. FDA (Seafood Safety, 1991) provided dose-response data for a benchmark dose approach to the RfD, rather than the previously used NOAEL/LOAEL method. The BMDL was based on a maternal hair mercury concentration of 11 parts per million (ppm). From that, an average blood mercury concentration of 44 μg/L was estimated based on a hair: blood concentration ratio of 250:1. Blood mercury concentration was, in turn, used to calculate a daily oral dose of 1.1 μg/kg-day, using an equation that assumed steady-state conditions and first-order kinetics for mercury. An uncertainty factor of 10 was applied to this dose to account for variability in the biological half-life of methylmercury, the lack of a two-generation reproductive study and insufficient data on the effects of exposure duration on developmental neurotoxicity and adult paresthesias. The oral RfD was then calculated to be 1×10^{-4} mg/kg-day, to protect against developmental neurological abnormalities in infants (IRIS, 1995). This fetal RfD was deemed protective of infants and sensitive adults.

The two previous RfDs for methylmercury were developed using data from high-dose poisoning events. Recently, the National Academy of Sciences was directed to provide scientific guidance to U.S. EPA on the development of a new RfD for methylmercury (NAS/NRC, 2000). Three large prospective epidemiological studies were evaluated in an attempt to provide more precise dose-response estimates for methylmercury at chronic low-dose exposures, such as might be expected to occur in the United States. The three studies were conducted in the Seychelles Islands (Davidson et al., 1995, 1998), the Faroe Islands (Grandjean et al., 1997, 1998, 1999), and New Zealand (Kjellstrom et al., 1986, 1989). The residents of these areas were selected for study because their diets rely heavily on consumption of fish and marine mammals, which provide a continual source of methylmercury exposure (NAS/NRC, 2000).

Although estimated prenatal methylmercury exposures were similar among the three studies, subtle neurobehavioral effects in children were found to be associated with maternal methylmercury dose in the Faroe Islands and New Zealand studies, but not in the Seychelle Islands study. The reasons for this discrepancy were unclear; however, it may have resulted from differences in sources of exposure (marine mammals and/or fish), differences in exposure pattern, differences in neurobehavioral tests administered and age at testing, the effects of confounding variables, or issues of statistical analysis (NAS/NRC, 2000). The National Academy of Sciences report supported the current U.S. EPA RfD of $1x10^{-4}$ mg/kg-day for fetuses, but suggested that it should be based on the Faroe Islands study rather than Iraqi data.

U.S. EPA recently published a new RfD document that arrives at the same numerical RfD as the previous fetal RfD, using data from all three recent epidemiological studies while placing emphasis on the Faroe Island data (IRIS, 2001). In order to develop an RfD, U.S. EPA used several test scores from the Faroes data, rather than a single measure for the critical endpoint as is customary (IRIS, 2001). U.S. EPA developed BMDLs utilizing test scores for several different neuropsychological effects with cord blood as the biomarker. The BMDLs for different neuropsychological effects in the Faroes study ranged from 46-79 μg mercury/liter blood. U.S. EPA then chose a one-compartment model for conversion of cord blood to ingested maternal dose, which resulted in estimated maternal mercury exposures of 0.857-1.472 μg/kg-day (IRIS, 2001). An uncertainty factor of ten was applied to the oral doses corresponding to the range of BMDLs to account for interindividual toxicokinetic variability in ingested dose estimation from cord-blood mercury levels and pharmacodynamic variability and uncertainty, leading to an RfD of $1x10^{-4}$ mg/kg-day (IRIS, 2001). In support of this RfD, U.S. EPA found that benchmark dose analysis of several neuropsychological endpoints from the Faroe Island and New Zealand studies, as well as an integrative analysis of all three epidemiological studies, converged on an RfD of $1x10^{-4}$ mg/kg-day (IRIS, 2001). U.S. EPA (IRIS, 2001) now considers this RfD to be protective for all populations. However, in their joint Federal Advisory for Mercury in Fish, U.S. EPA and U.S. FDA only apply this RfD to women who are pregnant or might become pregnant, nursing mothers, and young children (U.S. EPA, 2004) (see Guidelines for Fish Consumption section for further details).

OEHHA finds that there is convincing evidence that the fetus is more sensitive than adults to the neurotoxic and subtle neuropsychological effects of methylmercury. As noted previously, during the Japanese and Iraqi methylmercury poisoning outbreaks, significant neurological toxicity occurred to the fetus even in the absence of symptoms in the mother. In later epidemiological studies at lower exposure levels (e.g., in the Faroe Islands), these differences in maternal and fetal susceptibility to methylmercury toxicity were also observed. Recent evidence has shown that the nervous system continues to develop through adolescence (see, for example, Giedd et al., 1999; Paus et al., 1999; Rice and Barone, 2000). As such, it is likely that exposure to a neurotoxic agent during this time may damage neural structure and function (Adams et al., 2000), which may not become evident for many years (Rice and Barone, 2000). Thus, OEHHA considers the RfD based on subtle neuropsychological effects following fetal exposure to be the best estimate of a protective daily exposure level for pregnant or nursing women and children aged 17 years and younger.

OEHHA also recognizes that fish can play an important role in a healthy diet, particularly when it replaces other, higher fat sources of protein. Numerous human and animal studies have shown that fish oils have beneficial cardiovascular and neurological effects (see, for example, Harris and Isley, 2001; Iso et al., 2001; Cheruka et al., 2002; Mori and Beilin et al., 2001; Daviglus et al., 1997; von Schacky et al., 1999; Valagussa et al., 1999; Moriguchi et al., 2000; Lim and Suzuki, 2000). Nonetheless, the hazards of methylmercury that may be present in fish, particularly to developing fetuses and children, cannot be overlooked. When contaminants are present in a specific food that can be differentially avoided, it is not necessary to treat all populations in the most conservative manner to protect the most sensitive population. Sport fish consumption advisories are such a case. Exposure advice can be tailored to specific risks and benefits for populations with different susceptibilities so that each population is protected without undue burden to the other. Fish consumption guidelines utilize the best scientific data available to provide the most relevant advice and protection for all potential consumers.

In an effort to address the risks of methylmercury contamination in different populations as well as the cardiovascular and neurological benefits of fish consumption, two separate RfDs will be used to assess risk for different population groups. OEHHA has formerly used separate methylmercury RfDs for adults and pregnant women to formulate advisories for methylmercury contamination of sport fish (Stratton et al., 1987). Additionally, the majority of states issues separate consumption advice for sensitive (e.g., children) and general population groups. OEHHA chooses to use both the current and previous U.S. EPA references doses for two distinct population groups. For these safe eating guidelines, the current RfD of 0.1 µg/kg-day, based on effects in infants will be used for women of childbearing age and children aged 17 and younger. The previous RfD of 0.3 µg/kg-day, based on effects in adults, will be used for women beyond their childbearing years and men.

MERCURY LEVELS IN FISH FROM TRINITY LAKE, LEWISTON LAKE, CARRVILLE POND, THE TRINITY RIVER UPSTREAM FROM TRINITY LAKE, AND THE EAST FORK TRINITY RIVER

In general, mercury concentrations in fish and other biota are dependent on the mercury level of the environment in which they reside. However, there are many factors that affect the accumulation of mercury in fish tissue. Fish species and age (as inferred from length) are known to be important determinants of tissue mercury concentration (WHO, 1989; 1990). Fish at the highest trophic levels (i.e., top predatory fish) generally have the highest levels of mercury. Additionally, because the biological half-life of methylmercury in fish is much longer (approximately 2 years) than it is in mammals, tissue concentrations increase with increased duration of exposure (Krehl, 1972; Stopford and Goldwater, 1975; Tollefson and Cordle, 1986). Thus, within a given species, tissue methylmercury concentrations are expected to increase with increasing age and length. The accumulation of mercury in fish is also dependent on environmental pH, redox potential, temperature, alkalinity, buffering capacity, suspended sediment load, and geomorphology in individual water bodies (Andren and Nriagu, 1979; Berlin, 1986; WHO, 1989).

The mean mercury concentration, length, and sample size for each species collected and analyzed from Trinity Lake and the Trinity River watershed are presented in Table 1. Although this region contains many separate water bodies, fish can migrate between some of the different sites (e.g., between the East Fork Trinity River and Trinity Lake). Fish can also migrate out of Lewiston or Trinity lakes to downstream sites; however, the reverse cannot occur. Data for rainbow trout showed that this species contained considerably lower levels of mercury from Lewiston Lake, Carrville Pond, and the Trinity River upstream of Trinity Lake (including Coffee Creek near the confluence of the Trinity River) (see Table 1) compared to other water bodies evaluated within the Trinity River watershed. Thus, rainbow trout from those three sites were evaluated separately. Complete descriptive statistics for each fish species in this study can be found in Appendix 3; individual mercury concentrations and lengths of legal/edible size fish from which species means were generated can be found in Appendix 4. Individual mercury concentrations and lengths for fish below legal/edible size fish are presented in Appendix 5, although these fish were not used for development of the safe eating guidelines.

Mercury concentrations in legal/edible size fish of all species ranged from 0.02 ppm in a rainbow trout to 1.23 ppm in a largemouth bass. For those species with sufficient sample size to adequately represent mercury levels ($n \geq 9$ fish), the following mercury concentrations and fish lengths were reported for edible/legal-sized fish: mean mercury concentration for largemouth bass was 0.55 ppm, with a range of 0.25 to 1.23 ppm. Largemouth bass ranged in length from 307 to 489 mm, with a mean of 385 mm. Mercury concentrations in smallmouth bass ranged from 0.17 ppm to 0.68 ppm, with a mean of 0.39 ppm. Lengths in this species ranged from 305 mm to 355 mm and averaged 319 mm. Mercury concentrations in white catfish ranged from 0.03 to 0.59 ppm, with a mean of 0.11 ppm; lengths in this species ranged from 250 to 370 mm, with a mean of 298 mm. Rainbow trout from all sites had a mean mercury concentration of 0.11 ppm (range: 0.02 to 0.41 ppm) and a mean length of 299 mm (range: 200 to 459 mm) at all sites. However, rainbow trout from Lewiston Lake, Carrville Pond, and the Trinity River upstream of Trinity Lake had mean mercury concentrations of 0.04, 0.02, and 0.07 ppm, respectively. Brown trout had a mean mercury concentration of 0.07 ppm (range: 0.06 to 0.09 ppm) and a mean length of 300 mm (range: 277 to 322 mm). Black bullhead, brown bullhead, brook trout, Chinook salmon, and green sunfish were not collected in sufficient numbers to provide a representative sample. Assessment of those species, and other fish that may exist in the lakes and rivers, are addressed in the guidelines for fish consumption section of this report.

GUIDELINES FOR FISH CONSUMPTION

Guidance tissue levels have been developed that relate the number and size of recommended fish meals to methylmercury concentrations found in fish (Table 2). OEHHA has developed guidance levels for mercury (Brodberg and Klasing, 2003) similar to risk-based consumption limits recommended by U.S. EPA (U.S. EPA, 2000b). These guidance values were designed so that individuals consuming no more than a preset number of meals should not exceed the RfD for methylmercury. Meal sizes are based on a standard 8-ounce (227 g) portion of uncooked fish (approximately 6 ounces after cooking) for adults who weigh approximately 70 kg or approximately 160 lbs. OEHHA's general advice allows fishers to consume up to three meals per week without exceeding the reference dose for a specific contaminant (e.g., mercury) (see Appendix 2 for additional general advice). Twelve meals per month is representative of an upper bound consumption rate for frequent sport fish consumers in California (Gassel, 2001). OEHHA begins issuing site-specific consumption advice if data indicate that consumption of twelve meals per month is potentially hazardous. This advice begins for sensitive populations when the methylmercury concentration exceeds 0.08 ppm. Guidance tissue levels for women beyond their childbearing years and men are approximately three times higher than for sensitive populations because of the 3-fold higher RfD level used for this population group.

Comparison of mean mercury concentrations in several fish species in Trinity Lake and selected water bodies in the Trinity River watershed with the guidance tissue levels for mercury indicates that issuance of safe eating guidelines is appropriate for these water bodies. Consumers should be informed of the potential hazards from eating certain fish from this area, particularly those hazards relating to the developing fetus and children. All individuals, especially women of childbearing age and children aged 17 and younger, are advised to limit their fish consumption to reduce methylmercury ingestion to a level near the RfD.

Fish consumption guidelines are appropriate whenever there are sufficient data to suggest that adverse health effects may occur from unrestricted consumption of individual fish species from certain sites. For Trinity Lake, sample size was sufficient to provide safe eating guidelines for largemouth bass, smallmouth bass, white catfish, brown trout, and rainbow trout. For Lewiston Lake, Carrville Pond, and the Trinity River upstream of Trinity Lake (including Coffee Creek near the confluence of the Trinity River), sample size was sufficient to provide safe eating guidelines for rainbow trout. When sample size for a particular species from a water body is too small to assure a statistically representative sample, other information may be useful to help develop consumption recommendations for that species. When there are less than nine individual or three composite samples at a site for a given species, advice for that species may be extrapolated from data for other, similar species at that site to develop a weight-of-evidence approach. This method is acceptable when evaluation of the entire data set shows clear trends that justify the issuance of prudent, protective health advice even in the absence of a statistically representative sample. For example, it may be reasonable to provide consumption advice for a particular species with few data (e.g., brown trout) when adequate data are available for another, related fish species at that site (e.g., rainbow trout).

For Trinity Lake and other listed water bodies, supporting data were examined to determine whether, in an effort to be health protective, fish consumption advice could be offered even in cases where the sample size for an individual species at a specific site was less than nine fish. Supporting data were used when contamination data for another closely related species at a similar trophic level were available. Because different species of black bass often contain similar levels of the same contaminant in the same water body, it is recommended that consumers follow the advice for largemouth and smallmouth bass for all other bass species in Trinity Lake and the selected nearby water bodies.

Although only two Chinook salmon were analyzed for mercury content from this watershed, the relatively high mercury level (0.39 ppm) found in this species was similar to that seen for inland Chinook salmon in another northern California lake affected by mercury mining (Gassel, personal communication, 2004) and more than six times higher than is typical for river-run Chinook. Inland, planted salmon have a different life history and feeding behavior than migratory salmon (planted or wild) (Linn, personal communication, 2004). Inland salmon may become more piscivorous and thus accumulate mercury concentrations in their tissues similar to top predatory species, such as bass. It is therefore considered prudent that consumers follow the largemouth bass and smallmouth bass guidelines when consuming Chinook salmon from Trinity Lake as well as any rivers or creeks draining into Trinity Lake, until such time as more species-specific data become available. This does not apply to Chinook salmon from the Trinity River below Lewiston Lake.

As is the case with black bass, different species of trout caught in the same water body often contain similar mercury concentrations. This was largely the case for water bodies tested within the Trinity River watershed, although brown trout from Trinity Lake had slightly lower mercury levels than other trout from this lake, which could have led to less restrictive consumption advice for this species. However, because of potential difficulty in consumer identification of trout species as well as ease of communicating consumption advice, it is recommended that consumers follow the guidelines based on rainbow trout data for any trout species from Trinity Lake. Because, as noted above, rainbow trout from Lewiston Lake, Carrville Pond, and the Trinity River upstream of Trinity Lake (including Coffee Creek near the confluence of the Trinity River) had considerably lower mercury concentrations than rainbow trout from Trinity Lake and the East Fork Trinity River, consumers should follow the separate guidelines developed from rainbow trout data for all trout caught from these water bodies.

Based on the evaluation of all data from these water bodies, it is recommended that **women of childbearing age and children aged 17 and younger** limit consumption of the following species to no more one meal per month: any bass species or Chinook salmon from Trinity Lake (including rivers and creeks draining into Trinity Lake). Alternatively, this population may eat one meal per week of white catfish or trout from Trinity Lake or the East Fork Trinity River. The "Best Choices" (fish that can be eaten two or more times per week) for this population group are trout from Lewiston Lake, Carrville Pond, or the Trinity River upstream of Trinity Lake (including Coffee Creek). With the exception of ocean or river-run salmon or steelhead, which may be consumed more frequently, for other generally low mercury fish in these water bodies and throughout California where more restrictive advice is not already in place, it is recommended that women of childbearing age and children aged 17 and younger follow the recent U.S. EPA and U.S. FDA Joint Federal Advisory for Mercury in Fish. This advice recommends that women who are pregnant or may become pregnant, nursing mothers, and young children consume no more than one meal per week of locally caught fish, when no other advice is available, and eat no other fish that week (U.S. EPA, 2004).

OEHHA also recommends that **women of childbearing age and children aged 17 and younger** follow the Joint Federal Advisory for Mercury in Fish for commercial fish. This advisory recommends that these individuals do not eat shark, swordfish, king mackerel, or tilefish because of their high levels of mercury. It also recommends that these individuals can safely eat up to an average of 12 ounces (two average meals) per week of a variety of other cooked fish such as shrimp, canned light tuna, salmon, pollock, or (farm-raised) catfish. Albacore ("white") tuna is known to contain more mercury than canned light tuna; it is therefore recommended that no more than 6 ounces of albacore tuna be consumed per week. Also, if 12 ounces of cooked fish from a store or restaurant are eaten in a given week, then OEHHA recommends that sport fish caught at Trinity Lake or other California water bodies should not be consumed in the same week.

For **women beyond their childbearing years and men**, OEHHA recommends that consumption should be limited to one meal per week for all bass species or Chinook salmon from Trinity Lake only (including rivers and creeks draining into Trinity Lake). Alternatively, this population may eat three meals per week of all trout species or white catfish from any other site listed in the guidelines. Additionally, OEHHA recommends that women beyond their childbearing years and men take into account the commercial fish that they eat, especially high-mercury fish such as shark, swordfish, king mackerel, or tilefish. If they consume these species, they should reduce consumption of sport fish caught from Trinity Lake, Lewiston Lake, Carrville Pond, the Trinity River upstream from Trinity Lake, and the East Fork Trinity River, or other California water bodies accordingly.

It is very important to note that if an individual consumes multiple species or catches fish from more than one site, the recommended guidelines for different species and locations should not be combined. For example, if a person eats a meal of fish from the one meal per month category, he or she should not eat any other fish for at least one month. For fish in the meal per week category, an individual can eat one species of fish one week, and the same or a different species from the meal per week category the next week. Fish species in the three meals per week category can be combined in the same week. As an example, an adult male could eat one meal of white catfish and two meals of trout from Trinity Lake in the same week.

For general advice on how to limit your exposure to chemical contaminants in sport fish (e.g., eating smaller fish of legal size), see Appendix 2. It should be noted that, unlike the case for many fat-soluble organic contaminants (e.g., DDTs and PCBs), various cooking and cleaning techniques will not reduce the methylmercury content of fish. Meal sizes should be adjusted to body weight as described in the safe eating guidelines table.

SAFE EATING GUIDELINES

FISH CONSUMPTION FROM TRINITY LAKE, LEWISTON LAKE, CARRVILLE POND, THE TRINITY RIVER UPSTREAM OF TRINITY LAKE, AND THE EAST FORK TRINITY RIVER

Fish are nutritious and should be part of a healthy, balanced diet. It is important, however, to choose your fish wisely. OEHHA recommends that you choose fish to eat that are low in mercury, including the following fish caught from Trinity Lake, Lewiston Lake, Carrville Pond, the Trinity River upstream of Trinity Lake, and the East Fork Trinity River.

BEST CHOICES **EAT UP TO 3 TIMES PER WEEK**
Women of childbearing age and children 17 years and younger:
All trout from Lewiston Lake, Carrville Pond, or the Trinity River upstream of Trinity Lake
Women beyond childbearing age and men:
All trout or white catfish from any site

Because some other types of fish from these water bodies contain higher levels of mercury, OEHHA provides the following recommendations that you can follow to reduce the risks from exposure to mercury in fish.

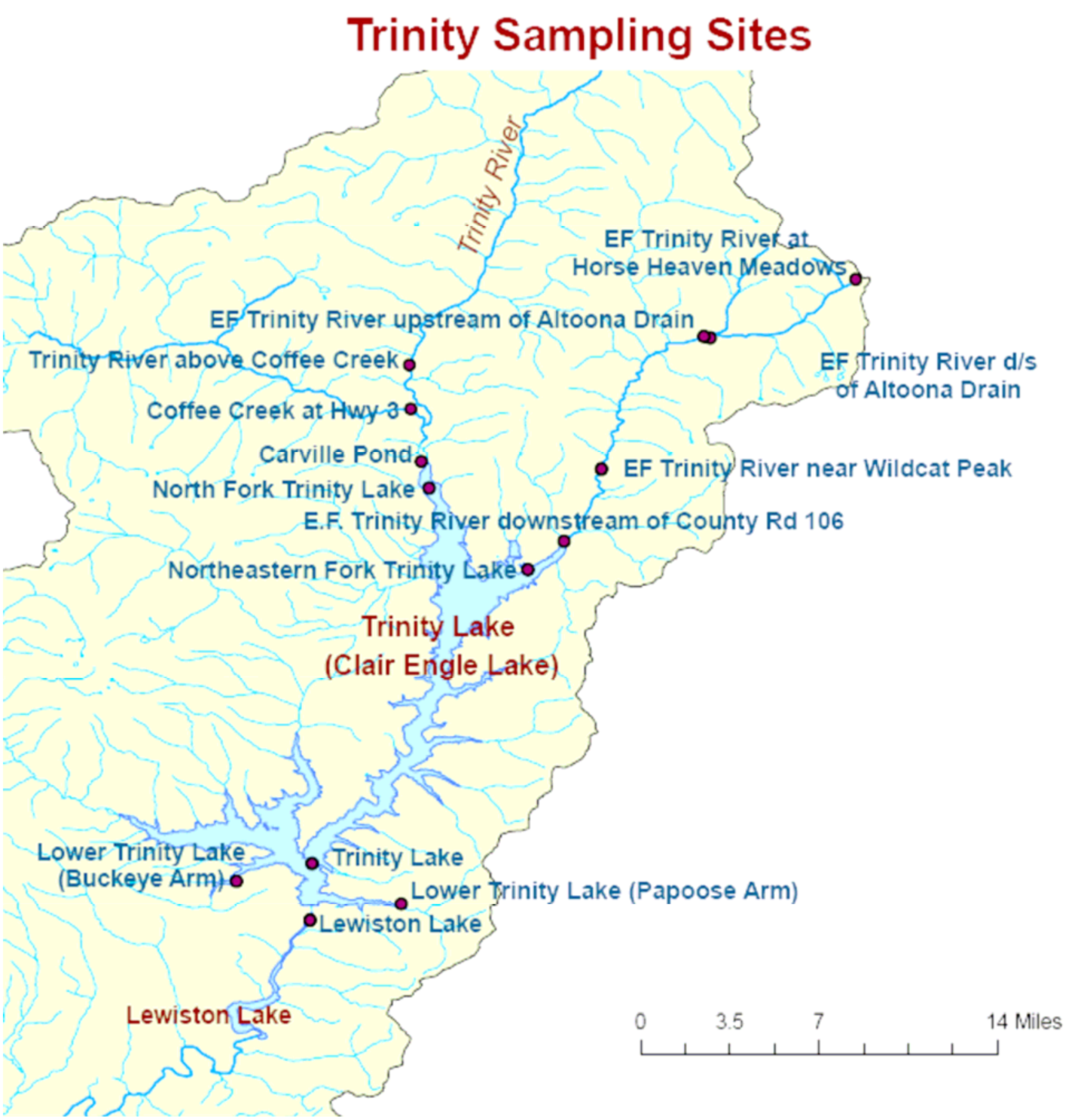
CAUTION **LIMIT CONSUMPTION TO NO MORE THAN:**	
Women of childbearing age and children 17 years and younger:	
Once a Month	Bass or Chinook (King) salmon from Trinity Lake ***or***
Once a Week	White catfish or trout from Trinity Lake and the East Fork Trinity River
Women beyond childbearing age and adult men:	
Once a Week	Bass or Chinook (King) salmon from Trinity Lake

CONTACT WITH THE WATER IS SAFE.
EAT SMALLER FISH OF LEGAL SIZE. Fish accumulate mercury as they grow.
SERVE SMALLER MEALS TO CHILDREN. Meal size is assumed to be 8 ounces for a 160-pound adult. If you weigh more or less than 160 pounds, add or subtract one ounce to your meal size, respectively, for each 20-pound difference in body weight.
DO NOT COMBINE FISH CONSUMPTION ADVICE. If you eat multiple species or catch fish from more than one area, the recommended guidelines for different species and locations should not be combined.
CONSIDER YOUR TOTAL FISH CONSUMPTION. Fish from many sources (including stores and restaurants) can contain elevated levels of mercury and other contaminants. If you eat commercial and/or sport fish with lower contaminant levels, you can safely eat more fish. The American Heart Association recommends that healthy adults eat at least two servings of fish per week. Commercial fish such as shrimp, king crab, scallops, farmed catfish, wild ocean salmon, oysters, tilapia, flounder, and sole generally contain some of the lowest levels of mercury, as do the local fish in the “Best Choices” table.
FISH FROM MANY OTHER WATER BODIES ARE KNOWN OR SUSPECTED TO HAVE ELEVATED MERCURY LEVELS. Not all water bodies in California have been tested. It is recommended that, with the exception of ocean or river-run salmon or steelhead, which may be eaten more frequently, generally low mercury fish from places without published guidelines should be eaten one meal per week or less.

RECOMMENDATIONS FOR FURTHER SAMPLING

To more clearly elucidate mercury contamination problems in Trinity Lake and the Trinity River watershed region, it is recommended that further fish sampling be done. In particular, emphasis should be placed on collecting data for popular fish species that were not previously sampled or had low sample size. For example, as brown trout, steelhead, coho, and Chinook salmon were not collected from the Trinity River or its tributaries, and Kokanee salmon were not collected from Trinity Lake, sampling at least nine fish of each species from the river and lake, when present, would provide data necessary for development of safe eating guidelines for these species. Additional Chinook salmon samples should also be collected from Trinity Lake. Bullhead, green sunfish and brook trout also were not collected in sufficient quantities to support development of consumption guidelines. Rainbow trout immediately downstream from mine drainage sites on the East Fork Trinity River appeared to have higher concentrations than trout from other sites; however, sample size did not permit the issuance of separate advice for this area. Further collection and analysis of edible-sized trout from the East Fork Trinity River downstream from mining sites are recommended. Collection of additional data will provide anglers with more information on their potential risks from consumption of high mercury fish as well as options for choosing lower mercury fish in these water bodies.

FIGURE 1



Trinity Sampling Sites
Trinity River
EF Trinity River at
Horse Heaven Meadows
EF Trinity River upstream of Altoona Drain
Trinity River above Coffee Creek
EF Trinity River d/s
of Altoona Drain
Coffee Creek at Hwy 3
Carville Pond
EF Trinity River near Wildcat Peak
North Fork Trinity Lake
E.F. Trinity River downstream of County Rd 106
Northeastern Fork Trinity Lake
Trinity Lake
(Clair Engle Lake)
Lower Trinity Lake
(Buckeye Arm)
Trinity Lake
Lower Trinity Lake (Papoose Arm)
Lewiston Lake
Lewiston Lake
0
3.5
7
14 Miles

Table 1. Overall Mean Mercury (Hg) Concentrations (ppm, wet weight) and Lengths (mm) of Fish from Trinity Lake and Selected Water Bodies in the Trinity River Watershed[1]			
	Hg (ppm)	Total Length (mm)[2]	Number of Fish
Black Bullhead	0.05	190	2
Brook Trout	0.15	220	2
Brown Bullhead	0.10	305	5
Brown Trout	0.07	300	15
Chinook Salmon	0.39	605	2
Green Sunfish	0.14	175	2
Largemouth Bass	0.55	385	24
Rainbow Trout – *All sites combined*	0.11	299	84
Lewiston Lake	0.04	410	10
Carrville Pond	0.02	291	10
Trinity River upstream of Trinity Lake	0.07	251	9
Trinity Lake and East Fork Trinity River	0.14	289	55
Smallmouth Bass	0.39	321	23
White Catfish	0.11	298	28

[1]Excludes fish below the following legal or edible size limits (mm):
Black bullhead: 170
Brook, brown, and rainbow trout: 200
Brown bullhead: 200
Green sunfish: 100
Largemouth and smallmouth bass: 305
Rainbow trout: 200
White catfish: 200

[2]Average total length of fish (the longest length from the tip of the tail fin to the tip of nose/mouth) is presented in Table 1. Some TSMP samples reported fork length only (the length from the tip of the nose/mouth to the fork of the tail), including 13 rainbow trout and two black bullhead. The conversion factor from fork length to total length for black bullhead was 1.03; for rainbow trout it was 1.025. Average fork length for the TSMP samples was 186 mm for black bullhead and 203 mm for rainbow trout.

Table 2. Guidance Tissue Levels (ppm total mercury or methylmercury*, wet weight) for Two Population Groups				
Population Group (RfD)	3 Meals/ Week** (90.0 g/day)	1 Meal/ Week (30.0 g/day)	1 Meal/ Month (7.5 g/day)	No Consumption
Women of childbearing age and children aged 17 and younger ($1x10^{-4}$ mg/kg-day)	≤ 0.08	>0.08-0.23	>0.23-0.93	>0.93
Women beyond their childbearing years and men ($3x10^{-4}$ mg/kg-day)	≤0.23	>0.23-0.70	>0.70-2.80	>2.80

*The values in this table are based on the assumption that 100% of total mercury measured in fish is methylmercury. This may not be true for shellfish, so methylmercury needs to be measured directly in these species for use in this table.

** OEHHA's general consumption advice protects fishers who eat up to three meals per week of sport fish. Twelve meals per month is representative of an upper bound consumption rate for frequent sport fish consumers in California (Gassel, 2001). OEHHA begins issuing site specific consumption advice if data indicate that consumption of twelve meals per month is potentially hazardous.

The recommended level for consumption of fish contaminated with a non-carcinogenic chemical such as methylmercury is below or equivalent to the chemical's reference level. People could eat more fish with a lower tissue concentration (before they exceed the reference level) than fish with a higher concentration. The following general equation can be used to calculate the fish tissue concentration (in mg/kg) at which the consumption exposure from a chemical with a non-carcinogenic effect is equal to the reference level for that chemical at any consumption level:

$$\text{Tissue concentration} = \frac{(\text{RfD mg/kg - day})(\text{kg Body Weight})(\text{RSC})}{\text{CR kg/day}}$$

where,

RfD = Chemical specific reference dose or other reference level
BW = Body weight of consumer
RSC = Relative source contribution of fish to total exposure (assumed to be 100%)
CR = Consumption rate as the daily amount of fish consumed

For example: $\frac{(1 \times 10^{-4} \text{ mg/kg-day})(70 \text{ kg body weight})\ (1)}{.030 \text{ kg/day}} = 0.23 \text{ mg/kg tissue}$

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APPENDIX 1. INTERIM FISH CONSUMPTION ADVISORY FOR TRINITY RIVER WATERSHED INCLUDING: Trinity Lake, Trinity River (above Trinity Lake), Coffee Creek, Carrville Pond, and the East Fork Trinity River and its tributaries

CONSUMPTION RECOMMENDATIONS July 2002

Eating sport fish in amounts slightly greater than what is recommended should not present a health hazard if only done occasionally, such as eating fish caught during an annual vacation.

High doses of methylmercury can affect people of all ages but it is safe to consume fish from Trinity Lake on a regular basis if you follow the consumption recommendations. Because the fetus and young children are more sensitive to the harmful effects of methylmercury, all women of childbearing age and children under age six should be particularly careful about following the consumption recommendations. The notification recommends that these groups consume less than the general adult population and children age six or older.

The limits given below for each species assume that no other contaminated fish is being eaten. If you consume several different listed species from the same area, or the same species from several areas, your total consumption still should not exceed the amount recommended for the fish with the fewest recommended meals. One should also realize that fish from other areas of the State may also be contaminated with mercury, and that the results of consuming all fish are cumulative. One simple approach is to just use the lowest recommended amount as a guideline to consumption. A meal for a person weighing 154 pounds is an eight-ounce serving (uncooked weight); meal size should be adjusted according to body weight, see chart below.

How big is a meal?

If you weigh….	Your meal size should not exceed
Pounds	Ounces*
19	1
39	2
58	3
77	4
96	5
116	6
135	7
154	8
173	9
193	10
212	11
231	12
250	13
270	14
289	15
308	16

**Sixteen ounces is equal to one pound, and meal sizes are for uncooked weight.*

Meals per month

The general adult population and children age 6 or older should not eat more than:

- 4 meals per month of bass and catfish, or
- 12 meals per month of other fish from Trinity River watershed areas listed above.

Women of childbearing age and young children (under the age of 6) should not eat more than:

- 1 meal per month of bass
- 2 meals per month of catfish, or
- 4 meals per month of other fish from the Trinity River watershed areas listed above.

If you have any further questions or concerns, please contact one the following agencies:

- Trinity County Health Services (530) 623-8209 or (800) 766-6147
- California EPA, Office of Environmental Health Hazard Assessment (916) 324-7572

Or see the OEHHA web site for more information on California sport fish consumption advisories: http://www.oehha.ca.gov/fish/general/index.html

APPENDIX 2. GENERAL ADVICE FOR SPORT FISH CONSUMERS

You can reduce your exposure to chemical contaminants in sport fish by following the recommendations below. Follow as many of them as you can to increase your health protection. This general advice is not meant to take the place of advisories for specific areas, but should be followed in addition to them. Sport fish in most water bodies in the state have not been evaluated for their safety for human consumption. This is why we strongly recommend following the general advice given below.

Fishing Practices

Chemical levels can vary from place to place. Your overall exposure to chemicals is likely to be lower if you eat fish from a variety of places rather than from one usual spot that might have high contamination levels.

Be aware that OEHHA may issue new advisories or revise existing ones. Consult the Department of Fish and Game regulations booklet or check with OEHHA on a regular basis to see if there are any changes that could affect you.

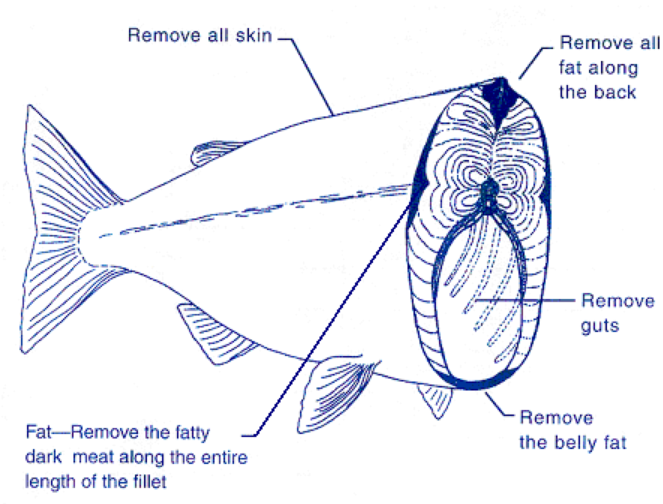
Consumption Guidelines

Fish Species: Some fish species have higher chemical levels than others in the same location. If possible, eat smaller amounts of several different types of fish rather than a large amount of one type that may be high in contaminants.

Fish Size: Smaller fish of a species will usually have lower chemical levels than larger fish in the same location because some of the chemicals may accumulate as the fish grows. It is advisable to eat smaller fish (of legal size).

Fish Preparation and Consumption

- Eat only the fillet portions. Do not eat the guts and liver because chemicals usually concentrate in those parts. Also, avoid frequent consumption of any reproductive parts such as eggs or roe.
- Many chemicals are stored in the fat. To reduce the levels of these chemicals, skin the fish when possible and trim any visible fat.
- Use a cooking method such as baking, broiling, grilling, or steaming that allows the juices to drain away from the fish. The juices will contain chemicals in the fat and should be thrown away. Preparing and cooking fish in this way can remove 30 to 50 percent of the chemicals stored in fat. If you make stews or chowders, use fillet parts.
- Raw fish may be infested by parasites. Cook fish thoroughly to destroy the parasites.



Advice For Pregnant Women, Women of Childbearing Age, and Children

Children and fetuses are more sensitive to the toxic effects of methylmercury, the form of mercury of health concern in fish. For this reason, OEHHA's advisories that are based on mercury provide special advice for women of childbearing age and children. Women should follow this advice throughout their childbearing years.

The U.S. Food and Drug Administration (FDA) is responsible for commercial seafood safety. FDA has issued the following advice about the risks of mercury in fish to pregnant women and women of childbearing age who may become pregnant. FDA advises these women not to eat shark, swordfish, king mackerel, or tilefish. FDA also advises that it is prudent for nursing mothers and young children not to eat these fish as well.

The U.S. Environmental Protection Agency has also issued national advice to protect women who are pregnant or may become pregnant, nursing mothers, and young children against consuming excessive mercury in fish. They recommend that these individuals eat no more than one meal per week of non-commercial freshwater fish caught by family and friends.

National advice for women and children on mercury in fish is available from the U.S. Environmental Protection Agency at *www.epa.gov/waterscience/fishadvice/advice.html* and the U.S. Food and Drug Administration at *www.cfsan.fda.gov/~dms/admehg.html*

OEHHA OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

Methylmercury in Sport Fish: Information for Fish Consumers

Methylmercury is a form of mercury that is found in most freshwater and saltwater fish. In some lakes, rivers, and coastal waters in California, methylmercury has been found in some types of fish at concentrations that may be harmful to human health. The Office of Environmental Health Hazard Assessment (OEHHA) has issued health advisories to fishers and their families giving recommendations on how much of the affected fish in these areas can be safely eaten. In these advisories, women of childbearing age and children are encouraged to be especially careful about following the advice because of the greater sensitivity of fetuses and children to methylmercury.

Fish are nutritious and should be a part of a healthy, balanced diet. As with many other kinds of food, however, it is prudent to consume fish in moderation. OEHHA provides advice to the public so that people can continue to eat fish without putting their health at risk.

Where does methylmercury in fish come from?

Methylmercury in fish comes from mercury in the aquatic environment. Mercury, a metal, is widely found in nature in rock and soil, and is washed into surface waters during storms. Mercury evaporates from rock, soil, and water into the air, and then falls back to the earth in rain, often far from where it started. Human activities redistribute mercury and can increase its concentration in the aquatic environment. The coastal mountains in northern California are naturally rich in mercury in the form of cinnabar ore, which was processed to produce quicksilver, a liquid form of inorganic mercury. This mercury was taken to the Sierra Nevada, Klamath mountains, and other regions, where it was used in gold mining. Historic mining operations and the remaining tailings from abandoned mercury and gold mines have contributed to the release of large amounts of mercury into California's surface waters. Mercury can also be released into the environment from industrial sources, including the burning of fossil fuels and solid wastes, and disposal of mercury-containing products.

Once mercury gets into water, much of it settles to the bottom where bacteria in the mud or sand convert it to the organic form of methylmercury. Fish absorb methylmercury when they eat smaller aquatic organisms. Larger and older fish absorb more methylmercury as they eat other fish. In this way, the amount of methylmercury builds up as it passes through the food chain. Fish eliminate methylmercury slowly, and so it builds up in fish in much greater concentrations than in the surrounding water. Methylmercury generally reaches the highest levels in predatory fish at the top of the aquatic food chain.

How might I be exposed to methylmercury?

Eating fish is the main way that people are exposed to methylmercury. Each person's exposure depends on the amount of methylmercury in the fish that they eat and how much and how often they eat fish.

Women can pass methylmercury to their babies during pregnancy, and this includes methylmercury that has built up in the mother's body even before pregnancy. For this reason, women of childbearing age are encouraged to be especially careful to follow consumption advice, even if they are not pregnant. In addition, nursing mothers can pass methylmercury to their child through breast milk.

You may be exposed to inorganic forms of mercury through dental amalgams (fillings) or accidental spills, such as from a broken thermometer. For most people, these sources of exposure to mercury are minor and of less concern than exposure to methylmercury in fish.

At what locations in California have elevated levels of mercury been found in fish?

Methylmercury is found in most fish, but some fish and some locations have higher amounts than others. Methylmercury is one of the chemicals in fish that most often creates a health concern. Consumption advisories due to high levels of methylmercury in fish have been issued in about 40 states. In California, methylmercury advisories have been issued for San Francisco Bay and the Delta; Tomales Bay in Marin County; and at the following inland lakes: Lake Nacimiento in San Luis Obispo County; Lake Pillsbury and Clear Lake in Lake County; Lake Berryessa in Napa County; Guadalupe Reservoir and associated reservoirs in Santa Clara County; Lake Herman in Solano County; San Pablo Reservoir in Contra Costa County; Black Butte Reservoir in Glenn and Tehama Counties; Trinity Lake in Trinity County; and certain lakes and river stretches in the Sierra Nevada foothills in Nevada, Placer, and Yuba counties. Other locations may be added in the future as more fish and additional water bodies are tested.

How does methylmercury affect health?

Much of what we know about methylmercury toxicity in humans stems from several mass poisoning events that occurred in Japan during the 1950s and 1960s, and Iraq during the 1970s. In Japan, a chemical factory discharged vast quantities of mercury into several bays near fishing villages. Many people who consumed large amounts of fish from these bays became seriously ill or died over a period of several years. In Iraq, thousands of people were poisoned by eating contaminated bread that was mistakenly made from seed grain treated with methylmercury.

From studying these cases, researchers have determined that the main target of methylmercury toxicity is the central nervous system. At the highest exposure levels experienced in these poisonings, methylmercury toxicity symptoms included such nervous system effects as loss of coordination, blurred vision or blindness, and hearing and speech impairment. Scientists also discovered that the developing nervous systems of fetuses are particularly sensitive to the toxic effects of methylmercury. In the Japanese outbreak, for example, some fetuses developed methylmercury toxicity during pregnancy even when their mothers did not. Symptoms reported in the Japan and Iraq epidemics resulted from methylmercury levels that were much higher than what fish consumers in the U.S. would experience.

Individual cases of adverse health effects from heavy consumption of commercial fish containing moderate to high levels of methylmercury have been reported only rarely. Nervous system symptoms reported in these instances included headaches, fatigue, blurred vision, tremor, and/or some loss of concentration, coordination, or memory. However, because there was no clear link between the severity of symptoms and the amount of mercury to which the person was exposed, it is not possible to say with certainly that these effects were a consequence of methylmercury exposure and not the result of other health problems. The most subtle symptoms in adults known to be clearly associated with methylmercury toxicity are numbness or tingling in the hands and feet or around the mouth.

In recent studies of high fish-eating populations in different parts of the world, researchers have been able to detect more subtle effects of methylmercury toxicity in children whose mothers frequently ate seafood containing low to moderate mercury concentrations during their pregnancy. Several studies found slight decreases in learning ability, language skills, attention and/or memory in some of these children. These effects were not obvious without using very specialized and sensitive tests. Children may have increased susceptibility to the effects of methylmercury through adolescence, as the nervous system continues to develop during this time.

Methylmercury builds up in the body if exposure continues to occur over time. Exposure to relatively high doses of methylmercury for a long period of time may also cause problems in other organs such as the kidneys and heart.

Can mercury poisoning occur from eating sport fish in California?

No case of mercury poisoning has been reported from eating California sport fish. The levels of mercury in California fish are much lower than those that occurred during the Japanese outbreak. Therefore, overt poisoning resulting from sport fish consumption in California would not be expected. At the levels of mercury found in California fish, symptoms associated with methylmercury are unlikely unless someone eats much more than what is recommended or is particularly sensitive. The fish consumption guidelines are designed to protect against subtle effects that would be difficult to detect but could still occur following unrestricted consumption of California sport fish. This is especially true in the case of fetuses and children.

Is there a way to reduce methylmercury in fish to make them safer to eat?

There is no specific method of cleaning or cooking fish that will significantly reduce the amount of methylmercury in the fish. However, fish should be cleaned and gutted before cooking because some mercury may be present in the liver and other organs of the fish. These organs should not be eaten.

In the case of methylmercury, fish size is important because large fish that prey upon smaller fish can accumulate more of the chemical in their bodies. It is better to eat the smaller fish within the same species, provided that they are legal size.

Is there a medical test to determine exposure to methylmercury?

Mercury in blood and hair can be measured to assess methylmercury exposure. However, this is not routinely done. Special techniques in sample collection, preparation, and analysis are required for these tests to be accurate. Although tests using hair are less invasive, they are also less accurate. It is important to consult with a physician before undertaking medical testing because these tests alone cannot determine the cause of personal symptoms.

How can I reduce the amount of methylmercury in my body?

Methylmercury is eliminated from the body over time provided that the amount of mercury taken in is reduced. Therefore, following the OEHHA consumption advice and eating less of the fish that have higher levels of mercury can reduce your exposure and help to decrease the levels of methylmercury already in your body if you have not followed these recommendations in the past.

What if I eat fish from other sources such as stores, restaurants, and other water bodies that may not have an advisory?

Most commercial fish have relatively low amounts of methylmercury and can be eaten safely in moderate amounts. However, several types of fish such as large, predatory, long-lived fish have high levels of methylmercury, and could cause overly high exposure to methylmercury if eaten often. The U.S. Food and Drug Administration (FDA) is responsible for the safety of commercial seafood. FDA advises that women who are pregnant or could become pregnant, nursing mothers, and young children not eat shark, swordfish, king mackerel, or tilefish.

FDA also advises that women of childbearing age and pregnant women may eat an average of 12 ounces of fish purchased in stores and restaurants each week. However, if 12 ounces of cooked fish from a store or restaurant are eaten in a given week, then fish caught by family or friends should not be eaten the same week. This is important to keep the total level of methylmercury contributed by all fish at a low level in the body. The FDA advice can be found at http://www.cfsan.fda.gov/~dms/admehg.html.

The United States Environmental Protection Agency (U.S. EPA) has issued the following advice for women and children who eat fish that are caught in freshwater bodies anywhere in the U.S. This advice should be followed for water bodies where OEHHA has not already issued more restrictive guidelines.

> "If you are pregnant or could become pregnant, are nursing a baby, or if you are feeding a young child, limit consumption of freshwater fish caught by family and friends to one meal per week. For adults, one meal is six ounces of cooked fish or eight ounces uncooked fish; for a young child, one meal is two ounces cooked fish or three ounces uncooked fish."

For more information on the nationwide advice, check the U.S. EPA Web Site at http://www.epa.gov/ost/fishadvice/advice.html.

In addition, OEHHA offers the following general advice that can be followed to reduce exposure to methylmercury in fish. Chemical levels can vary from place to place. Therefore, your overall exposure to chemicals is likely to be lower if you fish at a variety of places, rather than at one location that might have high contamination levels. Furthermore, some fish species have higher chemical levels than others in the same location. If possible, eat smaller amounts of several different types of fish rather than a large amount of one type that may be high in contaminants. Smaller fish of a species will usually have lower chemical levels than larger fish in the same location because some of the chemicals may become more concentrated in larger, older fish. It is advisable to eat smaller fish (of legal size) more often than larger fish. Cleaning and cooking fish in a manner that removes fat and organs is an effective way to reduce other contaminants that may be present in fish.

Where can I get more information?

The health advisories for sport fish are printed in the California Sport Fishing Regulations booklet, which is available wherever fishing licenses are sold. OEHHA also offers a booklet containing the advisories, and additional materials such as this fact sheet on related topics. For more information on fish contamination in California, contact:

Office of Environmental Health Hazard Assessment (OEHHA)
Pesticide and Environmental Toxicology Section (PETS)

1515 Clay St., 16th Floor
Oakland, California 94612
(510) 622-3170
FAX (510) 622-3218

P.O. Box 4010
Sacramento, California 95812-4010
(916) 327-7319
FAX (916) 327-7320

Additional information and documents related to fish advisories are available on the OEHHA Web Site at http://www.oehha.ca.gov/fish.html. County departments of environmental health may have more information on specific fishing areas.

updated June 2003

Appendix 3. Descriptive Statistics for Mercury Concentration (ppm, wet weight) and Length (mm) in fish From trinity Lake and selected water bodies in the trinity river watershed

Descriptive Statistics[1] for Mercury Concentration (ppm, wet weight) and Length (mm) for Legal/Edible-Size Fish																				
	Mercury ppm						**Total Length mm[2]**						**# Fish per Composite**							**Total # Fish**
Species	**Mean**	**Median**	**SD**	**Min**	**Max**	**CI[3]**	**Mean**	**Median**	**SD**	**Min**	**Max**	**CI[3]**	**n=1**	**n=2**	**n=3**	**n=4**	**n = 5**	**n=6**	**n=7**	
Black Bullhead	.05	.05	[4]	.05	.05	[4]	192	192	[4]	192	192	[4]	0	1	0	0	0	0	0	2
Brook Trout	.15	.15	.02	.13	.16	.00-.36	220	220	14	210	230	93-347	2	0	0	0	0	0	0	2
Brown Bullhead	.10	.08	.07	.03	.21	.01-.18	305	330	56	220	360	235-376	5	0	0	0	0	0	0	5
Brown Trout	.07	.07	.01	.06	.09	.07-.08	300	302	17	277	322	290-309	1	1	1	1	1	0	0	15
Chinook Salmon	.39	.39	.06	.35	.44	.00-.92	605	605	21	590	620	414-796	2	0	0	0	0	0	0	2
Green Sunfish	.14	.14	.04	.11	.16	.00-.45	175	175	7	170	180	111-239	2	0	0	0	0	0	0	2
Largemouth Bass	.55	.45	.29	.25	1.23	.43-.68	385	375	56	307	489	361-408	24	0	0	0	0	0	0	24
Rainbow Trout	.11	.07	.08	.02	.41	.09-.13	299	288	80	200	459	282-317	40	3	0	1	3	2	1	84
Lewiston Lake	.04	.04	.01	.03	.05	.04-.05	410	410	24	387	433	393-427	0	0	0	0	2	0	0	10
Carrville Pond	.02	.02	.01	.02	.04	.02-.03	291	288	19	260	325	277-305	10	0	0	0	0	0	0	10
Trinity River upstream of Trinity Lake	.07	.04	.05	.02	.19	.03-.11	251	242	46	206	358	215-286	9	0	0	0	0	0	0	9
Trinity Lake and East Fork Trinity River	.14	.13	.08	.03	.41	.12-.16	289	264	81	200	459	267-310	21	3	0	1	1	2	1	55
Smallmouth Bass	.39	.43	.13	.17	.68	.34-.45	321	319	14	305	355	315-328	18	0	0	0	1	0	0	23
White Catfish	.11	.07	.11	.03	.59	.06-.15	298	295	25	250	370	289-308	23	0	0	0	1	0	0	28

[1] Data weighted by number of individuals per sample.
[2] Average total lengths (of fish are presented in Appendix 3. Some TSMP samples reported fork length only. Average fork lengths for the TSMP samples were 186 mm for black bullhead and 203 mm for rainbow trout. The conversion factor for black bullhead was 1.03 (fork length times 1.03 = total length) and for rainbow trout 1.205 (fork length times 1.025 = total length).
[3] 95 percent Confidence Interval.
[4] Confidence Interval and Standard Deviation are omitted because Hg ppm and Length mm are constant.

APPENDIX 4. MERCURY VALUES OF INDIVIDUAL FISH TISSUE SAMPLES OF LEGAL/EDIBLE-SIZE FROM TRINITY WATERSHED

Common Name	Data Source	Collection Date	Site	#	Total Length (mm)	Fork Length (mm)	Total Weight (g)	Hg wet (ug/g)
Black Bullhead	TSMP	08/31/1992	Carrville Pond	2	192	186	100	.05
Brook Trout	USGS	09/07/2001	EF Trinity River at Horse Heaven Meadows	1	210	.	69	.16
Brook Trout	USGS	09/07/2001	EF Trinity River at Horse Heaven Meadows	1	230	.	145	.13
Brown Bullhead	USGS	11/09/2000	NF of Trinity Lake	1	220	.	152	.03
Brown Bullhead	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	278	.	370	.07
Brown Bullhead	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	330	.	698	.10
Brown Bullhead	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	339	.	734	.08
Brown Bullhead	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	360	.	695	.21
Brown Trout	TSMP	09/26/2002	Trinity Lake	5	302	.	280	.07
Brown Trout	TSMP	09/24/2002	Trinity Lake/North	4	277	.	.	.09
Brown Trout	TSMP	09/25/2002	Trinity Lake/North	1	285	.	.	.07
Brown Trout	TSMP	09/25/2002	Trinity Lake/North	2	312	.	.	.06
Brown Trout	TSMP	09/24/2002	Trinity Lake/North	3	322	.	.	.07
Chinook Salmon	TSMP	09/25/2002	Trinity Lake	1	620	.	3256	.35
Chinook Salmon	TSMP	09/24/2002	Trinity Lake/North	1	590	.	1978	.44
Green Sunfish	USGS	11/09/2000	NF of Trinity Lake	1	170	.	91	.11
Green Sunfish	USGS	11/09/2000	NF of Trinity Lake	1	180	.	114	.16
Largemouth Bass	TSMP	09/24/2002	Trinity Lake/North	1	350	.	908	.26
Largemouth Bass	USGS	05/16/2001	Lower Trinity Lake (Papoose Arm)	1	484	.	2427	.68
.Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	307	.	493	.25
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	310	.	507	.30
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	310	.	655	.34
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	315	.	593	.29
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	350	.	705	.36
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	355	.	865	.40
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	358	.	718	.74
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	385	.	977	.57
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	385	.	1041	.37
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	393	.	1302	.55
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	395	.	1155	.36
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	411	.	1411	.60
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	450	.	2023	.90
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	450	.	2089	.68
Largemouth Bass	USGS	05/17/2001	Northeastern Fork of Trinity Lake	1	349	.	650	.46
Largemouth Bass	USGS	05/17/2001	Northeastern Fork of Trinity Lake	1	352	.	651	.26
Largemouth Bass	USGS	05/17/2001	Northeastern Fork of Trinity Lake	1	353	.	738	.28
Largemouth Bass	USGS	05/17/2001	Northeastern Fork of Trinity Lake	1	365	.	744	.44
Largemouth Bass	USGS	05/17/2001	Northeastern Fork of Trinity Lake	1	408	.	1182	1.00
Largemouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	450	.	1936	1.01
Largemouth Bass	USGS	05/17/2001	Northeastern Fork of Trinity Lake	1	463	.	1978	.99
Largemouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	489	.	2438	1.23
Rainbow Trout	USGS	09/26/2000	Carrville Pond	1	260	.	209	.02
Rainbow Trout	USGS	09/12/2000	Carrville Pond	1	276	.	190	.04
Rainbow Trout	USGS	09/26/2000	Carrville Pond	1	280	.	262	.02
Rainbow Trout	USGS	09/26/2000	Carrville Pond	1	282	.	205	.03
Rainbow Trout	USGS	09/26/2000	Carrville Pond	1	283	.	276	.02
Rainbow Trout	USGS	09/26/2000	Carrville Pond	1	292	.	249	.02
Rainbow Trout	USGS	09/26/2000	Carrville Pond	1	296	.	328	.02
Rainbow Trout	USGS	09/26/2000	Carrville Pond	1	300	.	273	.02
Rainbow Trout	USGS	09/26/2000	Carrville Pond	1	315	.	320	.02
Rainbow Trout	USGS	09/26/2000	Carrville Pond	1	325	.	355	.03
Rainbow Trout	TSMP	09/25/2002	Trinity Lake/North	5	259	.	195	.06

Common Name	Data Source	Collection Date	Site	#	Total Length (mm)	Fork Length (mm)	Total Weight (g)	Hg wet (ug/g)
Rainbow Trout	TSMP	09/24/2002	Trinity Lake/North	2	264	.	.	.27
Rainbow Trout	TSMP	09/24/2002	Trinity Lake/North	2	325	.	337	.09
Rainbow Trout	TSMP	09/25/2002	Trinity Lake/North	6	339	.	427	.07
Rainbow Trout	TSMP	09/24/2002	Trinity Lake/North	2	435	.	751	.21
Rainbow Trout	TSMP	09/25/2002	Trinity Lake/North	4	459	.	987	.25
Rainbow Trout	USGS	09/12/2000	Coffee Creek at Hwy 3	1	206	.	84	.03
Rainbow Trout	USGS	09/12/2000	Coffee Creek at Hwy 3	1	218	.	105	.19
Rainbow Trout	USGS	09/12/2000	Coffee Creek at Hwy 3	1	229	.	126	.04
Rainbow Trout	USGS	09/12/2000	Coffee Creek at Hwy 3	1	242	.	146	.04
Rainbow Trout	USGS	09/12/2000	Coffee Creek at Hwy 3	1	358	.	391	.10
Rainbow Trout	USGS	08/12/2002	EF Trinity NR Wildcat Peak	1	202	.	73	.17
Rainbow Trout	USGS	08/12/2002	EF Trinity NR Wildcat Peak	1	216	.	92	.24
Rainbow Trout	USGS	09/06/2001	EF Trinity NR Wildcat Peak	1	220	.	118	.41
Rainbow Trout	TSMP	09/18/1991	EF Trinity River	7	203	198	92	.13
Rainbow Trout	TSMP	10/03/1990	EF Trinity River	6	214	209	120	.14
Rainbow Trout	USGS	09/06/2001	EF Trinity River downstream of County Rd 106	1	200	.	82	.09
Rainbow Trout	USGS	09/06/2001	EF Trinity River downstream of County Rd 106	1	210	.	95	.07
Rainbow Trout	USGS	09/06/2001	EF Trinity River downstream of County Rd 106	1	218	.	103	.14
Rainbow Trout	USGS	09/06/2001	EF Trinity River downstream of County Rd 106	1	227	.	128	.16
Rainbow Trout	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	294	.	277	.27
Rainbow Trout	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	344	.	409	.32
Rainbow Trout	USGS	09/11/2000	EF Trinity River upstream of Altoona Drain	1	200	.	76	.25
Rainbow Trout	TSMP	09/26/2002	Lewiston Lake	5	387	.	.	.03
Rainbow Trout	TSMP	09/26/2002	Lewiston Lake	5	433	.	1222	.05
Rainbow Trout	USGS	05/16/2001	Lower Trinity Lake (Papoose Arm)	1	332	.	302	.07
Rainbow Trout	USGS	05/16/2001	Lower Trinity Lake (Papoose Arm)	1	360	.	416	.04
Rainbow Trout	USGS	05/16/2001	Lower Trinity Lake (Papoose Arm)	1	379	.	496	.06
Rainbow Trout	USGS	11/09/2000	NF of Trinity Lake	1	238	.	129	.07
Rainbow Trout	USGS	11/09/2000	NF of Trinity Lake	1	295	.	248	.12
Rainbow Trout	USGS	11/09/2000	NF of Trinity Lake	1	309	.	302	.11
Rainbow Trout	USGS	11/09/2000	NF of Trinity Lake	1	310	.	290	.10
Rainbow Trout	USGS	11/09/2000	NF of Trinity Lake	1	345	.	343	.10
Rainbow Trout	USGS	11/09/2000	NF of Trinity Lake	1	364	.	443	.20
Rainbow Trout	USGS	11/09/2000	NF of Trinity Lake	1	375	.	485	.18
Rainbow Trout	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	315	.	339	.03
Rainbow Trout	USGS	09/12/2000	Trinity River Above Coffee Creek	1	216	.	97	.06
Rainbow Trout	USGS	09/12/2000	Trinity River Above Coffee Creek	1	258	.	181	.08
Rainbow Trout	USGS	09/12/2000	Trinity River Above Coffee Creek	1	259	.	161	.02
Rainbow Trout	USGS	09/12/2000	Trinity River Above Coffee Creek	1	269	.	200	.04
Smallmouth Bass	TSMP	09/25/2002	Trinity Lake/North	1	310	.	368	.66
Smallmouth Bass	TSMP	09/27/2002	Trinity Lake/North	1	310	.	369	.17
Smallmouth Bass	TSMP	09/27/2002	Trinity Lake/North	1	313	.	358	.22
Smallmouth Bass	TSMP	09/27/2002	Trinity Lake/North	1	313	.	378	.44
Smallmouth Bass	TSMP	09/27/2002	Trinity Lake/North	1	315	.	424	.31
Smallmouth Bass	TSMP	09/27/2002	Trinity Lake/North	1	318	.	375	.68
Smallmouth Bass	TSMP	09/27/2002	Trinity Lake/North	5	319	.	400	.43
Smallmouth Bass	TSMP	09/27/2002	Trinity Lake/North	1	338	.	465	.43
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Buckeye Arm)	1	308	.	360	.27
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Buckeye Arm)	1	329	.	494	.27
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Papoose Arm)	1	310	.	470	.26
Smallmouth Bass	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	305	.	495	.27
Smallmouth Bass	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	308	.	472	.34

Common Name	Data Source	Collection Date	Site	#	Total Length (mm)	Fork Length (mm)	Total Weight (g)	Hg wet (ug/g)
Smallmouth Bass	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	310	.	538	.54
Smallmouth Bass	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	325	.	583	.33
Smallmouth Bass	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	330	.	600	.32
Smallmouth Bass	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	349	.	706	.47
Smallmouth Bass	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	350	.	684	.37
Smallmouth Bass	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	355	.	829	.51
White Catfish	TSMP	09/25/2002	Trinity Lake	1	250	.	236	.03
White Catfish	TSMP	09/27/2002	Trinity Lake	1	285	.	359	.07
White Catfish	TSMP	09/27/2002	Trinity Lake	1	290	.	371	.04
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	265	.	.	.06
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	265	.	.	.11
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	272	.	.	.05
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	278	.	.	.06
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	278	.	.	.09
White Catfish	TSMP	09/25/2002	Trinity Lake/North	1	280	.	351	.05
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	285	.	.	.06
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	285	.	353	.23
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	290	.	365	.06
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	293	.	417	.09
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	295	.	391	.04
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	295	.	403	.05
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	298	.	428	.06
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	300	.	378	.07
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	308	.	435	.08
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	315	.	500	.07
White Catfish	TSMP	09/27/2002	Trinity Lake/North	5	316	.	490	.11
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	325	.	580	.06
White Catfish	TSMP	09/27/2002	Trinity Lake/North	1	330	.	556	.25
White Catfish	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	325	.	524	.59
White Catfish	USGS	11/09/2000	Northeastern Fork of Trinity Lake	1	370	.	713	.14

APPENDIX 5. MERCURY VALUES OF INDIVIDUAL FISH TISSUE SAMPLES BELOW LEGAL/EDIBLE-SIZE FROM TRINITY WATERSHED

Common Name	Data Source	Collection Date	Site	#	Total Length (mm)	Fork Length (mm)	Total Weight (g)	Hg wet (ug/g)
Brook Trout	USGS	09/07/2001	EF Trinity River at Horse Heaven Meadows	1	83	.	5	.120
Brook Trout	USGS	09/07/2001	EF Trinity River at Horse Heaven Meadows	1	91	.	7	.118
Brook Trout	USGS	09/07/2001	EF Trinity River at Horse Heaven Meadows	1	119	.	15	.094
Brook Trout	USGS	08/14/2002	EF Trinity River at Horse Heaven Meadows	1	133	.	26	.084
Brook Trout	USGS	08/14/2002	EF Trinity River at Horse Heaven Meadows	1	136	.	23	.088
Brook Trout	USGS	08/14/2002	EF Trinity River at Horse Heaven Meadows	1	137	.	28	.116
Brook Trout	USGS	08/14/2002	EF Trinity River at Horse Heaven Meadows	1	138	.	28	.062
Brook Trout	USGS	08/14/2002	EF Trinity River at Horse Heaven Meadows	1	143	.	27	.077
Brook Trout	USGS	09/07/2001	EF Trinity River at Horse Heaven Meadows	1	144	.	29	.096
Brook Trout	USGS	09/07/2001	EF Trinity River at Horse Heaven Meadows	1	148	.	32	.123
Brook Trout	USGS	09/07/2001	EF Trinity River at Horse Heaven Meadows	1	158	.	36	.225
Largemouth Bass	USGS	05/16/2001	Lower Trinity Lake (Buckeye Arm)	1	219	.	138	.137
Largemouth Bass	USGS	11/09/2000	NF of Trinity Lake	1	235	.	186	.119
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	260	.	248	.408
Largemouth Bass	USGS	05/17/2001	NF of Trinity Lake	1	303	.	488	.223
Largemouth Bass	USGS	05/17/2001	Northeastern Fork of Trinity Lake	1	280	.	334	.371
Rainbow Trout	USGS	09/07/2001	Crow Cr US from EF Trinity	1	108	.	14	.087
Rainbow Trout	USGS	09/07/2001	Crow Cr US from EF Trinity	1	110	.	13	.120
Rainbow Trout	USGS	09/07/2001	Crow Cr US from EF Trinity	1	115	.	16	.124
Rainbow Trout	USGS	09/07/2001	Crow Cr US from EF Trinity	1	127	.	20	.082
Rainbow Trout	USGS	09/07/2001	Crow Cr US from EF Trinity	1	129	.	24	.153
Rainbow Trout	USGS	08/13/2002	Crow Cr US from EF Trinity	1	130	.	22	.120
Rainbow Trout	USGS	09/07/2001	Crow Cr US from EF Trinity	1	130	.	23	.125
Rainbow Trout	USGS	08/13/2002	Crow Cr US from EF Trinity	1	131	.	20	.148
Rainbow Trout	USGS	08/13/2002	Crow Cr US from EF Trinity	1	132	.	22	.113
Rainbow Trout	USGS	09/07/2001	Crow Cr US from EF Trinity	1	132	.	25	.141
Rainbow Trout	USGS	08/13/2002	Crow Cr US from EF Trinity	1	133	.	27	.121
Rainbow Trout	USGS	09/07/2001	Crow Cr US from EF Trinity	1	134	.	24	.172
Rainbow Trout	USGS	08/13/2002	Crow Cr US from EF Trinity	1	143	.	33	.117
Rainbow Trout	USGS	09/07/2001	Crow Cr US from EF Trinity	1	145	.	29	.117
Rainbow Trout	USGS	08/13/2002	Crow Cr US from EF Trinity	1	150	.	32	.117
Rainbow Trout	USGS	09/07/2001	Crow Cr US from EF Trinity	1	160	.	42	.273
Rainbow Trout	USGS	08/13/2002	Crow Cr US from EF Trinity	1	161	.	47	.089
Rainbow Trout	USGS	08/13/2002	Crow Cr US from EF Trinity	1	165	.	44	.222
Rainbow Trout	USGS	08/13/2002	Crow Cr US from EF Trinity	1	176	.	52	.130
Rainbow Trout	USGS	08/13/2002	Crow Cr US from EF Trinity	1	186	.	66	.169
Rainbow Trout	USGS	09/06/2001	EF Trinity NR Wildcat Peak	1	103	.	10	.146
Rainbow Trout	USGS	09/06/2001	EF Trinity NR Wildcat Peak	1	108	.	11	.169
Rainbow Trout	USGS	09/06/2001	EF Trinity NR Wildcat Peak	1	113	.	13	.166
Rainbow Trout	USGS	09/06/2001	EF Trinity NR Wildcat Peak	1	119	.	15	.133
Rainbow Trout	USGS	08/12/2002	EF Trinity NR Wildcat Peak	1	121	.	15	.153

Common Name	Data Source	Collection Date	Site	#	Total Length (mm)	Fork Length (mm)	Total Weight (g)	Hg wet (ug/g)
Rainbow Trout	USGS	08/12/2002	EF Trinity NR Wildcat Peak	1	121	.	16	.177
Rainbow Trout	USGS	08/12/2002	EF Trinity NR Wildcat Peak	1	129	.	19	.120
Rainbow Trout	USGS	08/12/2002	EF Trinity NR Wildcat Peak	1	137	.	24	.203
Rainbow Trout	USGS	09/06/2001	EF Trinity NR Wildcat Peak	1	142	.	25	.159
Rainbow Trout	USGS	09/06/2001	EF Trinity NR Wildcat Peak	1	148	.	28	.175
Rainbow Trout	USGS	08/12/2002	EF Trinity NR Wildcat Peak	1	161	.	35	.172
Rainbow Trout	USGS	08/12/2002	EF Trinity NR Wildcat Peak	1	165	.	41	.157
Rainbow Trout	USGS	09/06/2001	EF Trinity NR Wildcat Peak	1	165	.	42	.261
Rainbow Trout	USGS	09/06/2001	EF Trinity NR Wildcat Peak	1	168	.	41	.177
Rainbow Trout	USGS	08/12/2002	EF Trinity NR Wildcat Peak	1	170	.	40	.110
Rainbow Trout	USGS	08/12/2002	EF Trinity NR Wildcat Peak	1	194	.	66	.157
Rainbow Trout	USGS	09/06/2001	EF Trinity NR Wildcat Peak	1	196	.	66	.161
Rainbow Trout	USGS	09/07/2001	EF Trinity River at Horse Heaven Meadows	1	115	.	15	.141
Rainbow Trout	USGS	08/14/2002	EF Trinity River at Horse Heaven Meadows	1	138	.	30	.137
Rainbow Trout	USGS	09/07/2001	EF Trinity River at Horse Heaven Meadows	1	169	.	34	.219
Rainbow Trout	USGS	08/14/2002	EF Trinity River at Horse Heaven Meadows	1	183	.	60	.224
Rainbow Trout	USGS	09/05/2001	EF Trinity River downstream of Altoona Drain	1	89	.	6	.193
Rainbow Trout	USGS	09/05/2001	EF Trinity River downstream of Altoona Drain	1	100	.	9	.134
Rainbow Trout	USGS	09/05/2001	EF Trinity River downstream of Altoona Drain	1	107	.	12	.168
Rainbow Trout	USGS	09/05/2001	EF Trinity River downstream of Altoona Drain	1	121	.	15	.169
Rainbow Trout	USGS	09/05/2001	EF Trinity River downstream of Altoona Drain	1	126	.	19	.143
Rainbow Trout	USGS	08/13/2002	EF Trinity River downstream of Altoona Drain	1	130	.	24	.179
Rainbow Trout	USGS	08/13/2002	EF Trinity River downstream of Altoona Drain	1	133	.	22	.172
Rainbow Trout	USGS	09/05/2001	EF Trinity River downstream of Altoona Drain	1	134	.	21	.138
Rainbow Trout	USGS	08/13/2002	EF Trinity River downstream of Altoona Drain	1	134	.	22	.335
Rainbow Trout	USGS	08/13/2002	EF Trinity River downstream of Altoona Drain	1	134	.	23	.174
Rainbow Trout	USGS	08/13/2002	EF Trinity River downstream of Altoona Drain	1	137	.	25	.188
Rainbow Trout	USGS	09/05/2001	EF Trinity River downstream of Altoona Drain	1	138	.	25	.177
Rainbow Trout	USGS	09/05/2001	EF Trinity River downstream of Altoona Drain	1	144	.	30	.192
Rainbow Trout	USGS	08/13/2002	EF Trinity River downstream of Altoona Drain	1	144	.	30	.141
Rainbow Trout	USGS	09/05/2001	EF Trinity River downstream of Altoona Drain	1	149	.	32	.183
Rainbow Trout	USGS	09/05/2001	EF Trinity River downstream of Altoona Drain	1	154	.	32	.188
Rainbow Trout	USGS	08/13/2002	EF Trinity River downstream of Altoona Drain	1	155	.	36	.227
Rainbow Trout	USGS	08/13/2002	EF Trinity River downstream of Altoona Drain	1	155	.	39	.216
Rainbow Trout	USGS	08/13/2002	EF Trinity River downstream of Altoona Drain	1	156	.	40	.224

Common Name	Data Source	Collection Date	Site	#	Total Length (mm)	Fork Length (mm)	Total Weight (g)	Hg wet (ug/g)
Rainbow Trout	USGS	08/13/2002	EF Trinity River downstream of Altoona Drain	1	160	.	42	.131
Rainbow Trout	USGS	09/11/2000	EF Trinity River downstream of Altoona Drain	1	160	.	50	.211
Rainbow Trout	USGS	09/11/2000	EF Trinity River downstream of Altoona Drain	1	173	.	52	.230
Rainbow Trout	USGS	09/11/2000	EF Trinity River downstream of Altoona Drain	1	176	.	53	.168
Rainbow Trout	USGS	09/06/2001	EF Trinity River downstream of County Rd 106	1	85	.	7	.098
Rainbow Trout	USGS	09/06/2001	EF Trinity River downstream of County Rd 106	1	87	.	7	.116
Rainbow Trout	USGS	09/06/2001	EF Trinity River downstream of County Rd 106	1	95	.	10	.155
Rainbow Trout	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	120	.	19	.071
Rainbow Trout	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	124	.	19	.088
Rainbow Trout	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	133	.	20	.142
Rainbow Trout	USGS	09/06/2001	EF Trinity River downstream of County Rd 106	1	136	.	25	.089
Rainbow Trout	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	141	.	25	.129
Rainbow Trout	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	148	.	31	.197
Rainbow Trout	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	165	.	46	.134
Rainbow Trout	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	168	.	56	.102
Rainbow Trout	USGS	09/06/2001	EF Trinity River downstream of County Rd 106	1	180	.	65	.105
Rainbow Trout	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	199	.	74	.104
Rainbow Trout	USGS	09/05/2001	EF Trinity River upstream of Altoona Drain	1	90	.	8	.130
Rainbow Trout	USGS	09/05/2001	EF Trinity River upstream of Altoona Drain	1	94	.	7	.082
Rainbow Trout	USGS	09/05/2001	EF Trinity River upstream of Altoona Drain	1	106	.	11	.143
Rainbow Trout	USGS	09/05/2001	EF Trinity River upstream of Altoona Drain	1	108	.	10	.124
Rainbow Trout	USGS	09/05/2001	EF Trinity River upstream of Altoona Drain	1	110	.	12	.128
Rainbow Trout	USGS	08/13/2002	EF Trinity River upstream of Altoona Drain	1	133	.	23	.178
Rainbow Trout	USGS	09/05/2001	EF Trinity River upstream of Altoona Drain	1	134	.	21	.190
Rainbow Trout	USGS	08/13/2002	EF Trinity River upstream of Altoona Drain	1	134	.	23	.128
Rainbow Trout	USGS	08/13/2002	EF Trinity River upstream of Altoona Drain	1	136	.	26	.143
Rainbow Trout	USGS	09/05/2001	EF Trinity River upstream of Altoona Drain	1	138	.	24	.128
Rainbow Trout	USGS	08/13/2002	EF Trinity River upstream of Altoona Drain	1	138	.	26	.160
Rainbow Trout	USGS	09/05/2001	EF Trinity River upstream of Altoona Drain	1	140	.	27	.186

Common Name	Data Source	Collection Date	Site	#	Total Length (mm)	Fork Length (mm)	Total Weight (g)	Hg wet (ug/g)
Rainbow Trout	USGS	08/13/2002	EF Trinity River upstream of Altoona Drain	1	141	.	29	.125
Rainbow Trout	USGS	08/13/2002	EF Trinity River upstream of Altoona Drain	1	142	.	27	.238
Rainbow Trout	USGS	08/13/2002	EF Trinity River upstream of Altoona Drain	1	144	.	31	.141
Rainbow Trout	USGS	09/05/2001	EF Trinity River upstream of Altoona Drain	1	148	.	29	.173
Rainbow Trout	USGS	08/13/2002	EF Trinity River upstream of Altoona Drain	1	152	.	36	.218
Rainbow Trout	USGS	08/13/2002	EF Trinity River upstream of Altoona Drain	1	162	.	40	.172
Rainbow Trout	USGS	09/05/2001	EF Trinity River upstream of Altoona Drain	1	165	.	44	.178
Rainbow Trout	USGS	08/13/2002	EF Trinity River upstream of Altoona Drain	1	175	.	58	.144
Rainbow Trout	USGS	09/11/2000	EF Trinity River upstream of Altoona Drain	1	189	.	72	.285
Rainbow Trout	USGS	09/11/2000	EF Trinity River upstream of Altoona Drain	1	198	.	83	.228
Rainbow Trout	USGS	11/09/2000	NF of Trinity Lake	1	.	.	215	.085
Rainbow Trout	USGS	11/09/2000	NF of Trinity Lake	1	194	.	65	.032
Rainbow Trout	USGS	09/07/2001	Tamarack Cr at USFS Rd 25	1	96	.	8	.062
Rainbow Trout	USGS	09/07/2001	Tamarack Cr at USFS Rd 25	1	101	.	10	.046
Rainbow Trout	USGS	09/07/2001	Tamarack Cr at USFS Rd 25	1	102	.	12	.143
Rainbow Trout	USGS	08/14/2002	Tamarack Cr at USFS Rd 25	1	110	.	13	.045
Rainbow Trout	USGS	09/07/2001	Tamarack Cr at USFS Rd 25	1	120	.	16	.048
Rainbow Trout	USGS	08/14/2002	Tamarack Cr at USFS Rd 25	1	121	.	17	.043
Rainbow Trout	USGS	08/14/2002	Tamarack Cr at USFS Rd 25	1	122	.	20	.053
Rainbow Trout	USGS	08/14/2002	Tamarack Cr at USFS Rd 25	1	125	.	18	.043
Rainbow Trout	USGS	09/07/2001	Tamarack Cr at USFS Rd 25	1	125	.	20	.055
Rainbow Trout	USGS	09/07/2001	Tamarack Cr at USFS Rd 25	1	126	.	21	.032
Rainbow Trout	USGS	09/07/2001	Tamarack Cr at USFS Rd 25	1	128	.	22	.056
Rainbow Trout	USGS	08/14/2002	Tamarack Cr at USFS Rd 25	1	130	.	23	.045
Rainbow Trout	USGS	08/14/2002	Tamarack Cr at USFS Rd 25	1	133	.	21	.049
Rainbow Trout	USGS	08/14/2002	Tamarack Cr at USFS Rd 25	1	133	.	26	.033
Rainbow Trout	USGS	08/14/2002	Tamarack Cr at USFS Rd 25	1	139	.	23	.060
Rainbow Trout	USGS	08/14/2002	Tamarack Cr at USFS Rd 25	1	143	.	29	.042
Rainbow Trout	USGS	09/07/2001	Tamarack Cr at USFS Rd 25	1	144	.	28	.122
Rainbow Trout	USGS	08/14/2002	Tamarack Cr at USFS Rd 25	1	149	.	30	.074
Rainbow Trout	USGS	09/07/2001	Tamarack Cr at USFS Rd 25	1	167	.	44	.088
Rainbow Trout	USGS	09/07/2001	Tamarack Cr at USFS Rd 25	1	178	.	50	.113
Rainbow Trout	USGS	09/12/2000	Trinity River Above Coffee Creek	1	179	.	55	.071
Smallmouth Bass	TSMP	09/25/2002	Trinity Lake/North	1	280	.	260	.956
Smallmouth Bass	TSMP	09/25/2002	Trinity Lake/North	1	290	.	308	.276
Smallmouth Bass	TSMP	09/25/2002	Trinity Lake/North	1	295	.	312	.406
Smallmouth Bass	TSMP	09/25/2002	Trinity Lake/North	1	295	.	331	.248
Smallmouth Bass	TSMP	09/27/2002	Trinity Lake/North	1	300	.	334	.118
Smallmouth Bass	TSMP	09/25/2002	Trinity Lake/North	1	300	.	338	.755
Smallmouth Bass	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	76	.	6	.120
Smallmouth Bass	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	81	.	8	.253
Smallmouth Bass	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	89	.	11	.046
Smallmouth Bass	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	93	.	12	.153
Smallmouth Bass	USGS	08/12/2002	EF Trinity River downstream of County Rd 106	1	137	.	38	.213

Common Name	Data Source	Collection Date	Site	#	Total Length (mm)	Fork Length (mm)	Total Weight (g)	Hg wet (ug/g)
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Buckeye Arm)	1	268	.	244	.251
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Buckeye Arm)	1	275	.	292	.240
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Buckeye Arm)	1	275	.	298	.196
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Buckeye Arm)	1	289	.	310	.283
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Buckeye Arm)	1	295	.	350	.204
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Papoose Arm)	1	240	.	169	.165
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Papoose Arm)	1	279	.	297	.289
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Papoose Arm)	1	298	.	327	.296
Smallmouth Bass	USGS	05/16/2001	Lower Trinity Lake (Papoose Arm)	1	300	.	379	.257
Smallmouth Bass	USGS	05/15/2001	NF of Trinity Lake	1	172	.	56	.215
Smallmouth Bass	USGS	05/15/2001	NF of Trinity Lake	1	181	.	73	.238
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	188	.	67	.316
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	189	.	71	.165
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	194	.	93	.118
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	206	.	95	.795
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	208	.	114	.172
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	210	.	107	.271
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	220	.	121	.176
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	224	.	122	.195
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	224	.	129	.130
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	224	.	133	.708
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	229	.	134	.153
Smallmouth Bass	USGS	05/17/2001	Northeastern Fork of Trinity Lake	1	267	.	225	.768
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	280	.	267	.314
Smallmouth Bass	USGS	05/15/2001	Northeastern Fork of Trinity Lake	1	294	.	330	.264

APPENDIX 6. QUESTIONS AND COMMENTS ON THE DRAFT REPORT AND ADVISORY

Comments and questions were taken from the public workshop and the one written comment submitted to OEHHA during the original comment period. These are not necessarily reproduced verbatim, but related comments have been combined, reorganized and paraphrased for ease of communication.

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1. How do our guidance tissue levels compare with those used by U.S. EPA and U.S. FDA?

OEHHA's guidance tissue levels are similar to those recommended by U.S. EPA; however, U.S. EPA has more consumption categories than does OEHHA (e.g., 0.5, 2, 3, 4, 8, and 16 meals/month). U.S. FDA, on the other hand, sets action levels for some contaminants found in fish, which are levels above which FDA can take legal action to remove a food item from the market. Foods with contaminant levels below a specific action level should not be assumed to be safe for unlimited consumption.

2. Water is exported out of Trinity Lake. What impact might this have on Whiskeytown Lake and other nearby water bodies?

More information is needed to determine the impact of water exported from Trinity Lake on fish in Whiskeytown Lake. The best way to determine whether the fish in Whiskeytown Lake contain mercury levels similar to those in Trinity Lake is to collect and analyze a sufficient number of fish samples from the lake.

3. The number of samples for Chinook salmon used in the advisory was smaller than you recommend, yet you offered advice anyway. Why?

Yes, we recommend that at least nine fish of a species from a water body be sampled in order to provide a statistically valid representation of fish from that water body. In the case of Chinook salmon, we only had two samples. However, mercury levels in those two samples were more than six times the typical mercury concentration of river-run Chinook. We discussed the life cycle of land-locked salmon with fishery biologists and compared the mercury concentrations of Trinity Lake Chinook salmon with land-locked Chinook salmon in other northern California lakes affected by mercury. Because of the similarities in mercury concentrations among land-locked Chinook salmon, we chose to issue advice for this species in Trinity Lake.

4. The tourism economy is important from Trinity dam to the ocean – there is more fishing in the Trinity River than in the lake. There should be more of an attempt to differentiate fish in the lake versus the river in terms of their mercury concentrations. River-run salmon from Trinity River would not be expected to have different mercury concentrations than salmon from other river systems or commercial salmon. The advisory table is inconsistent in that it suggests limiting salmon from the river to one meal per week while also encouraging people to consume up to two meals per week of salmon or other low-mercury fish.

Yes, the draft advice for salmon highlighted an inconsistency between the federal advice for untested sport fish consumed by women of childbearing age and children and advice typically provided by the American Heart Association. As they are generally quite low in mercury, we have excluded ocean or river-run salmon or steelhead from the final guidelines. This information has been specifically added to the guidelines. Additionally, because of limited data, the Trinity Lake safe eating guidelines will no longer include consumption advice for fish of any species from Trinity River downstream of Trinity Lake.

5. The press release did not state that waters are safe to drink and swim in.

An effort is generally made to ensure that people recognize that drinking water and recreational activities such as swimming are not impacted by mercury levels in fish. This was not specified in the press release for this draft advisory; subsequent press releases, as well as the final advisory table and text, will highlight this fact.

6. Have studies been done on mercury levels in local salmon or on health effects related to mercury exposure that could potentially occur in subsistence fishers living on the Hoopa Reservation?

To the best of our knowledge, no studies of this nature have been done in this area. Local sampling studies are the best means of obtaining an accurate picture of local exposures.

7. Why weren't the Board of Supervisors or Chamber of Commerce members informed of this advisory? Why didn't the information about the public meeting come out in the newspaper sooner? There should be more local input on the advisories. Can the comment period be extended as many people did not receive adequate notification of the release of the draft advisory?

Local input is obtained during the comment period; the report cannot be pre-released before it becomes public. The Trinity County Department of Health and Human Services provided local contact names, including most members of the Board of Supervisors. A copy of the draft advisory was sent to these individuals on the same day that the draft advisory was released to the public. The local newspaper was also notified that day, but did not print an article about the public workshop until just before the workshop was held. After the workshop, the comment period was extended through June 30 as requested. Notification of this extension was sent to 38 contacts, including the Trinity County Chamber of Commerce, the Board of Supervisors, the County Department of Health and Human Services, the Hoopa and Karuk tribes, various state and federal agencies, as well as private citizens who provided us with an email address during the public workshop. The OEHHA Public Information Officer also contacted two local newspapers (including the Hoopa Tribe) to notify them of the extension period.

8. Is the health of local fish or wildlife adversely impacted by mercury concentrations?

Impacts to fish and wildlife health are outside the scope of this advisory and the knowledge of the authors.

9. Fish that are safe to consume up to 12 meals per week (the "green" category) should not be included in the "Health Advisory" table as it implies that there is something wrong with those fish. Also, "general advice" that applies to all untested California water bodies should be provided in a separate table and not included in the site-specific advice table.

Input from the public on ways to improve clarity of our communications is always greatly appreciated. OEHHA is now providing fish consumption advice in the form of "safe eating guidelines". These guidelines separate the advice into two tables: a "best choices" table, with fish that may be eaten two or more times per week, and a "caution" table, with fish that may only be eaten once a week or less. "General advice" is now limited to typically low mercury fish that are consumed by women of childbearing age and children aged 17 and younger.

10. Why aren't additional fish samples collected before a final report is released?

There is no systematic sampling program designed to provide sufficient data for fish consumption advice in California. OEHHA relies upon other agencies to collect and analyze fish contaminants and to provide the resulting data for human health risk assessment. OEHHA does not control the number, species, or location of fish samples collected by other agencies, or which chemicals are analyzed in samples. When possible, OEHHA makes sampling recommendations for collection and analyses of samples. Following collection of some fish samples from Trinity Lake from 2000 to 2002 by U.S.G.S., OEHHA worked with the North Coast Regional Water Quality Control Board to collect and analyze some additional samples in Trinity Lake and Lewiston Lake. This additional sampling included testing for pesticides and organochlorine contaminants in fish from these water bodies. This additional data was incorporated into the draft report. Adequate resources are seldom available to collect and analyze as many species and samples as would be required to develop ideal safe eating guidelines. Consequently, OEHHA often utilizes supporting information to provide as much advice as possible to the public.

11. Does the number of mines affect how much mercury is found in fish?

The presence or absence of a mine near a water body may affect the mercury level in fish, but this is not necessarily the most important factor. Other sources of available mercury as well as geochemical factors such as pH, and ecological factors such as the number of trophic levels in a water body are also important factors in determining how much mercury accumulates in fish.

12. How can local mercury contamination be cleaned up?

Clean-up efforts are outside of the scope of the guidelines and OEHHA.

13. OEHHA should issue another draft advisory before finalizing the report to allow time for more public participation.

OEHHA received a wealth of comments during the public workshop but received no additional comments during the extended public comment period. OEHHA feels that we have addressed the key issues brought up during the public workshop, e.g., exclusion of the Trinity River from the advisory, particularly with respect to river-run salmon. OEHHA believes the revised report should thus be finalized to provide fish consumption guidance to the public.