HEALTH ADVISORY:

SAFE EATING GUIDELINES FOR FISH AND SHELLFISH FROM LAKE BERRYESSA AND PUTAH CREEK INCLUDING LAKE SOLANO (NAPA, YOLO, AND SOLANO COUNTIES)

June 2006

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EXECUTIVE SUMMARY

The Office of Environmental Health Hazard Assessment (OEHHA), formerly part of the Department of Health Services (DHS) but now in the California Environmental Protection Agency, issued a health advisory in 1987 for sport fish from Lake Berryessa (Napa County) based on mercury contamination in edible fish tissue collected from the lake (Appendix I). Since the advisory was issued, additional data have been collected for Lake Berryessa as well as for Putah Creek. The Central Valley Regional Water Quality Control Board (CVRWQCB) compiled a large dataset comprised of historical and more recently collected fish tissue data. OEHHA reviewed this dataset and compared it to the original datasets from which it was derived. Data suitable for issuing fish consumption advisories were selected out and verified before using them to update the advisory for Lake Berryessa, and to determine whether there may be potential adverse health effects associated with consuming sport fish from Putah Creek.

Mercury is a trace metal that can be toxic to humans and other organisms. Mercury occurs naturally in the environment, and is also redistributed in the environment as a result of human activities such as mining and the burning of fossil fuels. Once mercury is released into the environment, it cycles through land, air, and water. In aquatic systems, it undergoes chemical transformation to the more toxic organic form, methylmercury, which accumulates in fish and other organisms. More than 95 percent of the mercury found in fish occurs as methylmercury, which is a highly toxic form of the element. Consumption of fish is the major route of exposure to methylmercury in the United States. For more information on mercury, see Appendix II.

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 (that is the daily exposure likely to be without significant risks of deleterious effects during a lifetime) for methylmercury of $3x10^{-4}$ milligrams per kilogram of body weight per day (mg/kg-day), based on central nervous system effects (ataxia, or loss of muscular coordination; and paresthesia, a sensation of numbness and tingling) in adults. This reference dose (RfD) was lowered to $1x10^{-4}$ mg/kg-day in 1995 (and confirmed in 2001), based on developmental neurologic abnormalities in infants exposed *in utero*. Because 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, OEHHA chooses to use both the current and previous U.S. EPA reference doses for two distinct population groups. In this advisory, the current RfD based on effects in infants will be used for women of childbearing age and children aged 17 years and younger. The previous RfD, based on effects in adults, will be used for women beyond their childbearing years and men.

Sufficient data were available to characterize the concentrations of mercury and issue safe eating guidelines for the following species and locations: channel catfish, white catfish, largemouth bass, rainbow trout, and chinook (king) salmon in Lake Berryessa; and channel catfish, white catfish, largemouth bass, Sacramento blackfish, Sacramento sucker, bluegill, carp, and crayfish in Putah Creek. Additional data for other species were considered and compared to federal advice to develop health-protective guidelines whenever possible. Mercury concentrations were generally lower in fish from Putah Creek compared to Lake Berryessa (for those species collected in both water bodies), and the data supported different advice for Lake Berryessa and Putah Creek for

several of the species. Although it might be easier for fish consumers to follow the same guidelines for both water bodies, we chose to provide different guidelines as they generally allow for more consumption of fish from Putah Creek and thus provide a safer option for sport fish consumers. Anyone wishing to adhere to a simpler set of guidelines could choose to apply the more restrictive guidelines to both water bodies.

Mercury concentrations were compared to 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. Evaluation of data and comparison with guidance tissue levels for methylmercury indicated that fish consumption guidelines were appropriate for Lake Berryessa and Putah Creek. "Safe eating guidelines" provide information to fish consumers as to which fish species have high mercury levels and whose consumption should be restricted or avoided altogether, as well as low-mercury fish that may be consumed frequently as part of a healthy diet. All individuals, especially women of childbearing age and children aged 17 years and younger, are advised to follow the safe eating guidelines to ensure that methylmercury ingestion does not exceed the reference dose. To help sport fish consumers achieve this goal, OEHHA has developed the guidelines contained in this report.

The revised guidelines for Lake Berryessa differ in several ways from the original advisory issued in 1987. The definition of the sensitive population has been expanded to include all women of childbearing age, in order to reduce the chance that mercury may accumulate in their bodies during the months and years preceding pregnancy. Additionally, the guidelines now include all children 17 years and younger in this sensitive population, as recent studies have shown that the still developing adolescent brain is more sensitive to toxins than is the adult brain. Whereas the previous advice instructed women who are pregnant or might become pregnant and young children not to eat any fish from Lake Berryessa, the new draft guidelines identify types of fish with lower levels of mercury that can be eaten by this population. With a wealth of data indicating that consumption of fish low in contaminants confers numerous health benefits to the fetus, children and adults, OEHHA's new safe eating guidelines provide for and encourage consumption of such fish by all consumers. The new draft guidelines also present the recommended consumption in meals per week or meals per month rather than in pounds of fish. Meal sizes should be adjusted to body weight as described in the advisory table.

For general advice on how to limit your exposure to chemical contaminants in sport fish (*e.g.*, eating smaller fish of legal size), see the California Sport Fish Consumption Advisories (http://www.oehha.ca.gov/fish.html) or Appendix III. Site-specific advice for other California water bodies can be found online at: http://www.oehha.ca.gov/fish/so_cal/index.html. Unlike the case for many chlorinated hydrocarbon contaminants, however, various cooking and cleaning techniques will not reduce the methylmercury content of fish.

SAFE EATING GUIDELINES
FISH CONSUMPTION FROM LAKE BERRYESSA

Fish are nutritious and should be part of a healthy, balanced diet. The American Heart Association recommends healthy adults eat at least two meals of fish a week. It is important, however, to choose your fish wisely. OEHHA recommends that you choose fish to eat that are low in mercury such as those in "Best Choices." Because some other types of fish from Lake Berryessa contain higher levels of mercury, OEHHA also provides additional recommendations below that you can follow to reduce the risks from exposure to methylmercury in fish.

Women of childbearing age, pregnant or breastfeeding women, and children 17 years and under

BEST CHOICES UP TO 3 MEALS A WEEK
There are no best choices for this population at Lake Berryessa
EAT IN MODERATION NO MORE THAN 1 MEAL A WEEK
Bluegill or other sunfish; trout; or kokanee
AVOID NO MORE THAN 1 MEAL A MONTH
Largemouth, smallmouth, or spotted bass; catfish; and chinook (king) salmon

Women beyond childbearing age and men

BEST CHOICES UP TO 3 MEALS A WEEK
Trout or kokanee
EAT IN MODERATION NO MORE THAN 1 MEAL A WEEK
Largemouth, smallmouth, or spotted bass; catfish; chinook (king) salmon; bluegill or other sunfish

- Incomplete information suggests that carp should only be eaten in limited amounts.
- **CONTACT WITH THE WATER IS SAFE.**
- **EAT SMALLER FISH OF LEGAL SIZE**. Fish build up mercury in their bodies as they grow.
- **MEAL SIZE DEPENDS ON BODY WEIGHT.** Meals are based on a 160-pound adult eating 8 ounces of fish (6 ounces after cooking) — about the size of two decks of cards. If you weigh less than 160 pounds, eat smaller portions of fish. Serve smaller meals to children.
- **DO NOT EAT MORE THAN ONE OF THE LISTED FISH SPECIES DURING THE SAME TIME PERIOD** unless you are eating from the Best Choices (green) category. If you eat fish from one place following the advisory, avoid eating fish from other sources during the same time period.
- **CONSIDER THE FISH YOU BUY FROM STORES AND RESTAURANTS.** Women of childbearing age and children can safely eat up to 2 meals a week of a variety of fish purchased in stores or restaurants*, **OR** use this guide for eating fish caught from this water body. In a week when you eat 2 meals of fish purchased from stores or restaurants, avoid eating fish caught from a local water body. 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. *Women of childbearing age and children should not eat shark or swordfish, which contain the most mercury.
- **FISH FROM OTHER WATER BODIES MAY ALSO CONTAIN MERCURY**. Not all water bodies in California have been tested. With the exception of ocean or river-run salmon or steelhead, which may be consumed more frequently, fish caught from places without an advisory should be eaten in limited amounts.

SAFE EATING GUIDELINES
FISH CONSUMPTION AT PUTAH CREEK

Fish are nutritious and should be part of a healthy, balanced diet. The American Heart Association recommends healthy adults eat at least two meals of fish a week. It is important, however, to choose your fish wisely. OEHHA recommends that you choose fish to eat that are low in mercury, including "Best Choices" fish caught from Putah Creek.

Women of childbearing age, pregnant or breastfeeding women, and children 17 years and under

BEST CHOICES UP TO 3 MEALS A WEEK
Trout or Sacramento blackfish
EAT IN MODERATION NO MORE THAN 1 MEAL A WEEK
Largemouth, smallmouth, or spotted bass, bluegill or other sunfish, carp or goldfish, catfish (including bullheads), crappie, sucker, hitch, or crayfish

Women beyond childbearing age and men

BEST CHOICES UP TO 3 MEALS A WEEK
Trout*, Sacramento blackfish*, bluegill or other sunfish, catfish (including bullheads), sucker, carp or goldfish, or crayfish
EAT IN MODERATION NO MORE THAN 1 MEAL A WEEK
Largemouth, smallmouth, or spotted bass, crappie, or hitch

***** May be eaten daily by women beyond childbearing age and men

- Incomplete information suggests that pikeminnow should only be eaten in limited amounts.
- **CONTACT WITH THE WATER IS SAFE.**
- **EAT SMALLER FISH OF LEGAL SIZE**. Fish build up mercury in their bodies as they grow.
- **MEAL SIZE DEPENDS ON BODY WEIGHT.** Meals are based on a 160-pound adult eating 8 ounces of fish (6 ounces after cooking) — about the size of two decks of cards. If you weigh less than 160 pounds, eat smaller portions of fish. Serve smaller meals to children.
- **DO NOT EAT MORE THAN ONE OF THE LISTED FISH SPECIES DURING THE SAME TIME PERIOD** unless you are eating from the Best Choices (green) category. If you eat fish from one place following the advisory, avoid eating fish from other sources during the same time period.
- **CONSIDER THE FISH YOU BUY FROM STORES AND RESTAURANTS.** Women of childbearing age and children can safely eat up to 2 meals a week of a variety of fish purchased in stores or restaurants*, **OR** use this guide for eating fish caught from this water body. In a week when you eat 2 meals of fish purchased from stores or restaurants, avoid eating fish caught from a local water body. 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. *Women of childbearing age and children should not eat shark or swordfish, which contain the most mercury.
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Lake Berryessa and Putah Creek Sport Fish

Note: Images are not to scale

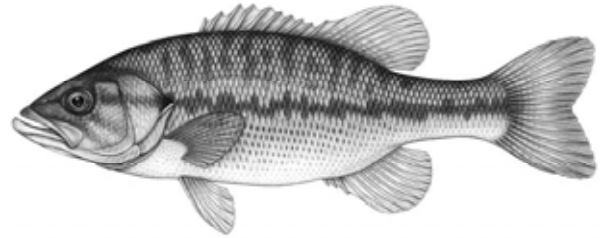
Largemouth Bass (*Micropterus salmoides*)

Duane Raver, USFWS

Smallmouth Bass (*Micropterus dolomieu*)

Duane Raver, USFWS

Spotted Bass (*Micropterus punctulatus*)



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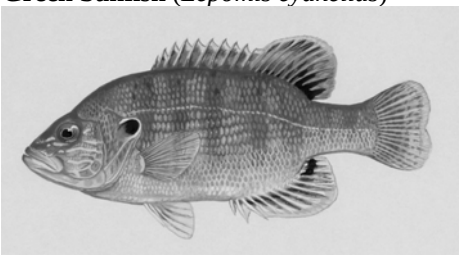
Bluegill (*Lepomis macrochirus*)

Duane Raver, USFWS

Green Sunfish (*Lepomis cyanellus*)

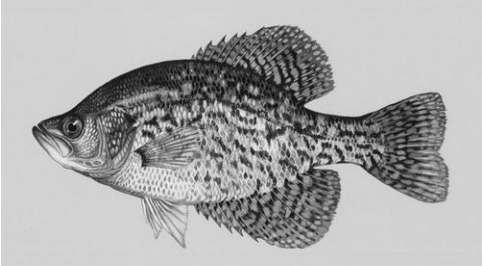


Duane Raver, USFWS

Redear Sunfish (*Lepomis microlophus)*

Duane Raver, USFWS

Black Crappie (*Pomoxis nigromaculatus*)



Duane Raver, USFWS

White Crappie (*Pomoxis annularis*)

Duane Raver, USFWS

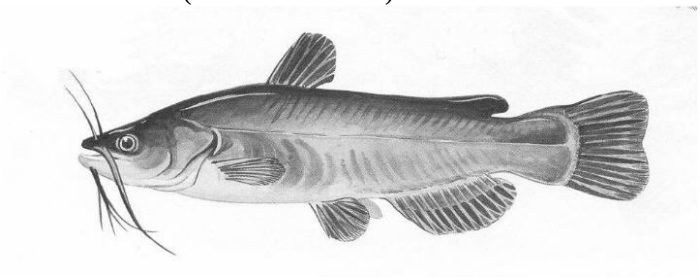
Channel Catfish (*Ictalurus punctalus*)

Duane Raver, USFWS

White Catfish (*Amereiurus catus*)

Duane Raver, USFWS

Black Bullhead (*Amereiurus melas*)



Duane Raver, USFWS

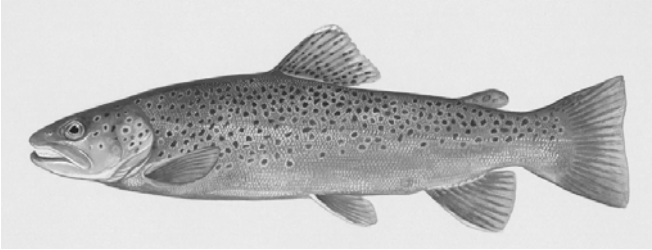
Sacramento Sucker (*Catostomus occidentalis*)

Rene' Reyes, USBR

Rainbow Trout (*Oncorhynchus mykiss*)

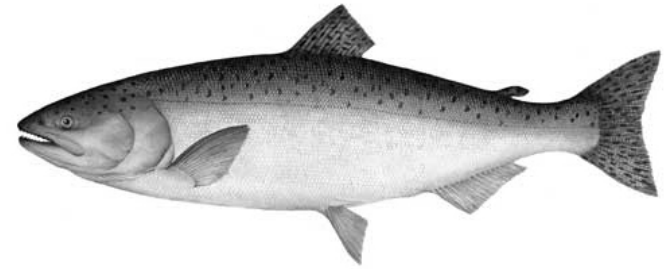
Duane Raver, USFWS

Brown Trout (*Salmo trutta*)



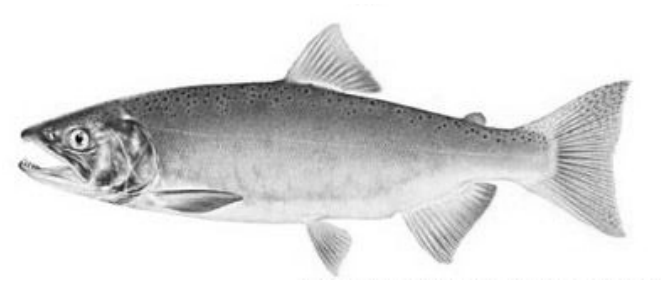
Duane Raver, USFWS

Chinook (King) Salmon (*Oncorhynchus tshawytscha*)



USBR

Kokanee (Sockeye Salmon) (*Oncorhynchus nerka*)



Courtesy of Colorado Division of Wildlife

Sacramento Blackfish (*Orthodon microlepidotus*)

Zak Sutphin, USBR

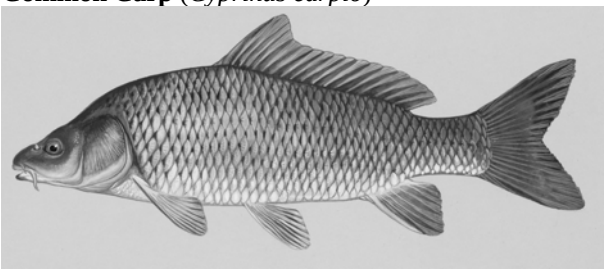
Hitch (*Lavinia exilicauda*)

Rene' Reyes, USBR

Sacramento Pikeminnow (*Ptychocheilus grandis*)

Rene' Reyes, USBR

Common Carp (*Cyprinus carpio*)



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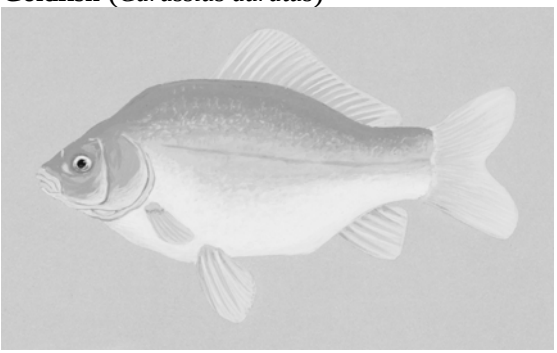
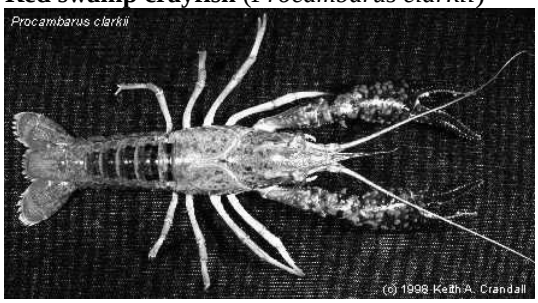
Goldfish (*Carassius auratus*)



Duane Raver, USFWS

Red swamp crayfish (*Procambarus clarkii*)



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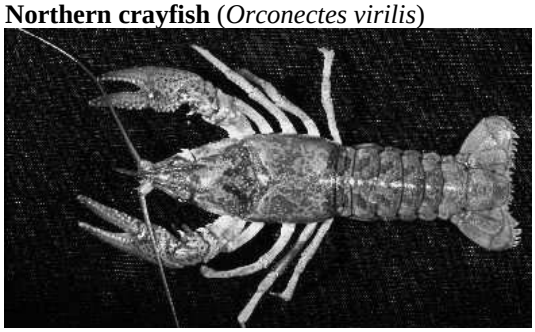
Northern crayfish (*Orconectes virilis*)



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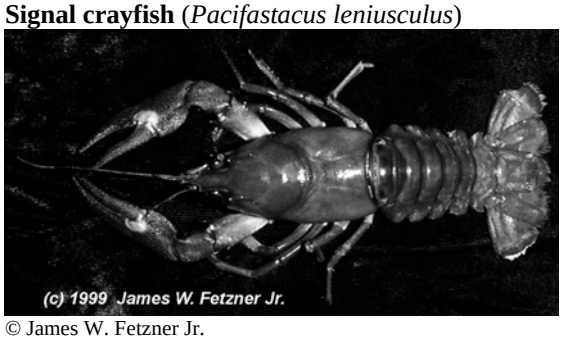
Signal crayfish (*Pacifastacus leniusculus*)



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Signal crayfish showing variation

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