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Mercury Concentrations in Fishes from Select Water Bodies in Trinity County, California, 2000–2002



Open-File Report 2005-1321

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Mercury Concentrations in Fishes from Select Water Bodies in Trinity County, California, 2000-2002

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U.S. Geological Survey Open-File Report 2005-1321

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Abbreviations and Datum Used

Horizontal coordinate information is referenced to North American Datum of 1983, (NAD 83)

BLM, Bureau of Land Management
CRV, certified reference value
CVAAS, cold-vapor atomic absorption spectroscopy
LOD, limit of detection
NRCC, National Research Council Canada
OEHHA, Office of Environmental Health Hazard Assessment (California)
QA, quality assurance
QC, quality control
RPD, relative percentage difference
SRM, standard reference material
SWRCB, State Water Resources Control Board (California)
TERL, Trace Element Research Laboratory
USDA-FS, U.S. Department of Agriculture-Forest Service
USEPA, U.S. Environmental Protection Agency
USGS, U.S. Geological Survey
Hg, mercury
Hg⁰, elemental mercury
Hg²⁺, mercuric ion
g, gram
mm, millimeter
ppm, part per million
ww, wet weight
µg/g, microgram per gram

Mercury Concentrations in Fishes from Select Water Bodies in Trinity County, California, 2000-2002

By Jason T. May, Roger L. Hothem, and Charles N. Alpers

Abstract

Sites of historical gold and mercury mining in the Trinity River watershed continue to release mercury to downstream water bodies. To evaluate the extent of mercury (Hg) contamination in the watershed, the U.S. Geological Survey collected samples of sediment, water, invertebrates, amphibians, and fishes from select water bodies and mine sites in Trinity County, California. This report presents total mercury data for 368 fishes collected during 2000–2002, from 4 locations within Trinity Lake, from 16 stream sites, and from 3 pond sites within the Trinity River watershed. The following species of fish were sampled (scientific name and number of samples in parentheses): brook trout (*Salvelinus fontinalis*, 13), brown bullhead (*Ameiurus nebulosus*, 5), green sunfish (*Lepomis cyanellus*, 13), largemouth bass (*Micropterus salmoides*, 33), marbled sculpin (*Cottus klamathensis*, 24), rainbow trout (*Oncorhynchus mykiss*, 237), smallmouth bass (*Micropterus dolomieu*, 41), and white catfish (*Ameiurus catus*, 2). Total mercury in 74 black bass (largemouth and smallmouth bass; *Micropterus* spp.) samples ranged from 0.046 to 1.225 micrograms per gram (equivalent to parts per million or ppm) wet weight (ww). Mercury concentrations in 26 of the 34 black bass (76 percent) of “legal catch size” (≥ 305 millimeters in length) were ≥ 0.3 ppm (ww), the U.S. Environmental Protection Agency water-quality criterion for the protection of human health. Mercury concentrations exceeded 1.0 ppm (ww), the Food and Drug Administration action level for commercial fish in 3 of the 34 black bass (9 percent) of legal catch size. In contrast, only 3 of the 237 (about 1 percent) rainbow trout of all sizes sampled from stream, pond, and lake sites had Hg concentrations ≥ 0.3 ppm (ww). These results indicate that some fish species inhabiting select water bodies of Trinity County contain undesirably high concentrations of mercury in their skinless fillets. In response to data generated by this study and other related investigations, the California Environmental Protection Agency’s Office of Environmental Health Hazard Assessment (OEHHA) issued a draft fish-consumption advisory

report that offered guidelines for human consumption of fish. The final version of the OEHHA fish-consumption advisory was approved by the State of California in July 2005 and is scheduled for publication in October 2005 (http://www.oehha.ca.gov/fish/so_cal/TrinRiverF2.html)

Introduction

Considerable mining of placer (alluvial) gold deposits, using hydraulic methods that employed mercury to process ore, took place in Trinity County, California, during the latter half of the 19th century and the first part of the 20th century (Clark, 1963; Alpers and others, 2005). In addition, mercury was mined by underground methods in the Altoona Mining district (Swinney, 1950).

During 2000–2002, the U.S. Geological Survey (USGS) conducted an investigation, in cooperation with other federal and state agencies, to assess mercury contamination associated with historical mining in the Trinity River watershed. Agencies that provided funding and in-kind services for the investigation included the U.S. Department of Agriculture–Forest Service (USDA–FS) Shasta-Trinity National Forest, the Bureau of Land Management (BLM), and the California State Water Resources Control Board (SWRCB). During 2000–2002, the USGS collected 368 fishes from 4 locations within Trinity Lake, from 16 stream sites, and from 3 pond sites within the Trinity River watershed (fig. 1; tables 1 and 2). The following species of fish were sampled and analyzed for total mercury (scientific name and number of samples in parentheses): brook trout (*Salvelinus fontinalis*, 13), brown bullhead (*Ameiurus nebulosus*, 5), green sunfish (*Lepomis cyanellus*, 13), largemouth bass (*Micropterus salmoides*, 33), marbled sculpin (*Cottus klamathensis*, 24), rainbow trout (*Oncorhynchus mykiss*, 237), smallmouth bass (*Micropterus dolomieu*, 41), and white catfish (*Ameiurus catus*, 2).

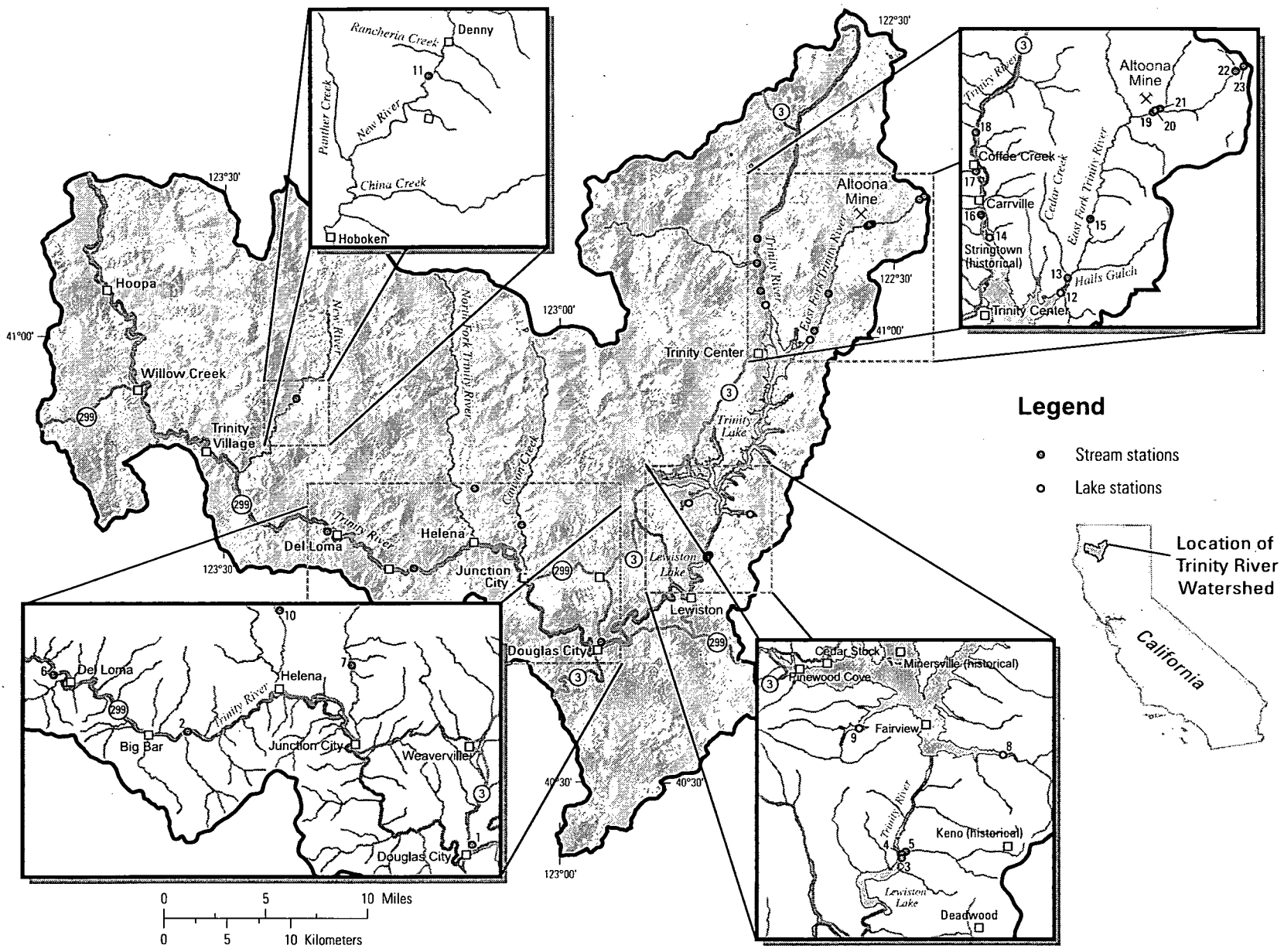


Figure 1. Fish sampling locations within the Trinity River watershed, Trinity County, California.

Table 1. Fish sampling sites and data-collection years, Trinity County, California, 2000–2002.

[Hwy, highway; Mt, Mount. USGS, U.S. Geological Survey. Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD83)]

Site number on fig. 1	Station Name	Station Number	Latitude	Longitude	2000	2001	2002
1	Union Hill Gulch near Douglas City	403927122561401	40°39'27"	122°56'18"	x		
2	Trinity River at Big Flat Day Use Area near Big Bar	404427123125701	40°44'27"	123°13'01"			x
3	Eastman Dredge Pond No.2 near Lewiston	404509122465001	40°45'09"	122°46'54"	x		
4	Eastman Dredge Pond No.1 near Lewiston	404516122465001	40°45'16"	122°46'54"	x		
5	Eastman Gulch near Lewiston	404520122464101	40°45'20"	122°46'45"	x		
6	Trinity River at Hayden Flat near Big Bar	404656123204501	40°46'56"	123°20'49"			x
7	Canyon Creek below Conrad Gulch near Junction City	404723123032001	40°47'23"	123°03'24"			x
8	Papoose Arm of Trinity Lake near Trinity Dam	404806122425801	40°48'06"	122°43'02"			x
9	Buckeye Arm of Trinity Lake near Trinity Dam	404852122482701	40°48'52"	122°48'31"		x	
10	East Fork of North Fork Trinity River 0.53 mile above Barney Gulch	404940123072901	40°49'40"	123°07'33"		x	
11	New River at Denny Campground near Denny	405557123233401	40°55'56"	123°23'38"			x
12	East Fork Trinity Arm of Trinity Lake near Trinity Center	405953122373301	40°59'53"	122°37'37"	x	x	
13	East Fork Trinity River below County Road 106 near Trinity Center	410031122370901	41°00'31"	122°37'13"		x	x
14	Trinity Lake near Trinity Center	410214122413201	41°02'14"	122°41'36"	x	x	
15	East Fork Trinity River 1.2 mile below Devils Creek near Trinity Center	410259122355201	41°02'59"	122°35'56"		x	x
16	Carrville Pond near Carrville	410311122420001	41°03'11"	122°42'04"	x		
17	Coffee Creek at Hwy 3 near Carrville	410502122421701	41°05'02"	122°42'21"	x		
18	Trinity River above Coffee Creek near Trinity Center	11523200	41°06'41"	122°42'20"	x		
19	East Fork Trinity River below Altoona Mine Drain near Trinity Center	410731122321801	41°07'31"	122°32'22"	x	x	x
20	East Fork Trinity River Upstream Altoona Mine Drain near Castella	410736122320901	41°07'36"	122°32'13"	x	x	x
21	Crow Creek above Confluence of East Fork Trinity River near Trinity	410740122315401	41°07'40"	122°31'58"		x	x
22	Tamarack Creek at East Fork Trinity River near Mt. Shasta	410916122273801	41°09'16"	122°27'42"		x	x
23	East Fork Trinity River at Horse Heaven Meadow near Mt. Shasta	410928122271201	41°09'28"	122°27'16"		x	x

Table 2. Data for fishes collected in Trinity County, California, 2000–2002.

[Fillet samples dissected from left fillet of fish; whole body, whole body fish analyzed with gastrointestinal tract cleaned out. Hwy, highway; Mt, Mount.

Hg, mercury; HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)]

Collection date	Common name	Scientific name	Total length (mm)	Total weight (g)	Moisture (%)	HgT-dry (µg/g)	HgT-wet (µg/g)	Sample type	Sample identification	Sex
Site 1 (fig. 1), Union Hill Gulch near Douglas City:										
10/25/2000	Green sunfish	<i>Lepomis cyanellus</i>	103	23.0	77.2	1.080	0.246	Whole body	TR-2000-W-036	M
Site 2 (fig. 1), Trinity River at Big Flat Day Use Area near Big Bar:										
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	74	3.5	76.6	0.142	0.033	Fillet	TR-2002-F-020	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	75	3.7	77.8	0.128	0.028	Fillet	TR-2002-F-019	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	85	5.9	80.5	0.102	0.020	Fillet	TR-2002-F-018	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	87	6.5	78	0.102	0.022	Fillet	TR-2002-F-017	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	92	7.6	79.6	0.161	0.033	Fillet	TR-2002-F-016	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	93	7.6	78	0.141	0.031	Fillet	TR-2002-F-015	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	100	9.0	79.9	0.164	0.033	Fillet	TR-2002-F-014	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	124	16.8	78.6	0.214	0.046	Fillet	TR-2002-F-013	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	146	25.8	78.4	0.182	0.039	Fillet	TR-2002-F-012	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	147	28.2	79.2	0.203	0.042	Fillet	TR-2002-F-011	F

Table 2. Data for fishes collected in Trinity County, California, 2000–2002—Continued.

[Fillet samples dissected from left fillet of fish; whole body, whole body fish analyzed with gastrointestinal tract cleaned out. Hwy, highway; Mt, Mount. Hg, mercury; HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)]

Collection date	Common name	Scientific name	Total length (mm)	Total weight (g)	Moisture (%)	HgT-dry (µg/g)	HgT-wet (µg/g)	Sample type	Sample identification	Sex
Site 3 (fig. 1), Eastman Dredge Pond No. 2 near Lewiston:										
10/23/2000	Green sunfish	<i>Lepomis cyanellus</i>	122	25.4	77.7	0.842	0.188	Whole body	TR-2000-W-032	F
10/23/2000	Green sunfish	<i>Lepomis cyanellus</i>	125	27.2	78.2	0.652	0.142	Whole body	TR-2000-W-031	F
10/23/2000	Green sunfish	<i>Lepomis cyanellus</i>	129	27.6	79.2	0.550	0.114	Whole body	TR-2000-W-034	U
10/23/2000	Green sunfish	<i>Lepomis cyanellus</i>	130	27.0	78.1	0.755	0.165	Whole body	TR-2000-W-033	F
10/23/2000	Green sunfish	<i>Lepomis cyanellus</i>	162	57.1	77.8	0.486	0.108	Whole body	TR-2000-W-035	M
Site 3 (fig. 1), Eastman Dredge Pond No. 1 near Lewiston:										
9/26/2000	Green sunfish	<i>Lepomis cyanellus</i>	91	13.2	75	0.409	0.102	Whole body	TR-2000-W-039	M
9/26/2000	Green sunfish	<i>Lepomis cyanellus</i>	92	15.0	76.9	0.432	0.100	Whole body	TR-2000-W-040	M
9/26/2000	Green sunfish	<i>Lepomis cyanellus</i>	109	21.8	76.7	0.843	0.196	Whole body	TR-2000-W-038	F
10/23/2000	Green sunfish	<i>Lepomis cyanellus</i>	84	8.4	74.8	0.806	0.203	Whole body	TR-2000-W-041	F
10/23/2000	Green sunfish	<i>Lepomis cyanellus</i>	125	29.7	77.9	0.730	0.161	Whole body	TR-2000-W-037	M
Site 5 (fig. 1), Eastman Gulch near Lewiston:										
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	136	26.1	74.2	0.430	0.111	Whole body	TR-2000-W-002	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	140	25.7	76.3	0.420	0.100	Whole body	TR-2000-W-001	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	142	30.5	74.6	0.448	0.114	Whole body	TR-2000-W-003	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	144	30.0	75.1	0.353	0.088	Whole body	TR-2000-W-004	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	150	35.5	72	0.345	0.097	Whole body	TR-2000-W-005	M
Site 6 (fig. 1), Trinity River at Hayden Flat near Big Bar:										
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	91	8.1	75.5	0.132	0.032	Fillet	TR-2002-F-010	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	93	8.2	76.8	0.151	0.035	Fillet	TR-2002-F-009	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	100	10.4	78.1	0.187	0.041	Fillet	TR-2002-F-008	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	102	10.5	81.5	0.350	0.065	Fillet	TR-2002-F-007	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	115	15.9	79.5	0.278	0.057	Fillet	TR-2002-F-006	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	116	17.9	80	0.209	0.042	Fillet	TR-2002-F-004	M
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	116	14.8	78.9	0.236	0.050	Fillet	TR-2002-F-005	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	137	24.7	79.1	0.250	0.052	Fillet	TR-2002-F-003	M
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	138	25.7	76.3	0.252	0.060	Fillet	TR-2002-F-002	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	166	40.9	78.7	0.306	0.065	Fillet	TR-2002-F-001	F
Site 7 (fig. 1), Canyon Creek below Conrad Gulch near Junction City:										
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	113	12.5	79.5	0.176	0.036	Fillet	TR-2002-F-050	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	126	18.2	80.2	0.243	0.048	Fillet	TR-2002-F-049	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	131	20.7	79.3	0.183	0.038	Fillet	TR-2002-F-048	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	137	23.1	80	0.173	0.035	Fillet	TR-2002-F-047	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	138	22.9	80.4	0.181	0.035	Fillet	TR-2002-F-046	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	144	25.6	79.1	0.221	0.046	Fillet	TR-2002-F-045	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	150	30.6	79.4	0.175	0.036	Fillet	TR-2002-F-044	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	158	32.9	79.8	0.189	0.038	Fillet	TR-2002-F-043	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	163	38.4	79.4	0.208	0.043	Fillet	TR-2002-F-042	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	235	122.2	78.6	0.296	0.063	Fillet	TR-2002-F-041	F
Site 8 (fig. 1), Papoose Arm of Trinity Lake near Trinity Dam:										
5/16/2001	Largemouth bass	<i>Micropterus salmoides</i>	484	2427.0	75.2	2.760	0.684	Fillet	TR-2001-F-314	F
5/16/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	332	302.0	76.6	0.278	0.065	Fillet	TR-2001-F-300	F
5/16/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	360	416.0	75.8	0.152	0.037	Fillet	TR-2001-F-301	F
5/16/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	379	496.0	77.4	0.274	0.062	Fillet	TR-2001-F-302	F
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	240	169.0	78.3	0.759	0.165	Fillet	TR-2001-F-303	M
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	279	297.0	78.4	1.340	0.289	Fillet	TR-2001-F-305	F
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	298	327.0	76.7	1.270	0.296	Fillet	TR-2001-F-306	M
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	300	379.0	78.6	1.200	0.257	Fillet	TR-2001-F-304	F
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	310	470.0	77.4	1.160	0.262	Fillet	TR-2001-F-307	F

Table 2. Data for fishes collected in Trinity County, California, 2000–2002—Continued.

[Fillet samples dissected from left fillet of fish; whole body, whole body fish analyzed with gastrointestinal tract cleaned out. Hwy, highway; Mt, Mount. Hg, mercury; HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)]

Collection date	Common name	Scientific name	Total length (mm)	Total weight (g)	Moisture (%)	HgT-dry (µg/g)	HgT-wet (µg/g)	Sample type	Sample identification	Sex
Site 9 (fig. 1), Buckeye Arm of Trinity Lake near Trinity Dam:										
5/16/2001	Largemouth bass	<i>Micropterus salmoides</i>	219	138.0	79	0.654	0.137	Fillet	TR-2001-F-297	M
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	268	244.0	78.7	1.180	0.251	Fillet	TR-2001-F-290	M
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	275	292.0	78	1.090	0.240	Fillet	TR-2001-F-294	M
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	275	298.0	78.2	0.900	0.196	Fillet	TR-2001-F-291	M
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	289	310.0	78.1	1.290	0.283	Fillet	TR-2001-F-292	M
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	295	350.0	77.6	0.911	0.204	Fillet	TR-2001-F-293	M
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	308	360.0	78	1.220	0.268	Fillet	TR-2001-F-295	M
5/16/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	329	494.0	76.7	1.150	0.268	Fillet	TR-2001-F-296	M
Site 10 (fig. 1), East Fork of Trinity River 0.53 mile above Barney Gulch:										
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	121	16.8	79.9	0.370	0.074	Fillet	TR-2002-F-040	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	125	18.2	79.4	0.315	0.065	Fillet	TR-2002-F-039	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	126	19.0	78.9	0.672	0.142	Fillet	TR-2002-F-038	M
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	129	20.1	79.5	0.524	0.107	Fillet	TR-2002-F-037	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	133	20.8	79.2	0.371	0.077	Fillet	TR-2002-F-036	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	142	26.5	79.8	0.325	0.066	Fillet	TR-2002-F-035	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	144	28.8	79.2	0.293	0.061	Fillet	TR-2002-F-034	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	155	32.1	80	0.590	0.118	Fillet	TR-2002-F-032	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	155	32.8	79.3	0.636	0.132	Fillet	TR-2002-F-033	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	176	52.1	79.3	0.480	0.099	Fillet	TR-2002-F-031	M
Site 11 (fig. 1), New River at Denny Campground near Denny:										
8/26/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	120	17.5	78.1	0.202	0.044	Fillet	TR-2002-F-030	F
8/26/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	125	17.9	77.4	0.232	0.052	Fillet	TR-2002-F-029	F
8/26/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	137	25.4	78.9	0.307	0.065	Fillet	TR-2002-F-028	F
8/26/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	149	28.7	78.4	0.300	0.065	Fillet	TR-2002-F-027	M
8/26/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	155	36.1	78.6	0.235	0.050	Fillet	TR-2002-F-026	F
8/26/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	156	33.4	78	0.191	0.042	Fillet	TR-2002-F-025	F
8/26/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	160	37.0	77.8	0.222	0.049	Fillet	TR-2002-F-024	F
8/26/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	167	42.8	78.9	0.207	0.044	Fillet	TR-2002-F-023	F
8/26/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	171	46.1	78.7	0.184	0.039	Fillet	TR-2002-F-022	F
8/26/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	202	74.0	78.6	0.260	0.056	Fillet	TR-2002-F-021	F
Site 12 (fig. 1), East Fork Trinity Arm of Trinity Lake near Trinity Center:										
11/9/2000	Brown bullhead	<i>Ameiurus nebulosus</i>	360	694.6	78.5	0.961	0.207	Fillet	TR-2000-F-248	F
11/9/2000	Smallmouth bass	<i>Micropterus dolomieu</i>	305	495.5	75.8	1.110	0.269	Fillet	TR-2000-F-200	M
11/9/2000	Smallmouth bass	<i>Micropterus dolomieu</i>	308	471.5	76.7	1.470	0.343	Fillet	TR-2000-F-201	M
11/9/2000	Smallmouth bass	<i>Micropterus dolomieu</i>	310	537.5	75	2.160	0.540	Fillet	TR-2000-F-202	F
11/9/2000	Smallmouth bass	<i>Micropterus dolomieu</i>	325	583.4	75.9	1.370	0.330	Fillet	TR-2000-F-203	M
11/9/2000	Smallmouth bass	<i>Micropterus dolomieu</i>	330	599.8	75.6	1.330	0.325	Fillet	TR-2000-F-204	F
11/9/2000	Smallmouth bass	<i>Micropterus dolomieu</i>	349	706.1	75.9	1.960	0.472	Fillet	TR-2000-F-205	M
11/9/2000	Smallmouth bass	<i>Micropterus dolomieu</i>	350	683.6	74.7	1.480	0.374	Fillet	TR-2000-F-206	M
11/9/2000	Smallmouth bass	<i>Micropterus dolomieu</i>	355	828.9	75.9	2.100	0.506	Fillet	TR-2000-F-207	M
11/9/2000	White catfish	<i>Ameiurus catus</i>	325	523.5	77.5	2.620	0.590	Fillet	TR-2000-F-247	F
11/9/2000	White catfish	<i>Ameiurus catus</i>	370	712.6	79.7	0.693	0.141	Fillet	TR-2000-F-249	M
5/15/2001	Brown bullhead	<i>Ameiurus nebulosus</i>	278	369.9	80	0.339	0.068	Fillet	TR-2001-F-284	F
5/15/2001	Brown bullhead	<i>Ameiurus nebulosus</i>	330	697.9	79.1	0.473	0.099	Fillet	TR-2001-F-285	F
5/15/2001	Brown bullhead	<i>Ameiurus nebulosus</i>	339	733.9	78.6	0.386	0.083	Fillet	TR-2001-F-286	F
5/15/2001	Largemouth bass	<i>Micropterus salmoides</i>	450	1936.4	74.2	3.900	1.006	Fillet	TR-2001-F-312	M
5/15/2001	Largemouth bass	<i>Micropterus salmoides</i>	489	2438.4	75.1	4.920	1.225	Fillet	TR-2001-F-313	M
5/15/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	315	338.9	76	0.141	0.034	Fillet	TR-2001-F-287	F
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	188	66.9	79.9	1.570	0.316	Fillet	TR-2001-F-271	M
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	189	70.6	79	0.788	0.165	Fillet	TR-2001-F-270	F
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	194	92.9	78.8	0.558	0.118	Fillet	TR-2001-F-273	M
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	206	94.9	79.3	3.840	0.795	Fillet	TR-2001-F-276	F
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	208	113.8	78.7	0.808	0.172	Fillet	TR-2001-F-280	M

Table 2. Data for fishes collected in Trinity County, California, 2000–2002—Continued.

[Fillet samples dissected from left fillet of fish; whole body, whole body fish analyzed with gastrointestinal tract cleaned out. Hwy, highway; Mt, Mount. Hg, mercury; HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)]

Collection date	Common name	Scientific name	Total length (mm)	Total weight (g)	Moisture (%)	HgT-dry (µg/g)	HgT-wet (µg/g)	Sample type	Sample identification	Sex
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	210	107.2	78	1.230	0.271	Fillet	TR-2001-F-275	M
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	220	120.7	78.9	0.836	0.176	Fillet	TR-2001-F-272	M
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	224	121.8	77.7	0.876	0.195	Fillet	TR-2001-F-274	M
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	224	128.7	78.1	0.593	0.130	Fillet	TR-2001-F-278	M
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	224	132.8	77.8	3.190	0.708	Fillet	TR-2001-F-277	M
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	229	134.1	79.7	0.755	0.153	Fillet	TR-2001-F-279	F
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	280	267.1	77.7	1.410	0.314	Fillet	TR-2001-F-282	M
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	294	329.5	77.2	1.160	0.264	Fillet	TR-2001-F-281	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	280	334.0	78.7	1.740	0.371	Fillet	TR-2001-F-308	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	349	650.0	77.7	2.070	0.462	Fillet	TR-2001-F-322	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	352	651.0	78.7	1.220	0.260	Fillet	TR-2001-F-309	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	353	738.0	77.9	1.270	0.281	Fillet	TR-2001-F-310	F
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	365	744.0	78.7	2.080	0.443	Fillet	TR-2001-F-323	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	408	1182.0	76.8	4.330	1.005	Fillet	TR-2001-F-311	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	463	1978.0	74.8	3.940	0.993	Fillet	TR-2001-F-324	M
5/17/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	267	225.0	78.3	3.540	0.768	Fillet	TR-2001-F-283	M
Site 13 (fig. 1), East Fork Trinity River below County Road 106 near Trinity Center:										
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	67	4.3	75.5	0.273	0.067	Whole body	TR-2001-W-052	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	72	5.2	73.8	0.289	0.076	Whole body	TR-2001-W-051	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	74	6.7	74	0.273	0.071	Whole body	TR-2001-W-049	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	75	6.3	72.3	0.312	0.086	Whole body	TR-2001-W-050	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	79	6.9	76.2	0.277	0.066	Whole body	TR-2001-W-048	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	80	8.7	75.9	0.463	0.112	Whole body	TR-2001-W-045	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	80	8.3	75.2	0.198	0.049	Whole body	TR-2001-W-046	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	80	7.1	72.4	0.253	0.070	Whole body	TR-2001-W-047	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	86	9.3	73.7	0.215	0.057	Whole body	TR-2001-W-043	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	86	9.0	73.5	0.247	0.065	Whole body	TR-2001-W-044	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	89	10.2	77.7	0.621	0.138	Fillet	TR-2001-F-346	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	90	12.1	76.2	0.661	0.157	Fillet	TR-2001-F-344	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	92	11.4	77.8	0.476	0.106	Fillet	TR-2001-F-345	U
9/6/2001	Marbled sculpin	<i>Cottus klamathensis</i>	103	16.5	75.8	1.030	0.249	Fillet	TR-2001-F-343	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	85	6.9	73.6	0.372	0.098	Fillet	TR-2001-F-341	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	87	6.6	73.9	0.444	0.116	Fillet	TR-2001-F-342	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	95	10.1	72.6	0.567	0.155	Fillet	TR-2001-F-340	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	136	25.1	76.6	0.379	0.089	Fillet	TR-2001-F-339	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	180	64.8	75.5	0.429	0.105	Fillet	TR-2001-F-338	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	200	81.5	74.9	0.357	0.090	Fillet	TR-2001-F-337	M
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	210	94.7	78.2	0.313	0.068	Fillet	TR-2001-F-336	M
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	218	102.7	75.1	0.560	0.139	Fillet	TR-2001-F-335	M
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	227	127.8	74.8	0.618	0.156	Fillet	TR-2001-F-334	M
8/12/2002	Marbled sculpin	<i>Cottus klamathensis</i>	81	9.4	72	0.359	0.101	Whole body	TR-2002-W-010	F
8/12/2002	Marbled sculpin	<i>Cottus klamathensis</i>	83	8.6	73.7	0.233	0.061	Whole body	TR-2002-W-009	U
8/12/2002	Marbled sculpin	<i>Cottus klamathensis</i>	85	8.4	73.6	0.375	0.099	Whole body	TR-2002-W-008	U
8/12/2002	Marbled sculpin	<i>Cottus klamathensis</i>	86	12.1	74.1	0.373	0.097	Whole body	TR-2002-W-007	U
8/12/2002	Marbled sculpin	<i>Cottus klamathensis</i>	92	13.8	75.8	0.581	0.141	Whole body	TR-2002-W-006	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	120	19.2	76.9	0.309	0.071	Fillet	TR-2002-F-102	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	124	19.4	77.6	0.392	0.088	Fillet	TR-2002-F-101	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	133	20.4	78.4	0.657	0.142	Fillet	TR-2002-F-100	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	141	25.3	78	0.585	0.129	Fillet	TR-2002-F-099	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	148	31.1	78.2	0.903	0.197	Fillet	TR-2002-F-098	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	165	45.6	78.1	0.613	0.134	Fillet	TR-2002-F-097	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	168	56.3	78.4	0.470	0.102	Fillet	TR-2002-F-096	M
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	199	74.4	78.2	0.477	0.104	Fillet	TR-2002-F-095	M
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	294	276.7	77.3	1.180	0.268	Fillet	TR-2002-F-094	F
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	344	408.7	76.7	1.370	0.319	Fillet	TR-2002-F-093	F
8/12/2002	Smallmouth bass	<i>Micropterus dolomieu</i>	76	6.2	75.6	0.493	0.120	Fillet	TR-2002-F-092	U
8/12/2002	Smallmouth bass	<i>Micropterus dolomieu</i>	81	7.9	78.6	1.180	0.253	Fillet	TR-2002-F-091	U
8/12/2002	Smallmouth bass	<i>Micropterus dolomieu</i>	89	10.8	78.3	0.214	0.046	Fillet	TR-2002-F-090	U
8/12/2002	Smallmouth bass	<i>Micropterus dolomieu</i>	93	11.6	77.8	0.687	0.153	Fillet	TR-2002-F-089	U
8/12/2002	Smallmouth bass	<i>Micropterus dolomieu</i>	137	38.0	78.4	0.987	0.213	Fillet	TR-2002-F-088	M

Table 2. Data for fishes collected in Trinity County, California, 2000–2002—Continued.

[Fillet samples dissected from left fillet of fish; whole body, whole body fish analyzed with gastrointestinal tract cleaned out. Hwy, highway; Mt, Mount. Hg, mercury; HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)]

Collection date	Common name	Scientific name	Total length (mm)	Total weight (g)	Moisture (%)	HgT-dry (µg/g)	HgT-wet (µg/g)	Sample type	Sample identification	Sex
Site 14 (fig. 1), Trinity Lake near Trinity Center:										
10/24/2000	Largemouth bass	<i>Micropterus salmoides</i>	102	16.7	75.5	0.229	0.056	Whole body	TR-2000-W-026	U
10/24/2000	Largemouth bass	<i>Micropterus salmoides</i>	103	16.7	75.5	0.220	0.054	Whole body	TR-2000-W-027	U
10/24/2000	Largemouth bass	<i>Micropterus salmoides</i>	104	18.1	76	0.210	0.050	Whole body	TR-2000-W-030	M
10/24/2000	Largemouth bass	<i>Micropterus salmoides</i>	109	19.1	74.7	0.359	0.091	Whole body	TR-2000-W-028	M
10/24/2000	Largemouth bass	<i>Micropterus salmoides</i>	110	20.6	75.6	0.196	0.048	Whole body	TR-2000-W-029	U
11/9/2000	Brown bullhead	<i>Ameiurus nebulosus</i>	220	151.8	80.6	0.133	0.026	Fillet	TR-2000-F-246	M
11/9/2000	Green sunfish	<i>Lepomis cyanellus</i>	170	91.5	81.9	0.610	0.110	Fillet	TR-2000-F-212	M
11/9/2000	Green sunfish	<i>Lepomis cyanellus</i>	180	113.7	80.7	0.830	0.160	Fillet	TR-2000-F-213	M
11/9/2000	Largemouth bass	<i>Micropterus salmoides</i>	235	185.8	79.7	0.584	0.119	Fillet	TR-2000-F-219	F
11/9/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	194	65.3	77.4	0.143	0.032	Fillet	TR-2000-F-211	U
11/9/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	238	128.8	78.6	0.311	0.067	Fillet	TR-2000-F-210	M
11/9/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	295	248.3	79.3	0.573	0.119	Fillet	TR-2000-F-215	M
11/9/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	309	302.4	77	0.457	0.105	Fillet	TR-2000-F-217	M
11/9/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	310	289.8	77	0.425	0.098	Fillet	TR-2000-F-216	M
11/9/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	345	342.5	77.1	0.448	0.103	Fillet	TR-2000-F-208	F
11/9/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	364	442.9	76.7	0.854	0.199	Fillet	TR-2000-F-209	F
11/9/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	375	484.9	75.4	0.750	0.185	Fillet	TR-2000-F-214	M
11/9/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	—	215.5	76.5	0.362	0.085	Fillet	TR-2000-F-218	M
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	172	56.2	79.9	1.070	0.215	Fillet	TR-2001-F-289	F
5/15/2001	Smallmouth bass	<i>Micropterus dolomieu</i>	181	72.5	80.2	1.200	0.238	Fillet	TR-2001-F-288	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	260	248.3	78.3	1.880	0.408	Fillet	TR-2001-F-315	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	303	487.8	77.5	0.993	0.223	Fillet	TR-2001-F-316	F
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	307	492.6	77.9	1.130	0.250	Fillet	TR-2001-F-320	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	310	507.1	76.6	1.280	0.300	Fillet	TR-2001-F-317	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	310	655.1	76.9	1.460	0.337	Fillet	TR-2001-F-318	F
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	315	593.2	76.5	1.220	0.287	Fillet	TR-2001-F-319	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	350	705.1	77.4	1.580	0.357	Fillet	TR-2001-F-321	F
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	355	864.8	76.6	1.690	0.395	Fillet	TR-2001-F-325	F
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	358	718.2	77.1	3.210	0.735	Fillet	TR-2001-F-326	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	385	976.9	75.3	2.290	0.566	Fillet	TR-2001-F-329	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	385	1040.5	77.2	1.630	0.372	Fillet	TR-2001-F-327	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	393	1302.4	76.7	2.380	0.555	Fillet	TR-2001-F-331	F
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	395	1155.1	76.3	1.510	0.358	Fillet	TR-2001-F-328	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	411	1411.3	75.2	2.430	0.603	Fillet	TR-2001-F-330	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	450	2023.2	75.1	3.600	0.896	Fillet	TR-2001-F-332	M
5/17/2001	Largemouth bass	<i>Micropterus salmoides</i>	450	2088.9	75.2	2.740	0.680	Fillet	TR-2001-F-333	M
Site 15 (fig. 1), East Fork Trinity River 1.2 mile below Devils Creek near Trinity Center:										
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	103	9.7	76.6	0.626	0.146	Fillet	TR-2001-F-413	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	108	11.2	76.5	0.719	0.169	Fillet	TR-2001-F-412	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	113	13.0	75.1	0.666	0.166	Fillet	TR-2001-F-411	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	119	14.9	78.5	0.617	0.133	Fillet	TR-2001-F-410	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	142	24.7	78.3	0.732	0.159	Fillet	TR-2001-F-408	M
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	148	28.0	75.6	0.719	0.175	Fillet	TR-2001-F-407	M
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	165	41.8	77.1	1.140	0.261	Fillet	TR-2001-F-402	U
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	168	41.4	78.7	0.833	0.177	Fillet	TR-2001-F-403	M
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	196	66.1	77.5	0.716	0.161	Fillet	TR-2001-F-400	M
9/6/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	220	117.8	77.3	1.810	0.411	Fillet	TR-2001-F-399	M
8/12/2002	Marbled sculpin	<i>Cottus klamathensis</i>	63	3.1	76.2	0.525	0.125	Whole body	TR-2002-W-004	U
8/12/2002	Marbled sculpin	<i>Cottus klamathensis</i>	63	3.1	75.9	0.967	0.233	Whole body	TR-2002-W-005	U
8/12/2002	Marbled sculpin	<i>Cottus klamathensis</i>	65	2.7	75.4	0.441	0.108	Whole body	TR-2002-W-002	U
8/12/2002	Marbled sculpin	<i>Cottus klamathensis</i>	65	3.3	76.4	0.738	0.174	Whole body	TR-2002-W-003	U
8/12/2002	Marbled sculpin	<i>Cottus klamathensis</i>	66	3.1	73.5	0.515	0.136	Whole body	TR-2002-W-001	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	121	15.4	79.1	0.733	0.153	Fillet	TR-2002-F-086	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	121	15.8	80.6	0.911	0.177	Fillet	TR-2002-F-087	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	129	19.1	80.7	0.622	0.120	Fillet	TR-2002-F-085	U
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	137	23.5	79.1	0.970	0.203	Fillet	TR-2002-F-084	M
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	161	35.4	79.5	0.840	0.172	Fillet	TR-2002-F-083	F
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	165	40.5	79.1	0.752	0.157	Fillet	TR-2002-F-082	F

Table 2. Data for fishes collected in Trinity County, California, 2000–2002—Continued.

[Fillet samples dissected from left fillet of fish; whole body, whole body fish analyzed with gastrointestinal tract cleaned out. Hwy, highway; Mt, Mount. Hg, mercury; HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)].

Collection date	Common name	Scientific name	Total length (mm)	Total weight (g)	Moisture (%)	HgT-dry (µg/g)	HgT-wet (µg/g)	Sample type	Sample identification	Sex
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	170	40.2	79.4	0.534	0.110	Fillet	TR-2002-F-081	F
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	194	66.4	78.5	0.730	0.157	Fillet	TR-2002-F-080	F
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	202	73.2	77.7	0.775	0.173	Fillet	TR-2002-F-079	F
8/12/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	216	92.2	78.9	1.120	0.236	Fillet	TR-2002-F-078	F
Site 16 (fig. 1), Carrville Pond near Carrville:										
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	276	189.6	78.2	0.172	0.037	Fillet	TR-2000-F-229	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	260	209.3	75.3	0.096	0.024	Fillet	TR-2000-F-220	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	280	262.2	76.8	0.092	0.021	Fillet	TR-2000-F-223	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	282	204.6	76.4	0.109	0.026	Fillet	TR-2000-F-221	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	283	275.9	75.6	0.099	0.024	Fillet	TR-2000-F-222	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	292	248.6	74.7	0.089	0.023	Fillet	TR-2000-F-226	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	296	328.3	75	0.086	0.021	Fillet	TR-2000-F-227	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	300	272.8	75.9	0.078	0.019	Fillet	TR-2000-F-225	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	315	319.6	75.5	0.089	0.022	Fillet	TR-2000-F-224	M
9/26/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	325	355.4	75.6	0.126	0.031	Fillet	TR-2000-F-228	M
Site 17 (fig. 1), Coffee Creek at Hwy 3 near Carrville:										
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	135	24.0	74.8	0.126	0.032	Whole body	TR-2000-W-006	U
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	154	34.5	73.8	0.096	0.025	Whole body	TR-2000-W-007	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	163	45.0	74.6	0.152	0.039	Whole body	TR-2000-W-010	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	170	46.9	73.4	0.080	0.021	Whole body	TR-2000-W-008	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	177	52.4	75.3	0.081	0.020	Whole body	TR-2000-W-009	U
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	206	83.6	77	0.141	0.032	Fillet	TR-2000-F-236	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	218	105.3	77.4	0.819	0.185	Fillet	TR-2000-F-237	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	229	125.7	77.6	0.184	0.041	Fillet	TR-2000-F-238	F
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	242	145.8	75.9	0.165	0.040	Fillet	TR-2000-F-239	F
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	358	390.9	75.7	0.410	0.100	Fillet	TR-2000-F-240	F
Site 18 (fig. 1), Trinity River above Coffee Creek near Trinity Center:										
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	125	18.4	78.5	0.166	0.036	Whole body	TR-2000-W-012	U
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	139	26.6	75.7	0.124	0.030	Whole body	TR-2000-W-013	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	141	30.2	75.2	0.141	0.035	Whole body	TR-2000-W-011	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	148	33.2	75.5	0.141	0.035	Whole body	TR-2000-W-014	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	166	43.6	78.6	0.154	0.033	Whole body	TR-2000-W-015	U
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	179	55.0	78.1	0.323	0.071	Fillet	TR-2000-F-241	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	216	97.4	75.9	0.244	0.059	Fillet	TR-2000-F-242	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	258	181.3	75.9	0.351	0.085	Fillet	TR-2000-F-244	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	259	161.0	78.4	0.098	0.021	Fillet	TR-2000-F-243	M
9/12/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	269	199.7	78.4	0.164	0.035	Fillet	TR-2000-F-245	M
Site 19 (fig. 1), East Fork Trinity River below Altoona Mine Drain near Trinity Center:										
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	116	16.6	75.8	0.503	0.122	Whole body	TR-2000-W-023	M
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	119	18.2	74.3	0.586	0.151	Whole body	TR-2000-W-024	M
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	120	16.8	76.1	0.535	0.128	Whole body	TR-2000-W-025	U
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	142	28.7	76.2	0.576	0.137	Whole body	TR-2000-W-022	F
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	144	29.9	76.1	0.553	0.132	Whole body	TR-2000-W-021	F
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	160	50.0	75.6	0.866	0.211	Fillet	TR-2000-F-230	F
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	173	52.3	77.9	1.040	0.230	Fillet	TR-2000-F-232	M
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	176	52.7	78.1	0.766	0.168	Fillet	TR-2000-F-231	F
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	89	5.9	68.9	0.621	0.193	Fillet	TR-2001-F-398	U
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	100	9.0	75.6	0.550	0.134	Fillet	TR-2001-F-397	U
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	107	11.9	75.7	0.691	0.168	Fillet	TR-2001-F-394	M
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	121	15.1	77	0.734	0.169	Fillet	TR-2001-F-392	M
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	126	18.7	76.5	0.609	0.143	Fillet	TR-2001-F-390	U
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	134	20.8	78.4	0.638	0.138	Fillet	TR-2001-F-389	U
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	138	25.0	79	0.844	0.177	Fillet	TR-2001-F-388	F
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	144	30.0	78.2	0.883	0.192	Fillet	TR-2001-F-386	M
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	149	32.1	75.7	0.754	0.183	Fillet	TR-2001-F-384	M

Table 2. Data for fishes collected in Trinity County, California, 2000–2002—Continued.

[Fillet samples dissected from left fillet of fish; whole body, whole body fish analyzed with gastrointestinal tract cleaned out. Hwy, highway; Mt, Mount. Hg, mercury; HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)]

Collection date	Common name	Scientific name	Total length (mm)	Total weight (g)	Moisture (%)	HgT-dry (µg/g)	HgT-wet (µg/g)	Sample type	Sample identification	Sex
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	154	31.6	77.1	0.822	0.188	Fillet	TR-2001-F-385	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	130	23.6	80.1	0.901	0.179	Fillet	TR-2002-F-112	U
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	133	21.9	79.8	0.853	0.172	Fillet	TR-2002-F-111	U
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	134	23.0	80	0.872	0.174	Fillet	TR-2002-F-109	U
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	134	22.2	79.2	1.610	0.335	Fillet	TR-2002-F-110	U
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	137	25.0	79.7	0.924	0.188	Fillet	TR-2002-F-108	M
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	144	30.0	79.1	0.675	0.141	Fillet	TR-2002-F-107	U
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	155	38.9	80.4	1.100	0.216	Fillet	TR-2002-F-105	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	155	36.3	79.4	1.100	0.227	Fillet	TR-2002-F-106	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	156	39.5	79.8	1.110	0.224	Fillet	TR-2002-F-104	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	160	41.6	80.4	0.670	0.131	Fillet	TR-2002-F-103	F
Site 20 (fig. 1), East Fork Trinity River Upstream Altoona Mine Drain near Castella:										
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	121	18.4	73.6	0.509	0.134	Whole body	TR-2000-W-017	M
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	133	22.8	75	0.462	0.116	Whole body	TR-2000-W-018	M
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	139	26.5	77.1	0.444	0.102	Whole body	TR-2000-W-016	M
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	142	27.6	76.6	0.388	0.091	Whole body	TR-2000-W-019	M
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	148	28.2	78	0.542	0.119	Whole body	TR-2000-W-020	M
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	189	71.8	76.8	1.230	0.285	Fillet	TR-2000-F-235	F
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	198	82.7	75.8	0.943	0.228	Fillet	TR-2000-F-233	M
9/11/2000	Rainbow trout	<i>Oncorhynchus mykiss</i>	200	76.1	77.4	1.120	0.253	Fillet	TR-2000-F-234	F
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	90	7.8	77	0.565	0.130	Fillet	TR-2001-F-382	U
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	94	6.7	76.5	0.351	0.082	Fillet	TR-2001-F-383	U
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	106	11.3	73.9	0.548	0.143	Fillet	TR-2001-F-380	U
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	108	10.5	77.7	0.554	0.124	Fillet	TR-2001-F-381	M
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	110	12.1	77.3	0.563	0.128	Fillet	TR-2001-F-379	U
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	134	21.2	75.9	0.790	0.190	Fillet	TR-2001-F-378	F
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	138	23.7	75.8	0.528	0.128	Fillet	TR-2001-F-377	F
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	140	27.3	75.2	0.748	0.186	Fillet	TR-2001-F-376	M
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	148	28.8	76.1	0.725	0.173	Fillet	TR-2001-F-374	M
9/5/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	165	43.6	75.2	0.716	0.178	Fillet	TR-2001-F-373	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	133	23.0	80.1	0.893	0.178	Fillet	TR-2002-F-077	U
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	134	23.0	80.6	0.660	0.128	Fillet	TR-2002-F-076	U
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	136	25.9	79.8	0.708	0.143	Fillet	TR-2002-F-075	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	138	25.7	79.3	0.774	0.160	Fillet	TR-2002-F-074	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	141	29.1	78.8	0.591	0.125	Fillet	TR-2002-F-073	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	142	26.5	79.3	1.150	0.238	Fillet	TR-2002-F-072	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	144	31.0	79.1	0.673	0.141	Fillet	TR-2002-F-071	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	152	35.7	80.4	1.110	0.218	Fillet	TR-2002-F-070	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	162	40.0	79.7	0.849	0.172	Fillet	TR-2002-F-069	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	175	58.3	79.3	0.696	0.144	Fillet	TR-2002-F-068	F
Site 21 (fig. 1), Crow Creek above Confluence of East Fork Trinity River near Trinity:										
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	108	14.2	76.4	0.369	0.087	Fillet	TR-2001-F-427	U
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	110	13.0	78.3	0.553	0.120	Fillet	TR-2001-F-428	U
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	115	16.1	73.1	0.461	0.124	Fillet	TR-2001-F-426	U
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	127	20.0	75.9	0.340	0.082	Fillet	TR-2001-F-425	M
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	129	23.7	78.2	0.700	0.153	Fillet	TR-2001-F-422	M
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	130	22.8	76.4	0.530	0.125	Fillet	TR-2001-F-423	F
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	132	24.9	77.3	0.619	0.141	Fillet	TR-2001-F-420	F
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	134	24.1	77.6	0.768	0.172	Fillet	TR-2001-F-421	M
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	145	28.9	77	0.509	0.117	Fillet	TR-2001-F-417	F
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	160	42.0	77.4	1.210	0.273	Fillet	TR-2001-F-414	M
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	130	21.9	79.2	0.577	0.120	Fillet	TR-2002-F-122	U
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	131	20.4	80	0.741	0.148	Fillet	TR-2002-F-121	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	132	22.3	79.2	0.545	0.113	Fillet	TR-2002-F-120	M
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	133	27.0	79.4	0.585	0.121	Fillet	TR-2002-F-119	M
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	143	32.9	79.6	0.572	0.117	Fillet	TR-2002-F-118	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	150	31.9	79.7	0.578	0.117	Fillet	TR-2002-F-117	F

Table 2. Data for fishes collected in Trinity County, California, 2000–2002—Continued.

[Fillet samples dissected from left fillet of fish; whole body, whole body fish analyzed with gastrointestinal tract cleaned out. Hwy, highway; Mt, Mount. Hg, mercury; HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)]

Collection date	Common name	Scientific name	Total length (mm)	Total weight (g)	Moisture (%)	HgT-dry (µg/g)	HgT-wet (µg/g)	Sample type	Sample identification	Sex
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	161	47.2	78.4	0.412	0.089	Fillet	TR-2002-F-116	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	165	43.8	79.6	1.090	0.222	Fillet	TR-2002-F-115	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	176	52.0	79	0.620	0.130	Fillet	TR-2002-F-114	F
8/13/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	186	66.3	79.2	0.811	0.169	Fillet	TR-2002-F-113	F
Site 22 (fig. 1), Tamarack Creek at East Fork Trinity River near Mt. Shasta:										
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	96	8.4	78.8	0.294	0.062	Fillet	TR-2001-F-362	U
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	101	9.7	74.9	0.183	0.046	Fillet	TR-2001-F-361	U
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	102	11.9	75.9	0.592	0.143	Fillet	TR-2001-F-360	U
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	120	16.1	71.5	0.167	0.048	Fillet	TR-2001-F-358	M
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	125	20.3	75.8	0.228	0.055	Fillet	TR-2001-F-356	M
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	126	20.8	75.1	0.130	0.032	Fillet	TR-2001-F-354	M
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	128	22.4	77.5	0.248	0.056	Fillet	TR-2001-F-353	U
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	144	27.5	76.4	0.515	0.122	Fillet	TR-2001-F-351	M
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	167	44.0	79.8	0.438	0.088	Fillet	TR-2001-F-348	M
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	178	50.2	81.3	0.604	0.113	Fillet	TR-2001-F-347	M
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	110	13.1	78.6	0.210	0.045	Fillet	TR-2002-F-060	M
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	121	16.9	78.8	0.204	0.043	Fillet	TR-2002-F-059	F
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	122	20.3	79.3	0.254	0.053	Fillet	TR-2002-F-058	F
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	125	18.4	79.4	0.211	0.043	Fillet	TR-2002-F-057	M
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	130	22.8	79.4	0.219	0.045	Fillet	TR-2002-F-056	M
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	133	26.0	78.1	0.151	0.033	Fillet	TR-2002-F-054	F
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	133	21.0	79.3	0.235	0.049	Fillet	TR-2002-F-055	F
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	139	23.4	81	0.317	0.060	Fillet	TR-2002-F-053	F
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	143	29.1	79	0.202	0.042	Fillet	TR-2002-F-052	M
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	149	29.6	79.9	0.370	0.074	Fillet	TR-2002-F-051	F
Site 23 (fig. 1), East Fork Trinity River at Horse Heaven Meadow near Mt. Shasta:										
9/7/2001	Brook trout	<i>Salvelinus fontinalis</i>	83	5.3	79.5	0.584	0.120	Fillet	TR-2001-F-370	U
9/7/2001	Brook trout	<i>Salvelinus fontinalis</i>	91	7.3	78.7	0.554	0.118	Fillet	TR-2001-F-369	F
9/7/2001	Brook trout	<i>Salvelinus fontinalis</i>	119	15.4	77	0.409	0.094	Fillet	TR-2001-F-368	F
9/7/2001	Brook trout	<i>Salvelinus fontinalis</i>	144	29.2	77.4	0.426	0.096	Fillet	TR-2001-F-367	M
9/7/2001	Brook trout	<i>Salvelinus fontinalis</i>	148	32.2	76.3	0.517	0.123	Fillet	TR-2001-F-366	U
9/7/2001	Brook trout	<i>Salvelinus fontinalis</i>	158	36.1	81.1	1.190	0.225	Fillet	TR-2001-F-365	F
9/7/2001	Brook trout	<i>Salvelinus fontinalis</i>	210	69.4	80.3	0.835	0.164	Fillet	TR-2001-F-364	M
9/7/2001	Brook trout	<i>Salvelinus fontinalis</i>	230	144.7	77.2	0.572	0.130	Fillet	TR-2001-F-371	M
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	115	14.6	78.3	0.649	0.141	Fillet	TR-2001-F-372	M
9/7/2001	Rainbow trout	<i>Oncorhynchus mykiss</i>	169	34.3	81.3	1.170	0.219	Fillet	TR-2001-F-363	U
8/14/2002	Brook trout	<i>Salvelinus fontinalis</i>	133	26.2	78.1	0.384	0.084	Fillet	TR-2002-F-067	F
8/14/2002	Brook trout	<i>Salvelinus fontinalis</i>	136	23.4	78.3	0.405	0.088	Fillet	TR-2002-F-066	F
8/14/2002	Brook trout	<i>Salvelinus fontinalis</i>	137	28.2	78.7	0.546	0.116	Fillet	TR-2002-F-065	F
8/14/2002	Brook trout	<i>Salvelinus fontinalis</i>	138	28.2	78.8	0.293	0.062	Fillet	TR-2002-F-064	F
8/14/2002	Brook trout	<i>Salvelinus fontinalis</i>	143	26.7	79.4	0.372	0.077	Fillet	TR-2002-F-063	F
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	138	29.8	78.4	0.632	0.137	Fillet	TR-2002-F-062	M
8/14/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	183	60.2	80	1.120	0.224	Fillet	TR-2002-F-061	M

Field Methods and Sample Preservation Techniques

Field and laboratory methods were similar to those used by May and others (2000). Most fish were collected using electrofishing equipment and dip nets. Additional collection techniques included gill netting, hook and line capture, as well as dip netting. Fish were held in clean containers with ambient water until they were weighed, to the nearest gram, and measured for standard and total length, in millimeters. After recording the length and mass, spines or scales were removed for future age determination. Each fish was then wrapped in clean, heavy-duty aluminum foil, labeled, placed in a plastic bag on wet ice and held for less than 8 hours. The fish were then taken to the laboratory where they were stored frozen until processing.

The processing of fish followed standard procedures (U.S. Environmental Protection Agency, 1995). Fish were handled with powder-free latex gloves, and dissections were performed on a new sheet of heavy-duty aluminum foil for each fish. High-quality stainless steel instruments and disposable scalpel blades were used in the processing of the fish samples. Scalpel blades were changed and instruments were cleaned thoroughly between samples. Cleaning the instruments involved washing with deionized water and laboratory detergent, acid washing, and finally rinsing with deionized water before and after dissection of each fish specimen.

Larger fish were thawed and scaled or the skin was removed (on scaleless fish such as catfish) before dissection. Boneless and skinless fillet portions were dissected from the upper medial-axial region of the fish in an approximately rectangular shape. Excised tissues were placed directly into labeled, chemically cleaned borosilicate-glass jars on a pre-tared balance. The sample mass was recorded, and a Teflon-lined lid was screwed atop each jar and sealed with Parafilm. Fish tissue samples were stored frozen in sealed sample jars until they were packed in coolers with dry ice and shipped to the analytical laboratory.

Muscle tissues were removed from both the left and right fillet of the larger fish processed during this study. Tissues dissected from the left fillet were labeled with sample numbers beginning with "F-" for individual samples. Tissues removed from the right fillet were labeled with sample numbers beginning with "R-"; these samples served as archive samples, as well as replicates for additional quality-assurance purposes.

For larger fish (longer than about 175-mm total length), concentrations of total mercury (Hg) were determined from fillet samples of axial muscle. For some smaller fish, such as marbled sculpin (*Cottus klamathensis*), rainbow trout (*Oncorhynchus mykiss*), and green sunfish (*Lepomis cyanellus*), whole-body samples (with the gastrointestinal contents removed) were submitted for total mercury analysis.

Laboratory Methods of Chemical Analysis

Analysis of mercury (Hg) in fish samples was done at the Trace Element Research Laboratory (TERL) at Texas A&M University in College Station, Texas, under the direction of Dr. Robert Taylor. Before samples were analyzed for Hg by cold-vapor atomic absorption spectroscopy (CVAAS), the Hg was converted to the divalent mercury (Hg^{2+}) form. Mercury was digested using a modified version of U.S. Environmental Protection Agency (USEPA) methods 245.5 and 245.6 (U.S. Environmental Protection Agency, 1991). Tissue samples were homogenized in the original sample containers using a Tekmar Tissumizer, and then subsampled. Tissue subsamples were digested with nitric acid, sulfuric acid, potassium permanganate, and potassium persulfate in polypropylene tubes in a water bath at 90 to 95 degrees Celsius ($^{\circ}\text{C}$). Before analysis, hydroxylamine hydrochloride was added to reduce excess permanganate, and the samples were brought to volume using distilled-deionized water.

In the CVAAS procedure for determination of Hg, divalent mercury (Hg^{2+}) in aqueous samples (digests of tissue samples) is reduced to the elemental state (Hg^0) by a strong reducing agent (stannous chloride). Gaseous Hg^0 enters the sweep gas and is introduced into an atomic absorption cell, where light produced by a Hg vapor lamp is absorbed by the free Hg atoms. Mercury concentration in the sample is determined by comparing light absorption of the sample with that of external calibration standards. The range limit of detection (LOD) for these analyses was 0.009 to 0.0613 micrograms per gram ($\mu\text{g/g}$), dry weight.

Procedures that require tissue samples to be freeze-dried to determine mercury concentrations result in removal of the original moisture in the sample. Therefore, it is necessary to determine tissue moisture content to provide an estimate of mercury concentration on a "live" or "wet weight" basis. Mercury concentration in tissue is regulated on wet weight basis (U.S. Food and Drug Administration, 1994; U.S. Environmental Protection Agency, 2001). Additionally, tissue moisture is a relative measure of the quality of the tissue sample.

Moisture content was determined by weight loss upon freeze drying and is expressed as weight percentage of the original wet sample. Depending on sample size, either the whole sample or a representative aliquot was frozen and then dried under vacuum until a constant weight was attained. Samples were prepared and dried using plastic materials to minimize potential contamination artifacts.

Quality Assurance and Quality Control

As part of normal quality-assurance (QA) and quality-control (QC) procedures, a standard number of procedural blanks, laboratory duplicate samples, blind duplicate samples, spiked samples, and standard reference materials were analyzed for each set of samples. Three sets of fish samples from Trinity County were analyzed at the TERL during the period 2000–2002.

Procedural blanks were analyzed to quantify the amount of total mercury that may have been added inadvertently during sample processing. A total of 18 procedural blanks were analyzed in the three sample sets, with results ranging from 0.00001 to 0.0047 µg/g (dry weight); results were within acceptable limits for all the samples.

Laboratory replicate samples were analyzed to provide a measure of the precision of the methods used for analysis. After the sample was homogenized, two separate subsamples were taken and analyzed. Replicate analyses were evaluated in accordance with a two-tiered acceptance criterion as follows: if the sample concentration was within the range of 2 to 10 times the limit of detection (LOD), the variation in terms of a 95-percent confidence interval had to be within 20 percent of the original value to meet the criterion, or if the sample concentration was greater than 10 times the LOD, then the replicate sample had to be within 10 percent of the original value to fall within the 95-percent confidence interval.

Relative percentage difference (RPD) is a measure of variability or precision for replicate analyses, and is computed as 100 times the absolute value of the difference between two replicate analyses divided by the mean of the replicate analyses. Values of RPD for the 15 laboratory replicates analyzed in the

three sample sets ranged from 0.24 to 9.17 percent, well within acceptable limits.

Spiked samples were analyzed to provide a measure of the accuracy of the methods used for analysis. After the sample was homogenized, two separate subsamples were taken: one was processed as a sample, and the other subsample had a known quantity of analyte added prior to analysis. Spike recoveries were considered acceptable if the average recovery was 85 to 115 percent of the spike concentration after subtraction of the sample concentration. For the 18 spiked samples in the three sample sets, the recovered percentage of the added spike total concentration ranged from 93.5 to 107 percent.

Standard reference material (SRM) was analyzed to provide an estimate of range in accuracy of the laboratory instrument used for the determination of total mercury concentration and to ensure that this method produced results that were comparable to those obtained by an independent organization. The SRM used by the TERL was dogfish (*Squalus* sp.) muscle (DORM-2), certified by the National Research Council Canada (NRCC) as having a certified reference value (CRV) of 4.64 µg/g mercury (dry). The percentage recovery for the 18 analyses of DORM-2 in the three sample sets ranged from 82.7 to 107 percent, which is within acceptable limits.

Blind replicate samples were submitted to the TERL as additional QA-QC check on laboratory procedures. A total of 39 blind replicate samples from the three sample sets were submitted to the TERL. Data for these analyses are listed in table 3. Most of the blind replicate samples showed little variation. The median value of RPD for the 39 replicates was 3.8 percent, and the mean value was 8.0 percent. Thirty-two of the 39 blind replicate pairs (82 percent) had RPD values less than 10 percent, and 36 of 39 pairs (92 percent) had RPD values less than 20 percent. These results are considered to be within acceptable limits of variability.

Table 3. Data from replicate analyses of fishes collected in Trinity County, California, 2000–2002

[Sample dissected from left fillet of fish; replicate sample dissected from right fillet of fish. Hwy, highway; Mt, Mount. Hg, mercury. HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)]

Collection date	Common name	Total length (mm)	Total weight (g)	Left fillet moisture (%)	Right fillet moisture (%)	Left fillet HgT-dry (µg/g)	Right fillet HgT-dry (µg/g)	Absolute value of relative percentage difference, HgT-dry	Left fillet sample ID	Right fillet sample ID	Sex
Site 2 (fig. 1), Trinity River at Big Flat Day Use Area near Big Bar: 8/27/2002	Rainbow trout	166	40.9	78.7	78.4	0.306	0.278	9.6	TR-2002-F-001	TR-2002-R-001	F
Site 6, (fig. 1): Trinity River at Hayden Flat near Big Bar: 8/27/2002	Rainbow trout	147	28.2	79.2	80.1	0.203	0.199	2.0	TR-2002-F-011	TR-2002-R-011	F
Site 7 (fig. 1), Canyon Creek below Conrad Gulch near Junction City: 8/27/2002	Rainbow trout	235	122.2	78.6	78.5	0.296	0.300	1.3	TR-2002-F-041	TR-2002-R-041	F
Site 10 (fig. 1), East Fork of North Fork Trinity River, 0.53 mile above Barney Gulch: 8/27/2002	Rainbow trout	176	52.1	79.3	79.3	0.480	0.428	11.5	TR-2002-F-031	TR-2002-R-031	M
Site 11 (fig. 1), New River at Denny Campground near Denny: 9/7/2001	Rainbow trout	202	74.0	78.6	78.1	0.260	0.245	5.9	TR-2002-F-021	TR-2002-R-021	F

Table 3. Data from replicate analyses of fishes collected in Trinity County, California, 2000–2002—Continued.

[Sample dissected from left fillet of fish; replicate sample dissected from right fillet of fish. Hwy, highway; Mt, Mount. Hg, mercury. HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; $\mu\text{g/g}$, microgram per gram (equivalent to part per million)]

Collection date	Common name	Total length (mm)	Total weight (g)	Left fillet moisture (%)	Right fillet moisture (%)	Left fillet HgT-dry ($\mu\text{g/g}$)	Right fillet HgT-dry ($\mu\text{g/g}$)	Absolute value of relative percentage difference, HgT-dry	Left fillet sample ID	Right fillet sample ID	Sex
Site 12 (fig. 1), East Fork Trinity Arm of Trinity Lake near Trinity Center:											
11/9/2000	Smallmouth bass	308	471.5	76.7	76.6	1.470	1.430	2.8	TR-2000-F-201	TR-2000-R-201	M
11/9/2000	Smallmouth bass	325	583.4	75.9	76.4	1.370	1.390	1.4	TR-2000-F-203	TR-2000-R-203	M
11/9/2000	Smallmouth bass	330	599.8	75.6	55.0	1.330	1.280	3.8	TR-2000-F-204	TR-2000-R-204	F
11/9/2000	White catfish	325	523.5	77.5	71.4	2.620	2.030	25.4	TR-2000-F-247	TR-2000-R-247	F
5/15/2001	Smallmouth bass	224	121.8	77.7	77.5	0.876	0.893	1.9	TR-2001-F-274	TR-2001-R-274	M
5/15/2001	Smallmouth bass	206	94.9	79.3	79.0	3.840	3.710	3.4	TR-2001-F-276	TR-2001-R-276	F
5/15/2001	Smallmouth bass	229	134.1	79.7	79.5	0.755	0.754	0.1	TR-2001-F-279	TR-2001-R-279	F
5/15/2001	Smallmouth bass	294	329.5	77.2	77.2	1.160	1.180	1.7	TR-2001-F-281	TR-2001-R-281	M
5/17/2001	Largemouth bass	353	738.0	77.9	77.7	1.270	1.210	4.8	TR-2001-F-310	TR-2001-R-310	F
5/17/2001	Largemouth bass	463	1978.0	74.8	74.9	3.940	4.130	4.7	TR-2001-F-324	TR-2001-R-324	M
Site 13 (fig. 1), East Fork Trinity River below County Road 106 near Trinity Center:											
9/6/2001	Rainbow trout	227	127.8	74.8	75.1	0.618	0.600	3.0	TR-2001-F-334	TR-2001-R-334	M
8/12/2002	Rainbow trout	344	408.7	76.7	76.2	1.370	1.390	1.4	TR-2002-F-093	TR-2002-R-093	F
Site 14 (fig. 1), Trinity Lake near Trinity Center:											
11/9/2000	green sunfish	180	113.7	80.7	80.6	0.830	0.810	2.4	TR-2000-F-213	TR-2000-R-213	M
11/9/2000	Rainbow trout	364	442.9	76.7	77.8	0.854	0.869	1.7	TR-2000-F-209	TR-2000-R-209	F
5/17/2001	Largemouth bass	393	1302.4	76.7	77.8	2.380	2.820	16.9	TR-2001-F-331	TR-2001-R-331	F
5/17/2001	Largemouth bass	450	2023.2	75.1	74.6	3.600	3.250	10.2	TR-2001-F-332	TR-2001-R-332	M
Site 15 (fig. 1), East Fork Trinity River 1.2 mile below Devils Creek near Trinity Center:											
9/6/2001	Rainbow trout	220	117.8	77.3	77.1	1.810	1.760	2.8	TR-2001-F-399	TR-2001-R-369	M
8/12/2002	Rainbow trout	216	92.2	78.9	78.4	1.120	1.100	1.8	TR-2002-F-078	TR-2002-R-078	F
Site 16 (fig. 1), Carrville Pond near Carrville:											
9/26/2000	Rainbow trout	283	275.9	76.8	75.5	0.092	0.110	17.8	TR-2000-F-223	TR-2000-R-222	M
9/26/2000	Rainbow trout	296	328.3	75.0	74.9	0.086	0.090	4.5	TR-2000-F-227	TR-2000-R-227	M
Site 17 (fig. 1), Coffee Creek at Hwy 3 near Carrville:											
9/12/2000	Rainbow trout	206	83.6	77.0	77.1	0.141	0.130	8.1	TR-2000-F-236	TR-2000-R-236	M
Site 18 (fig. 1), Trinity River above Coffee Creek near Trinity Center:											
9/12/2000	Rainbow trout	216	97.4	75.9	76.2	0.244	0.232	5.0	TR-2000-F-242	TR-2000-R-242	M
9/12/2000	Rainbow trout	259	161.0	78.4	78.8	0.098	0.096	1.7	TR-2000-F-243	TR-2000-R-243	M
Site 19 (fig. 1), East Fork Trinity River below Altoona Mine Drain below Trinity Center:											
9/5/2001	Rainbow trout	144	30.0	78.2	78.5	0.883	0.910	3.0	TR-2001-F-386	TR-2001-R-364	M
8/13/2002	Rainbow trout	156	39.5	79.8	80.0	1.110	1.160	4.4	TR-2002-F-104	TR-2002-R-104	F
Site 20 (fig. 1), East Fork Trinity River Upstream Altoona Mine Drain near Castella:											
9/11/2000	Rainbow trout	189	71.8	76.8	77.6	1.230	1.190	3.3	TR-2000-F-235	TR-2000-R-235	F
9/5/2001	Rainbow trout	138	23.7	75.8	75.8	0.528	0.212	85.4	TR-2001-F-377	TR-2001-R-360	F
8/13/2002	Rainbow trout	175	58.3	79.3	79.3	0.696	0.668	4.1	TR-2002-F-068	TR-2002-R-068	F
Site 21 (fig. 1), Crow Creek above Confluence of East Fork Trinity River near Trinity:											
9/7/2001	Rainbow trout	130	22.8	76.4	76.7	0.530	0.505	4.8	TR-2001-F-423	TR-2001-R-388	F
8/13/2002	Rainbow trout	186	66.3	79.2	79.2	0.811	0.850	4.7	TR-2002-F-113	TR-2002-R-113	F

Table 3. Data from replicate analyses of fishes collected in Trinity County, California, 2000–2002—Continued.

[Sample dissected from left fillet of fish; replicate sample dissected from right fillet of fish. Hw, highway; Mt, Mount. Hg, mercury. HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)]

Collection date	Common name	Total length (mm)	Total weight (g)	Left fillet moisture (%)	Right fillet moisture (%)	Left fillet HgT-dry (µg/g)	Right fillet HgT-dry (µg/g)	Absolute value of relative percentage difference, HgT-dry	Left fillet sample ID	Right fillet sample ID	Sex
Site 22 (fig. 1), Tamarack Creek at East Fork Trinity River near Mt. Shasta:											
9/7/2001	Rainbow trout	178	50.2	81.3	81.4	0.604	0.600	0.7	TR-2001-F-347	TR-2001-R-340	M
8/14/2002	Rainbow trout	133	26.0	78.1	78.3	0.151	0.164	8.3	TR-2002-F-054	TR-2002-R-054	F
Site 23 (fig. 1), East Fork Trinity River at Horse Heaven Meadow near Mt. Shasta:											
9/7/2001	Brook trout	230	144.7	77.2	80.5	0.572	0.776	30.3	TR-2001-F-371	TR-2001-R-351	M
9/7/2001	Rainbow trout	169	34.3	81.3	83.1	1.170	1.210	3.4	TR-2001-F-363	TR-2001-R-350	U

Results

A total of 368 fishes were collected and processed for the analysis of total mercury (table 2). Total mercury in 74 black bass (largemouth and smallmouth bass; *Micropterus* spp.) samples ranged from 0.046 to 1.225 µg/g (equivalent to parts per million or ppm) wet weight (ww). Mercury concentrations in 26 of the 34 black bass (76 percent) of legal catch size (≥ 305 millimeters in length) were ≥ 0.3 ppm (ww), the U.S. Environmental Protection Agency water-quality criterion for the protection of human health (U.S. Environmental Protection Agency, 2001). Mercury concentrations exceeded 1.0 ppm (ww), the Food and Drug Administration action level for commercial fish (U.S. Food and Drug Administration, 1994), in 3 of the 34 black bass (9 percent) of legal catch size. In contrast, only 3 of the 237 (about 1 percent) rainbow trout of all sizes sampled from stream, pond, and lake sites had Hg concentrations ≥ 0.3 ppm (ww) (table 2).

In response to data generated by this study and other related investigations, the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) issued a draft fish-consumption advisory report that offered guidelines for human consumption of fish (Klasing and Brodberg, 2005). The final version of the OEHHA fish-consumption advisory (Klasing and Brodberg, in press) was approved by the State of California in July 2005 and is scheduled for publication in October 2005 (http://www.oehha.ca.gov/fish/so_cal/TrinRiverF2.html)

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HEALTH ADVISORY

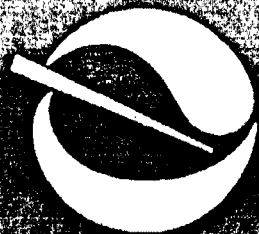
SAFE EATING GUIDELINES FOR FISH FROM TRINITY LAKE, LEWISTON LAKE, CARRVILLE POND, THE TRINITY RIVER UPSTREAM FROM TRINITY LAKE AND THE EAST FORK TRINITY RIVER (TRINITY COUNTY)

October 2005

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State of California**

**Alan C. Lloyd, Ph.D.
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**Joan E. Denton, Ph.D.
Director
Office of Environmental Health Hazard Assessment**



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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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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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 3×10^{-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 1×10^{-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.

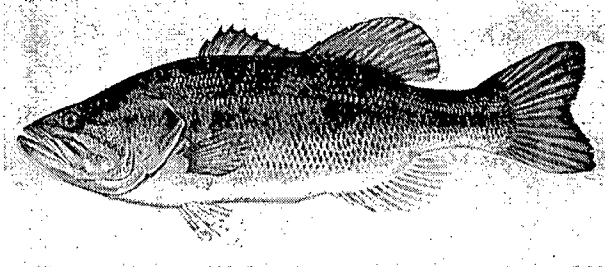
DO NOT COMBINE FISH CONSUMPTION ADVICE. If you eat multiple species or catch fish from more than one area, the recommended guidelines for different species and locations should not be combined.

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.

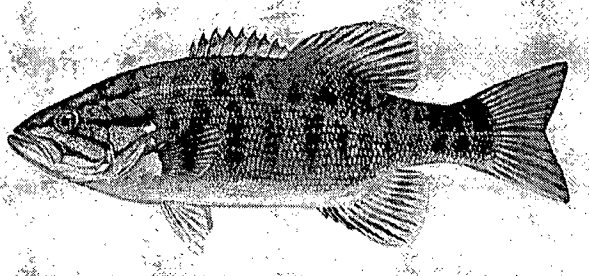
TRINITY LAKE and the TRINITY RIVER WATERSHED SPORT FISH

Largemouth Bass (*Micropterus salmoides*)



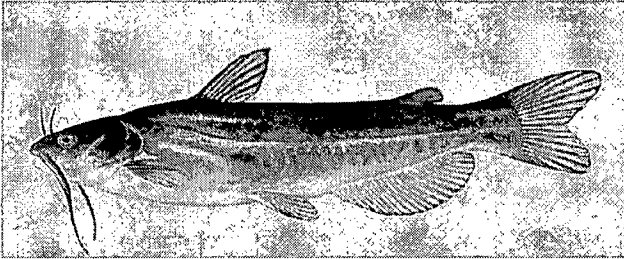
Duane Raver, USFWS

Smallmouth Bass (*Micropterus dolomieu*)



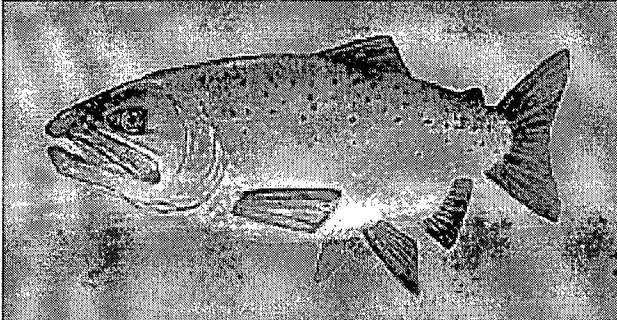
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White catfish (*Ameiurus catus*)



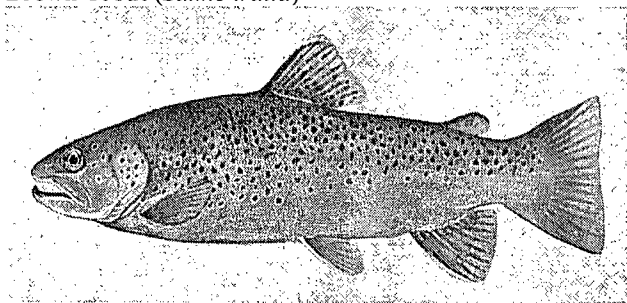
Duane Raver, USFWS

Chinook Salmon (*Oncorhynchus tshawytscha*)



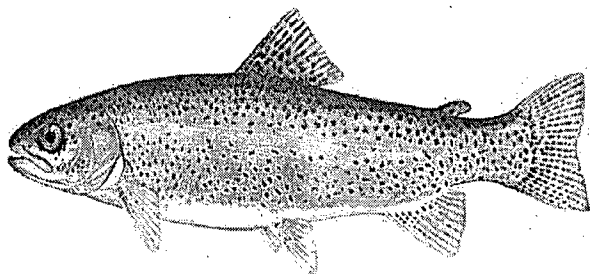
Timothy Knepp, USFWS

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 (≥ 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 ($\mu\text{g/g}$). 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 3×10^{-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 $\mu\text{g/L}$ and 50-125 $\mu\text{g/g}$, 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 1×10^{-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 $\mu\text{g}/\text{kg}$ -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 1×10^{-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 1×10^{-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; Daviglius 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 reference doses for two distinct population groups. For these safe eating guidelines, the current RfD of 0.1 $\mu\text{g}/\text{kg}\text{-day}$, 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 $\mu\text{g}/\text{kg}\text{-day}$, 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 <i>or</i>
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

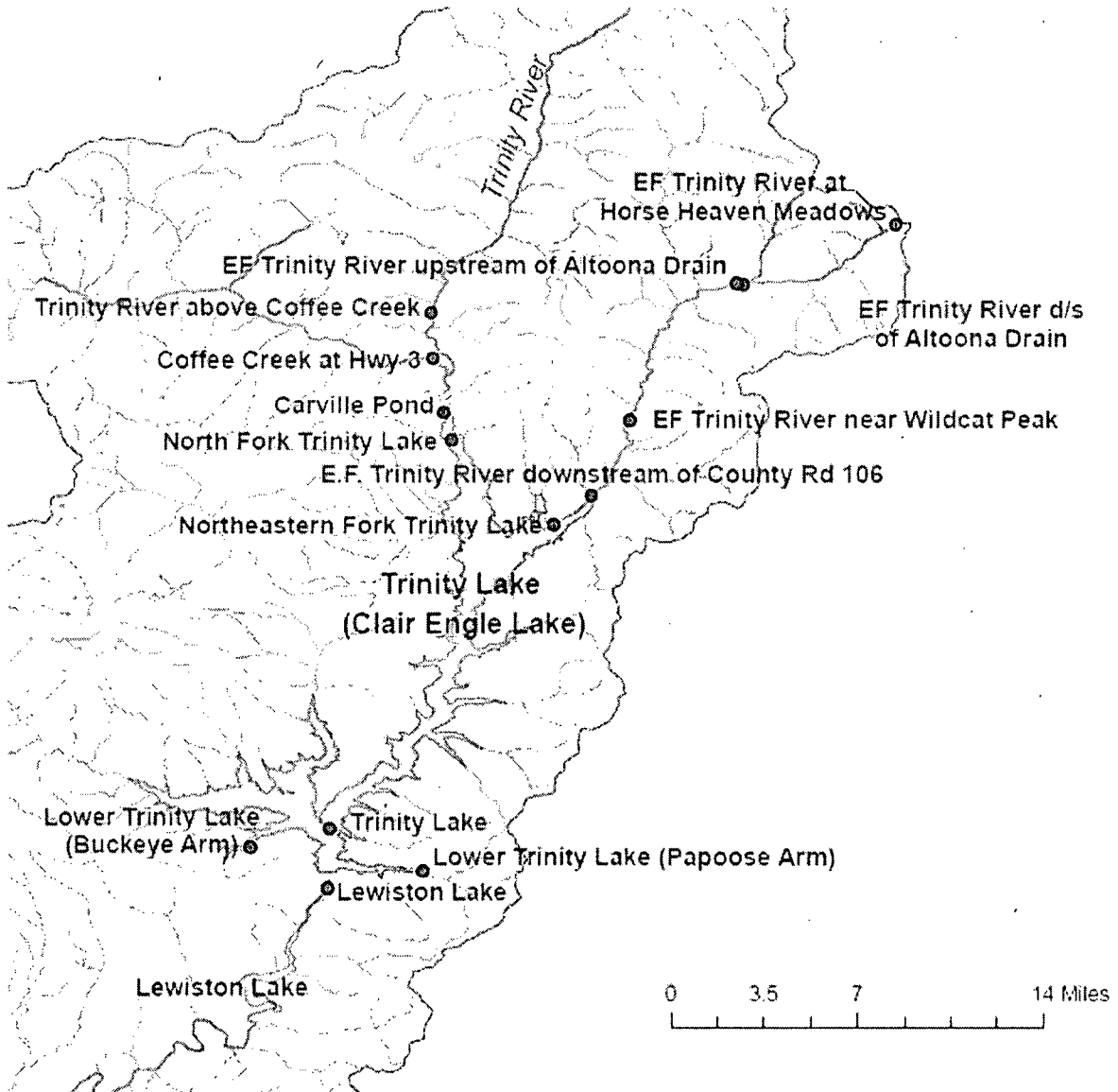


Table 1. Overall Mean Mercury (Hg) Concentrations (ppm, wet weight) and Lengths (mm) of Fish from Trinity Lake and Selected Water Bodies in the Trinity River Watershed ¹			
	Hg (ppm)	Total Length (mm) ²	Number of Fish
Black Bullhead	0.05	190	2
Brook Trout	0.15	220	2
Brown Bullhead	0.10	305	5
Brown Trout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

¹Excludes 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

²Average 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.

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

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.

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

If you have any further questions or concerns, please contact one of 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.

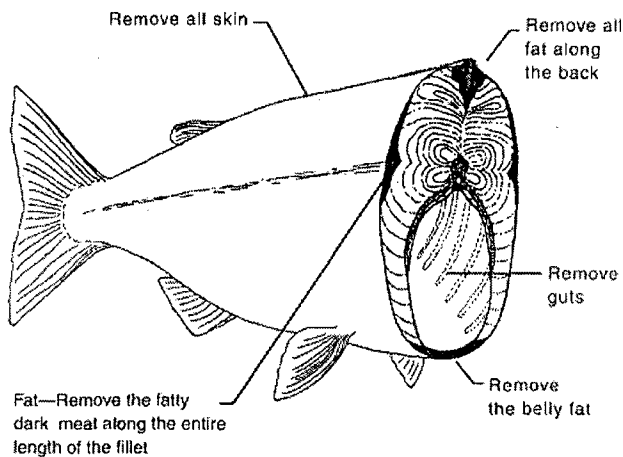
Consumption Guidelines

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.



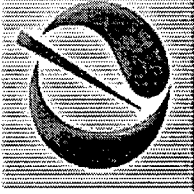
Advice For Pregnant Women, Women of Childbearing Age, and Children

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



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 certainty 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																				
Species	Mercury ppm						Total Length mm ²						# Fish per Composite							Total # Fish
	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
<i>Lewiston Lake</i>	.04	.04	.01	.03	.05	.04-.05	410	410	24	387	433	393-427	0	0	0	0	2	0	0	10
<i>Carrville Pond</i>	.02	.02	.01	.02	.04	.02-.03	291	288	19	260	325	277-305	10	0	0	0	0	0	0	10
<i>Trinity River upstream of Trinity Lake</i>	.07	.04	.05	.02	.19	.03-.11	251	242	46	206	358	215-286	9	0	0	0	0	0	0	9
<i>Trinity Lake and East Fork Trinity River</i>	.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.

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?

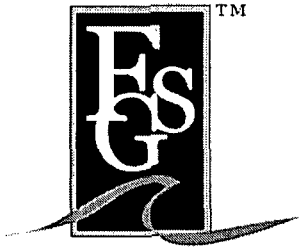
The presence or absence of a mine near a water body may affect the mercury level in fish, but this is not necessarily the most important factor. Other sources of available mercury as well as geochemical factors such as pH, and ecological factors such as the number of trophic levels in a water body are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



**Frontier
GeoSciences Inc.**

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fax 206-622-6870

October 20, 2005 - revised

Mr. Michael Wall
Natural Resources Defense Council
111 Sutter Street
20th Floor
San Francisco, CA 94104

Dear Mr. Wall,

Enclosed please find our report concerning total mercury and TSS in the 8 water samples and trace metals analysis for one water sample collected on August 23, 2005 for the Altoona Mine Project. There were no analytical issues and any QC issues encountered are addressed within the following report.

Please feel free to call or e-mail if you have further questions or concerns.

Sincerely,

Anh Ho
Project Manager
AnhH@frontiergeosciences.com

Report to Natural Resources Defense Council (NRDC)

Altoona Mine

Frontier Geosciences
414 Pontius Ave. N.
Seattle, WA 98109
(206) 622-6960

October 20, 2005

Scope of Work

Five water samples were submitted for total mercury and TSS analysis and one water sample was submitted for trace metals analysis.

Sample Receipt

Samples from the Altoona Mine project were received from NRDC on August 26, 2005. The samples were received in good condition in sealed coolers at temperature of 0.5 °C. There were no discrepancies associated with the receipt of the samples. A 250 mL aliquot was taken from each of the glass bottle and placed into a plastic bottle and refrigerated until TSS analysis was performed.

Analysis

Samples were processed using ultra-clean sample handling techniques in class 100 clean areas known to be low in atmospheric trace metals. Reagents, gases, and deionized water are all reagent or ultra-pure grade, and were previously analyzed for trace metals to ensure very low blanks.

Daily analytical runs were begun with a 5-8 point standard curve, spanning the entire analytical range of interest, with additional standards run every 10 samples for the trace metals and total mercury analysis. The daily standard curves were calculated using the blank-corrected initial standards, a linear regression forced through zero. For each analytical set for trace metals analyses one matrix duplicate, two matrix spikes, and at least three method blanks were co-processed and analyzed in exactly the same manner as ordinary samples.

Sample Digestion. Sample requested for trace metals analysis in HDPE bottles were acidified to 1% (v/v) with ultra-pure HNO₃ and digested in the original sample bottles for at least 3 hours at 85°C in a clean oven. Mercury samples were oxidized with the addition of 1% (v/v) of BrCl in concentrated HCl (directly to the sample bottle) and allowed to sit overnight at room temperature.

Total Hg analysis - waters. Digested samples S-1-1, S-1-2, and S-2-1 were analyzed for total Hg on September 16 and digested samples S-2-2 and S-2-3 were analyzed on September 28, 2005 in accordance with the standard operating procedures (SOPs) described in the Frontier Geosciences Quality Assurance manual. Aliquots of each digest were reduced in pre-purged reagent water to Hg⁰ with SnCl₂, and then the Hg⁰ purged onto gold traps as a preconcentration step. The Hg contained on the gold traps was then analyzed by thermal desorption into a cold vapor atomic fluorescence detector (CVAFS) using the dual amalgamation technique. Peak heights were measured by chart recorder and recorded on bench sheets in "chart units" to the nearest 0.2 unit. All results were corrected for the mean of the preparation blanks.

ICP/MS Analysis. The digested sample was analyzed with the Perkin-Elmer Elan-6000 with 3 point (⁴⁵Sc, ¹¹⁵In, and ¹⁹⁵Pt) internal standardization. All results were corrected for the mean of the instrument blanks and preparation blanks. Calibration verification is made by analysis of the independent multi-element LCSW, QCS-1. The sample was analyzed for Ni, Cu, Zn, Cd, As and Pb on September 21, 2005 and for Cr and Fe on September 26, 2005. The results for Cr and Fe were analyzed at a 5X dilution.

Analytical Issues

There were no significant analytical difficulties experienced with these samples and all quality control analyses were within acceptable limits except for the following:

The absolute value of the mean of the preparation blank for Fe was greater than the reporting limit of 5.00 ug/L at 11.36 ug/L. Because the result for Fe was 10X greater than the mean of the preparation blank, no further action was taken.

Analytical Results for Natural Resources Defense Council

Altoona Mine

Reported October 20, 2005 - revised

Frontier Geosciences Inc., 414 Pontius Ave. N, Suite B, Seattle WA 98109

Sample Results for water samples

Sample ID	Date Collected	Hg (ng/L)	TSS (mg/L)
NRDC AM 8/23/05 S-1-1	8/23/05 15:06	1400	1.5
NRDC AM 8/23/05 S-1-2	8/23/05 15:08	1430	1.0
NRDC AM 8/23/05 S-2-1	8/23/05 16:17	219	1.0
NRDC AM 8/23/05 S-2-2	8/23/05 16:32	4.52	1.5
NRDC AM 8/23/05 S-2-3	8/23/05 16:36	1.81	1.0
Reporting Limit		0.15	1.0

Analyte (µg/L)	NRDC AM 8/23/05 S-1-3
Date Collected	8/23/05 15:10
Cr	< 0.35
Fe	768
Ni	30.5
Cu	1.42
Zn	1.79
As	76.4
Cd	< 0.008
Pb	< 0.015

QC Summary for Metals

Altoona Mine

Reported October 20, 2005 - revised

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

Quality Control Data - Preparation Blank Report

Analyte (µg/L)	PBW1	PBW2	PBW3	PBW4	Mean	Std Dev	R.L
Cr	-0.07	-0.06	-0.06	-0.06	-0.06	0.003	0.07
Fe	-9.71	-11.97	-11.75	-12.01	-11.36*	1.11	5.00
Ni	0.01	0.00	0.00	0.00	0.00	0.003	0.04
Cu	0.00	0.01	0.00	0.00	0.00	0.003	0.04
Zn	OL	0.03	0.00	0.06	0.03	0.03	0.10
As	-0.03	-0.02	-0.02	-0.01	-0.02	0.01	0.15
Cd	0.000	0.000	0.000	0.000	0.000	0.0003	0.008
Pb	0.001	0.001	0.000	0.000	0.001	0.0005	0.015

Quality Control Data - Certified Reference Material Report

Analyte (µg/L)	CRM Identity	Cert. Value	Obs. Value	% Rec.
Cr	NIST 1640	38.60	37.62	97.5
Fe	NIST 1640	34.3	33.5	97.7
Ni	NIST 1640	27.4	27.5	100.3
Cu	NIST 1640	85.2	88.2	103.6
Zn	NIST 1640	53.2	55.3	104.0
As	NIST 1640	26.67	25.63	96.1
Cd	NIST 1640	22.79	22.51	98.8
Pb	NIST 1640	27.89	28.34	101.6

*Absolute value of the blank is greater than the RL. See case narrative.

OL = preparation blank was determined as a statistical outlier according to the Grubb's Test.

QC Summary for Metals

Altoona Mine

Reported October 20, 2005 - revised

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

Quality Control Data - Duplicate Report

Analyte (µg/L)	Sample QC'd	Rep. 1	Rep. 2	Mean	RPD
Cr	NRDC AM 8/23/05 S-1-3 5X	< 0.35	< 0.35	< 0.35	N/C
Fe	NRDC AM 8/23/05 S-1-3 5X	767.7	787.4	777.5	2.5
Ni	NRDC AM 8/23/05 S-1-3	30.50	29.84	30.17	2.2
Cu	NRDC AM 8/23/05 S-1-3	1.42	1.21	1.31	15.6
Zn	NRDC AM 8/23/05 S-1-3	1.79	1.80	1.80	0.8
As	NRDC AM 8/23/05 S-1-3	76.40	76.14	76.27	0.3
Cd	NRDC AM 8/23/05 S-1-3	< 0.008	< 0.008	< 0.008	N/C
Pb	NRDC AM 8/23/05 S-1-3	< 0.015	< 0.015	< 0.015	N/C

N/C - Not Calculated. One or more values are below the reporting limits.

Quality Control Data - Matrix Spike / Matrix Spike Duplicate Report

Analyte (µg/L)	Sample QC'd	Sample Mean	Spike Level	MS	% Rec.	MSD	% Rec.	RPD
Cr	NRDC AM 8/23/05 S-1-3 5X	< 0.35	100.00	94.04	94.0	99.37	99.4	5.5
Fe	NRDC AM 8/23/05 S-1-3 5X	777.5	500.0	1276	99.7	1334	111.3	11.0
Ni	NRDC AM 8/23/05 S-1-3	30.17	25.00	50.73	82.3	50.31	80.5	2.1
Cu	NRDC AM 8/23/05 S-1-3	1.31	25.00	25.04	94.9	24.99	94.7	0.2
Zn	NRDC AM 8/23/05 S-1-3	1.80	50.00	48.85	94.1	49.49	95.4	1.3
As	NRDC AM 8/23/05 S-1-3	76.27	20.00	98.40	110.6	98.78	112.6	1.7
Cd	NRDC AM 8/23/05 S-1-3	< 0.008	2.000	1.920	96.0	1.990	99.5	3.6
Pb	NRDC AM 8/23/05 S-1-3	< 0.015	5.000	5.030	100.6	5.239	104.8	4.1

QC Summary for Total Hg and TSS

Altoona Mine

Reported October 20, 2005 - revised

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

Quality Control Data - Preparation Blank Report

Analyte	Batch ID	PBW1	PBW2	PBW3	Mean	St. Dev.	R.L.
Total Hg (ng/L)	A1	-0.06	0.05	-0.07	-0.03	0.07	0.15
Total Hg (ng/L)	A2	0.08	0.07	0.07	0.07	0.01	0.15
TSS (mg/L)	B1	0.2	-0.2	0.0	0.0	0.2	1.0

St. Dev. = Standard Deviation

R.L.= Reporting Limit

Est. MDL = Estimated method detection limit

Quality Control Data - Certified Reference Materials Report

Analyte	Batch ID	CRM Identity	Cert. Value	Obs. Value	% Rec.
Total Hg (ng/L)	A1	NIST 1641d	1601000	1694000	105.8
Total Hg (ng/L)	A2	NIST 1641d	1601000	1461000	91.3

CRM Identity = Certified reference material identity

Cert. Value = Certified value

Obs. Value = Experimental result

% Rec. = Percent recovery

Quality Control Data - Matrix Duplicate Report

Analyte	Batch ID	Sample QC'd	Rep. 1	Rep. 2	Mean	RPD
Total Hg (ng/L)	A1	NRDC AM 8/23/05 S-1-1	1395	1326	1360	5.1
Total Hg (ng/L)	A2	Batch QC	2.64	3.06	2.85	15.0
TSS (mg/L)	B1	Batch QC	353.3	316.0	334.7	11.1

RPD = Relative Percent Difference

Quality Control Data - Matrix Spike / Matrix Spike Duplicate Report

Analyte	Batch ID	Sample QC'd	Sample Mean	Spike Level	MS	% Rec.	MSD	% Rec.	RPD
Total Hg (ng/L)	A1	NRDC AM 8/23/05 S-1-1	1360	2105	3803	116.0	3652	108.8	6.4
Total Hg (ng/L)	A2	Batch QC	1.39	6.06	7.43	99.8	7.10	94.3	5.6

MS = Matrix Spike

MSD = Matrix Spike Duplicate

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

414 Pontius Avenue North, Suite B Seattle WA 98109
(206) 622-6960 fax (206) 622-6870 Info@Frontier.WA.com

Chain-of-Custody Record & Laboratory Analysis Request

Date: 8/25/05 Page: 1 of 1

Client Company: <u>NATURAL RESOURCES DEFENSE COUNCIL</u>	Frontier Project Manager: <u>Ann Ho</u>
Address: <u>111 SUTTER ST, 20TH FLOOR</u> <u>SAN FRANCISCO, CA 94104</u>	Guaranteed Turnaround Time:
CONTACT: <u>Michael Wall</u>	Confirmation of Sample Arrival at Frontier: <input type="checkbox"/> YES <input type="checkbox"/> NO
Phone: <u>415-875-6100 x162</u> Fax: <u>415-875-6161</u>	Quality Assurance Level: <input type="checkbox"/> Standard <input type="checkbox"/> High
Email: <u>mwall@nrdc.org</u>	Disposal*: <input type="checkbox"/> Frontier Dispose <input type="checkbox"/> Return to Client <input type="checkbox"/> Ship to 3rd Party**
Project Name: <u>Altoona Mine</u>	*All samples are held for at least 2 months after date of receipt. Please note that after this time they are disposed of or returned to the client. Clients may request a longer holding time by writing to the Frontier Project Manager.
Contract/PO #:	**Please discuss this with the Frontier Project Manager.
	Carrier Information: FED EX <input checked="" type="checkbox"/> UPS <input type="checkbox"/> Other <input type="checkbox"/>
	Tracking # <u>7925 1121 5157</u>

Engraved/Bottle ID	Sample ID	Matrix	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments
500 mL glass	NRDC AM 8/23/05 S-1-1	FW	1	8/23/05 15:06	GS/MR-E	ice/refrig	low-level Hg + TSS (F)
500 mL glass	NRDC AM 8/23/05 S-1-2	FW	1	8/23/05 15:08	GS/MR-E	"	low-level Hg + TSS (F)
AL-D-1947	NRDC AM 8/23/05 S-1-3	FW	1	8/23/05 15:10	GS/MR-E	"	total recoverable metals
500 mL glass	NRDC AM 8/23/05 S-2-1	FW	1	8/23/05 16:17	GS/MR-E	"	low-level Hg + TSS (F)
500 mL glass	NRDC AM 8/23/05 S-2-2	FW	1	8/23/05 16:32	GS/MR-E	"	low-level Hg + TSS (F)
500 mL glass	NRDC AM 8/23/05 S-2-3	FW	1	8/23/05 16:36	GS/MR-E	"	low-level Hg + TSS (F)

NOTE: For samples marked w/ (F) AN ALIQUOT WILL BE TAKEN FROM THE HG BOTTLES FOR TSS DETERMINATION BEFORE PRESERVATION.

Sample Receipt: C.O.C. Seal Intact? <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A Cooler Temperature: <u>0.5</u> °C Comments: VTSR: <u>10:30</u>	Matrix Codes: FW = fresh water (salinity < 0.5 ppt) BW = brackish water SW = seawater WW = wastewater SE = sediment SO = soil AT = animal tissue PT = plant tissue TR = trap PP = petroleum product OT = other	Relinquished by: <u>[Signature]</u> Print name: <u>MICHAEL WALL</u> Company: <u>NRDC</u> Date: <u>8/28/05</u> Time: <u>4pm</u> Received by: <u>[Signature]</u> Print name: <u>NRDC</u> Company: <u>FGS</u> Date: <u>8/26/05</u> Time: <u>11:45</u>	Relinquished by: Print name: Company: Date: Time: Received by: Print name: Company: Date: Time:
--	--	---	--

.000002 ug/L

BECKMAN NRDC

680

196

65

Trinity Lake, Lewiston Reservoir, Trinity River, East Fork Trinity River, Soda Creek, and All Rivers and Creeks Draining into Trinity Lake

The designated beneficial uses of the waters of the Upper Trinity River Hydrologic Area, including Trinity Lake, Lewiston Reservoir, and the Trinity River include, among others, commercial and sport fishing; rare, threatened, and endangered species; migration of aquatic organisms; spawning, reproduction and/or early development; and aquaculture. See Water Quality Control Plan for the North Coastal Basin at 2-12:00. The water quality objectives for these waters include a narrative requirement that "[a]ll water shall be maintained free of toxic substances in concentrations that are toxic to, or produce detrimental physiological responses in human, plant, animal or aquatic life." See *id.* at 3-4:00.

3

These standards and objectives are not being met. In October 2005, the state's Office of Environmental Health Hazard Assessment ("OEHHA") issued a fish consumption advisory for Trinity Lake, Lewiston Lake, Carville Pond, the Trinity River upstream of Trinity Lake, all rivers and creeks draining into Trinity Lake, and the East Fork Trinity River. A copy of this advisory is attached. See http://www.oehha.ca.gov/fish/so_cal/pdf_zip/TrinityFinalAdvisory100605.pdf.

OEHHA based its fish consumption advisory for these waters principally on three years of sampling and analysis conducted by the United States Geological Survey ("USGS"). Over the course of its extensive sampling effort, USGS repeatedly found unsafe levels of mercury in the tissue of edible fish. A copy of the USGS final report is attached. See Jason May, et al., *Open File Report 2005-1321, Mercury Concentrations in Fishes from Select Water Bodies, Trinity County, California, 2000-2002* (2005). OEHHA's advisory also relied on separate sampling that found unsafe levels of mercury in resident Chinook salmon.

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As noted in the OEHHA advisory, it is likely that abandoned gold and mercury mines contribute materially to the mercury contamination of the Trinity River watershed. One mine in particular, the Altoona Mercury Mine, was identified by both the USGS and OEHHA in their reports. In 2005, NRDC conducted water quality sampling on a small drainage that originates below the Altoona mercury mine and flows into the East Fork Trinity River. This drainage is not shown on the current USGS quadrangle map, but is referred to as the "Altoona Mine Drain" in the USGS report referenced above and is identified as Soda Creek in California Department of Fish and Game correspondence from the 1960s. Our water quality sampling results (copy attached) show that the mercury concentration on Soda Creek immediately below the Altoona mine site exceeded 1400 ng/L in August 2005 (sample nos. S-1-1 and S-1-2 on accompanying Frontier Geosciences report); that the mercury concentration on Soda Creek immediately above the confluence of the East Fork Trinity River was 219 ng/L (sample no. S-2-1); and that mercury concentrations on the East Fork Trinity River itself were 1.81 ng/L immediately upstream of Soda Creek (sample no. S-2-3) and 4.52 ng/L immediately downstream of Soda Creek (sample no. S-2-2).

6

NOT TEMPORALLY REPRESENTATIVE

— TRINITY RIVER
— EAST FORK "
— SODA CREEK "

3.4
Section 3.5 of The Water Quality Control Plan for Developing California's Clean Water Act Section 303(d) List provides that:

A water segment shall be placed on the section 303(d) list if a health advisory against consumption of edible resident organisms, or a shellfish harvesting ban has been issued by the Office of Environmental Health Hazard Assessment (OEHHA), or Department of Health Services and there is a designated or existing fish consumption beneficial use for the segment. In addition, water segment-specific data must be available indicating the evaluation guidelines for tissue is exceeded.

Based on the data we have submitted, the waters covered by the OEHHA advisory, including all of the waters noted above, should be listed as impaired by mercury pursuant to section 303(d) of the Clean Water Act.

(2)



**Frontier
GeoSciences Inc.**

414 Pontius Ave N
Seattle, WA 98109

206-622-6960
fax 206-622-6870

October 20, 2005 - revised

Mr. Michael Wall
Natural Resources Defense Council
111 Sutter Street
20th Floor
San Francisco, CA 94104

Dear Mr. Wall,

Enclosed please find our report concerning total mercury and TSS in the 8 water samples and trace metals analysis for one water sample collected on August 23, 2005 for the Altoona Mine Project. There were no analytical issues and any QC issues encountered are addressed within the following report.

Please feel free to call or e-mail if you have further questions or concerns.

Sincerely,

Anh Ho
Project Manager
AnhH@frontiergeosciences.com

Report to Natural Resources Defense Council (NRDC)

Altoona Mine

Frontier Geosciences
414 Pontius Ave. N.
Seattle, WA 98109
(206) 622-6960

October 20, 2005

Scope of Work

Five water samples were submitted for total mercury and TSS analysis and one water sample was submitted for trace metals analysis.

Sample Receipt

Samples from the Altoona Mine project were received from NRDC on August 26, 2005. The samples were received in good condition in sealed coolers at temperature of 0.5 °C. There were no discrepancies associated with the receipt of the samples. A 250 mL aliquot was taken from each of the glass bottle and placed into a plastic bottle and refrigerated until TSS analysis was performed.

Analysis

Samples were processed using ultra-clean sample handling techniques in class 100 clean areas known to be low in atmospheric trace metals. Reagents, gases, and deionized water are all reagent or ultra-pure grade, and were previously analyzed for trace metals to ensure very low blanks.

Daily analytical runs were begun with a 5-8 point standard curve, spanning the entire analytical range of interest, with additional standards run every 10 samples for the trace metals and total mercury analysis. The daily standard curves were calculated using the blank-corrected initial standards, a linear regression forced through zero. For each analytical set for trace metals analyses one matrix duplicate, two matrix spikes, and at least three method blanks were co-processed and analyzed in exactly the same manner as ordinary samples.

Analytical Results for Natural Resources Defense Council

Altoona Mine

Reported October 20, 2005 - revised

Frontier Geosciences Inc., 414 Pontius Ave. N, Suite B, Seattle WA 98109

Sample Results for water samples

SODA CREEK

1.4 ug

Sample ID	Date Collected	Hg (ng/L)	TSS (mg/L)
NRDC AM 8/23/05 S-1-1	8/23/05 15:06	1400	1.5
NRDC AM 8/23/05 S-1-2	8/23/05 15:08	1430	1.0
NRDC AM 8/23/05 S-2-1	8/23/05 16:17	219	1.0
NRDC AM 8/23/05 S-2-2	8/23/05 16:32	4.52	1.5
NRDC AM 8/23/05 S-2-3	8/23/05 16:36	1.81	1.0
Reporting Limit		0.15	1.0

Analyte (µg/L)	NRDC AM 8/23/05 S-1-3
Date Collected	8/23/05 15:10
Cr	< 0.35
Fe	768
Ni	30.5
Cu	1.42
Zn	1.79
As	76.4
Cd	< 0.008
Pb	< 0.015

QC Summary for Metals

Altoona Mine

Reported October 20, 2005 - revised

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

Quality Control Data - Preparation Blank Report

Analyte ($\mu\text{g/L}$)	PBW1	PBW2	PBW3	PBW4	Mean	Std Dev	R.L
Cr	-0.07	-0.06	-0.06	-0.06	-0.06	0.003	0.07
Fe	-9.71	-11.97	-11.75	-12.01	-11.36*	1.11	5.00
Ni	0.01	0.00	0.00	0.00	0.00	0.003	0.04
Cu	0.00	0.01	0.00	0.00	0.00	0.003	0.04
Zn	OL	0.03	0.00	0.06	0.03	0.03	0.10
As	-0.03	-0.02	-0.02	-0.01	-0.02	0.01	0.15
Cd	0.000	0.000	0.000	0.000	0.000	0.0003	0.008
Pb	0.001	0.001	0.000	0.000	0.001	0.0005	0.015

Quality Control Data - Certified Reference Material Report

Analyte ($\mu\text{g/L}$)	CRM Identity	Cert. Value	Obs. Value	% Rec.
Cr	NIST 1640	38.60	37.62	97.5
Fe	NIST 1640	34.3	33.5	97.7
Ni	NIST 1640	27.4	27.5	100.3
Cu	NIST 1640	85.2	88.2	103.6
Zn	NIST 1640	53.2	55.3	104.0
As	NIST 1640	26.67	25.63	96.1
Cd	NIST 1640	22.79	22.51	98.8
Pb	NIST 1640	27.89	28.34	101.6

*Absolute value of the blank is greater than the RL. See case narrative.

OL = preparation blank was determined as a statistical outlier according to the Grubb's Test.

QC Summary for Metals

Altoona Mine

Reported October 20, 2005 - revised

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

Quality Control Data - Duplicate Report

Analyte (µg/L)	Sample QC'd	Rep. 1	Rep. 2	Mean	RPD
Cr	NRDC AM 8/23/05 S-1-3 5X	< 0.35	< 0.35	< 0.35	N/C
Fe	NRDC AM 8/23/05 S-1-3 5X	767.7	787.4	777.5	2.5
Ni	NRDC AM 8/23/05 S-1-3	30.50	29.84	30.17	2.2
Cu	NRDC AM 8/23/05 S-1-3	1.42	1.21	1.31	15.6
Zn	NRDC AM 8/23/05 S-1-3	1.79	1.80	1.80	0.8
As	NRDC AM 8/23/05 S-1-3	76.40	76.14	76.27	0.3
Cd	NRDC AM 8/23/05 S-1-3	< 0.008	< 0.008	< 0.008	N/C
Pb	NRDC AM 8/23/05 S-1-3	< 0.015	< 0.015	< 0.015	N/C

N/C - Not Calculated. One or more values are below the reporting limits.

Quality Control Data - Matrix Spike / Matrix Spike Duplicate Report

Analyte (µg/L)	Sample QC'd	Sample Mean	Spike Level	MS	% Rec.	MSD	% Rec.	RPD
Cr	NRDC AM 8/23/05 S-1-3 5X	< 0.35	100.00	94.04	94.0	99.37	99.4	5.5
Fe	NRDC AM 8/23/05 S-1-3 5X	777.5	500.0	1276	99.7	1334	111.3	11.0
Ni	NRDC AM 8/23/05 S-1-3	30.17	25.00	50.73	82.3	50.31	80.5	2.1
Cu	NRDC AM 8/23/05 S-1-3	1.31	25.00	25.04	94.9	24.99	94.7	0.2
Zn	NRDC AM 8/23/05 S-1-3	1.80	50.00	48.85	94.1	49.49	95.4	1.3
As	NRDC AM 8/23/05 S-1-3	76.27	20.00	98.40	110.6	98.78	112.6	1.7
Cd	NRDC AM 8/23/05 S-1-3	< 0.008	2.000	1.920	96.0	1.990	99.5	3.6
Pb	NRDC AM 8/23/05 S-1-3	< 0.015	5.000	5.030	100.6	5.239	104.8	4.1

QC Summary for Total Hg and TSS

Altoona Mine

Reported October 20, 2005 - revised

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

Quality Control Data - Preparation Blank Report

Analyte	Batch ID	PBW1	PBW2	PBW3	Mean	St. Dev.	R.L.
Total Hg (ng/L)	A1	-0.06	0.05	-0.07	-0.03	0.07	0.15
Total Hg (ng/L)	A2	0.08	0.07	0.07	0.07	0.01	0.15
TSS (mg/L)	B1	0.2	-0.2	0.0	0.0	0.2	1.0

St. Dev. = Standard Deviation

R.L. = Reporting Limit

Est. MDL = Estimated method detection limit

Quality Control Data - Certified Reference Materials Report

Analyte	Batch ID	CRM Identity	Cert. Value	Obs. Value	% Rec.
Total Hg (ng/L)	A1	NIST 1641d	1601000	1694000	105.8
Total Hg (ng/L)	A2	NIST 1641d	1601000	1461000	91.3

CRM Identity = Certified reference material identity

Cert. Value = Certified value

Obs. Value = Experimental result

% Rec. = Percent recovery

Quality Control Data - Matrix Duplicate Report

Analyte	Batch ID	Sample QC'd	Rep. 1	Rep. 2	Mean	RPD
Total Hg (ng/L)	A1	NRDC AM 8/23/05 S-1-1	1395	1326	1360	5.1
Total Hg (ng/L)	A2	Batch QC	2.64	3.06	2.85	15.0
TSS (mg/L)	B1	Batch QC	353.3	316.0	334.7	11.1

RPD = Relative Percent Difference

Quality Control Data - Matrix Spike / Matrix Spike Duplicate Report

Analyte	Batch ID	Sample QC'd	Sample Mean	Spike Level	MS	% Rec.	MSD	% Rec.	RPD
Total Hg (ng/L)	A1	NRDC AM 8/23/05 S-1-1	1360	2105	3803	116.0	3652	108.8	6.4
Total Hg (ng/L)	A2	Batch QC	1.39	6.06	7.43	99.8	7.10	94.3	5.6

MS = Matrix Spike

MSD = Matrix Spike Duplicate

Frontier Geosciences Inc.

Environmental Research & Specialty Analytical Laboratory

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Chain-of-Custody Record & Laboratory Analysis Request

Date: 8/25/05 Page: 1 of 1

Client Company: <u>NATURAL RESOURCES DEFENSE COUNCIL</u>				Frontier Project Manager: <u>Anh Ho</u>				
Address: <u>111 SWITZER ST, 20TH FLOOR</u> <u>SAN FRANCISCO, CA 94104</u>				Guaranteed Turnaround Time:				
CONTACT: <u>Michael Wall</u>				Confirmation of Sample Arrival at Frontier: <input type="checkbox"/> YES <input type="checkbox"/> NO				
Phone: <u>415-875-6100 x162</u> Fax: <u>415-875-6161</u>				Quality Assurance Level: <input type="checkbox"/> Standard <input type="checkbox"/> High				
Email: <u>mwall@nrdc.org</u>				Disposal*: <input type="checkbox"/> Frontier Dispose <input type="checkbox"/> Return to Client <input type="checkbox"/> Ship to 3rd Party**				
Project Name: <u>Altoona Mine</u>				*All samples are held for at least 2 months after date of receipt. Please note that after this time they are disposed of or returned to the client. Clients may request a longer holding time by writing to the Frontier Project Manager. **Please discuss this with the Frontier Project Manager.				
Contract/PO #:				Carrier Information: <input checked="" type="checkbox"/> FED EX <input checked="" type="checkbox"/> UPS <input type="checkbox"/> Other <input type="checkbox"/>				
				Tracking # <u>7905 1121 5157</u>				
Encaved Bottle ID	Sample ID	Matrix	# Bottles	Date/Time Sampled	Collected by	Preservation	Analysis Required/Comments	
• 500 mL glass	NRDC AM 8/23/05 S-1-1	FW	1	8/23/05 15:06	GS/MR-E	ice/refrig	low-level Hg + TSS (F)	
• 500 mL glass	NRDC AM 8/23/05 S-1-2	FW	1	8/23/05 15:08	GS/MR-E	"	low-level Hg + TSS (F)	
• AL-D-1947	NRDC AM 8/23/05 S-1-3	FW	1	8/23/05 15:10	GS/MR-E	"	total recoverable metals	
• 500 mL glass	NRDC AM 8/23/05 S-2-1	FW	1	8/23/05 16:17	GS/MR-E	"	low-level Hg + TSS (F)	
• 500 mL glass	NRDC AM 8/23/05 S-2-2	FW	1	8/23/05 16:32	GS/MR-E	"	low-level Hg + TSS (F)	
• 500 mL glass	NRDC AM 8/23/05 S-2-3	FW	1	8/23/05 16:36	GS/MR-E	"	low-level Hg + TSS (F)	
NOTE: FOR SAMPLES MARKED W/ (F) AN ALIQUOT WILL BE TAKEN FROM THE HG BOTTLES FOR TSS DETERMINATION BEFORE PRESERVATION.								
Sample Received		Matrix Codes:			Relinquished by: <u>[Signature]</u>		Relinquished by:	
C.O.C. Seal Intact? <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> N/A		FW = fresh water (salinity < 0.5 ppt) BW = brackish water SW = seawater WW = wastewater SE = sediment SO = soil AT = animal tissue PT = plant tissue TR = trap PP = petroleum product OT = other			Print name: <u>Michael Wall</u>		Print name:	
Cooler Temperature: <u>0.5</u> °C					Company: <u>NRDC</u>		Company:	
Comments:					Date: <u>8/28/05</u> Time: <u>4pm</u>		Date: Time:	
VTSR: <u>10030</u>					Received by: <u>[Signature]</u>		Received by:	
					Print name: <u>RDK [Signature]</u>		Print name:	
					Company: <u>FGS</u>		Company:	
					Date: <u>8/26/05</u> Time: <u>11:45</u>		Date: Time:	

FIGURE 1

Trinity Sampling Sites

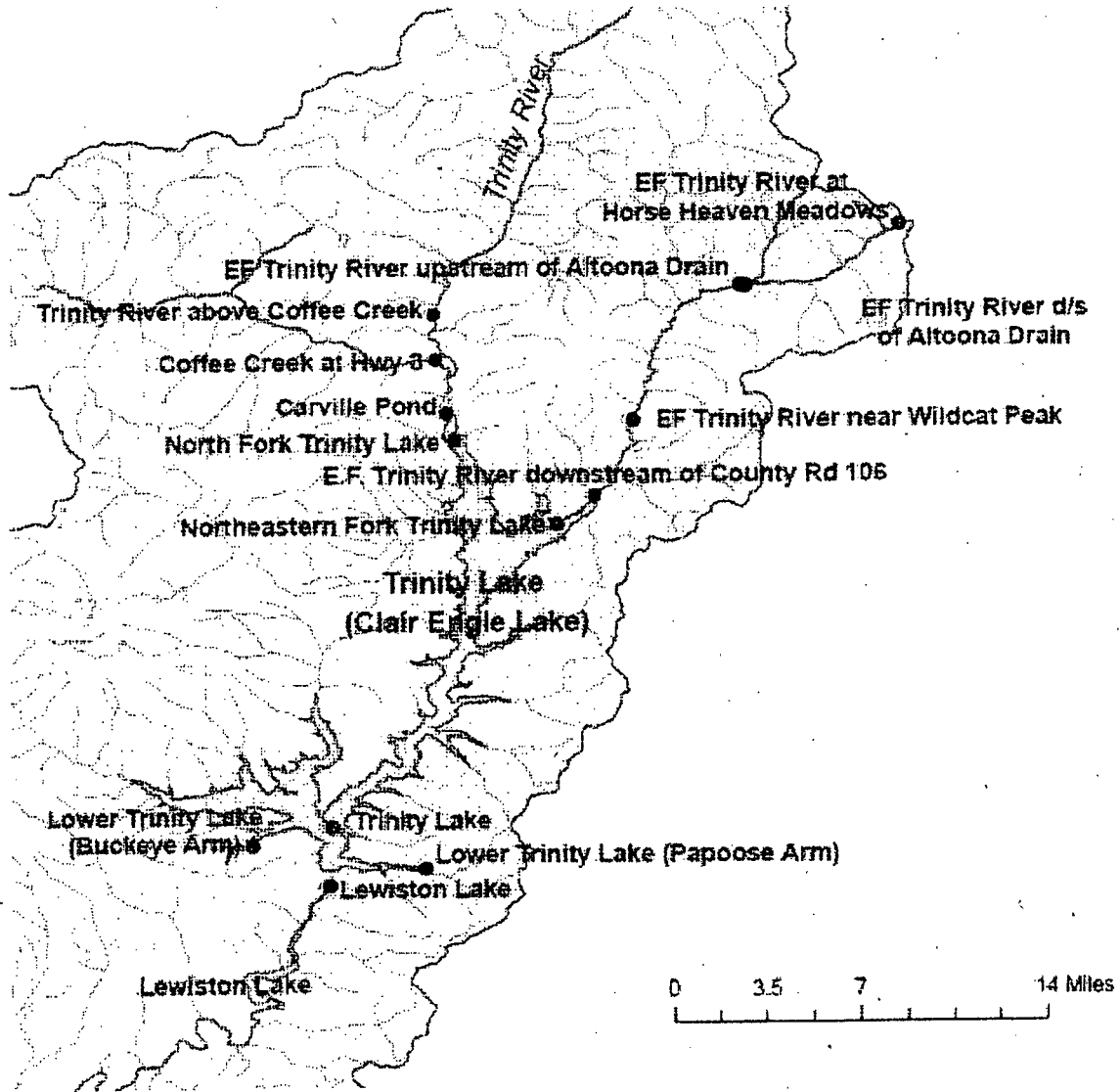


Table 1. Fish sampling sites and data-collection years, Trinity County, California, 2000–2002.

[Hwy, highway; Mt, Mount. USGS, U.S. Geological Survey. Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD83)]

Site number on fig. 1	Station Name	Station Number	Latitude	Longitude	2000	2001	2002
1	Union Hill Gulch near Douglas City	403927122561401	40°39'27"	122°56'18"	x		
2	Trinity River at Big Flat Day Use Area near Big Bar	404427123125701	40°44'27"	123°13'01"			x
3	Eastman Dredge Pond No.2 near Lewiston	404509122465001	40°45'09"	122°46'54"	x		
4	Eastman Dredge Pond No.1 near Lewiston	404516122465001	40°45'16"	122°46'54"	x		
5	Eastman Gulch near Lewiston	404520122464101	40°45'20"	122°46'45"	x		
6	Trinity River at Hayden Flat near Big Bar	404656123204501	40°46'56"	123°20'49"			x
7	Canyon Creek below Conrad Gulch near Junction City	404723123032001	40°47'23"	123°03'24"			x
8	Papoose Arm of Trinity Lake near Trinity Dam	404806122425801	40°48'06"	122°43'02"			x
9	Buckeye Arm of Trinity Lake near Trinity Dam	404852122482701	40°48'52"	122°48'31"		x	
10	East Fork of North Fork Trinity River 0.53 mile above Barney Gulch	404940123072901	40°49'40"	123°07'33"		x	
11	New River at Denny Campground near Denny	405557123233401	40°55'56"	123°23'38"			x
12	East Fork Trinity Arm of Trinity Lake near Trinity Center	405953122373301	40°59'53"	122°37'37"	x	x	
13	East Fork Trinity River below County Road 106 near Trinity Center	410031122370901	41°00'31"	122°37'13"		x	x
14	Trinity Lake near Trinity Center	410214122413201	41°02'14"	122°41'36"	x	x	
15	East Fork Trinity River 1.2 mile below Devils Creek near Trinity Center	410259122355201	41°02'59"	122°35'56"		x	x
16	Carrville Pond near Carrville	410311122420001	41°03'11"	122°42'04"	x		
17	Coffee Creek at Hwy 3 near Carrville	410502122421701	41°05'02"	122°42'21"	x		
18	Trinity River above Coffee Creek near Trinity Center	11523200	41°06'41"	122°42'20"	x		
19	East Fork Trinity River below Altoona Mine Drain near Trinity Center	410731122321801	41°07'31"	122°32'22"	x	x	x
20	East Fork Trinity River Upstream Altoona Mine Drain near Castella	410736122320901	41°07'36"	122°32'13"	x	x	x
21	Crow Creek above Confluence of East Fork Trinity River near Trinity	410740122315401	41°07'40"	122°31'58"		x	x
22	Tamarack Creek at East Fork Trinity River near Mt. Shasta	410916122273801	41°09'16"	122°27'42"		x	x
23	East Fork Trinity River at Horse Heaven Meadow near Mt. Shasta	410928122271201	41°09'28"	122°27'16"		x	x

Table 2. Data for fishes collected in Trinity County, California, 2000–2002.

[Fillet samples dissected from left fillet of fish; whole body, whole body fish analyzed with gastrointestinal tract cleaned out. Hwy, highway; Mt, Mount. Hg, mercury; HgT, total mercury. Sex: F, female; M, male; U, unknown. mm, millimeter; g, gram; %, percent; µg/g, microgram per gram (equivalent to part per million)]

Collection date	Common name	Scientific name	Total length (mm)	Total weight (g)	Moisture (%)	HgT-dry (µg/g)	HgT-wet (µg/g)	Sample type	Sample identification	Sex
Site 1 (fig. 1), Union Hill Gulch near Douglas City:										
10/25/2000	Green sunfish	<i>Lepomis cyanellus</i>	103	23.0	77.2	1.080	0.246	Whole body	TR-2000-W-036	M
Site 2 (fig. 1), Trinity River at Big Flat Day Use Area near Big Bar:										
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	74	3.5	76.6	0.142	0.033	Fillet	TR-2002-F-020	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	75	3.7	77.8	0.128	0.028	Fillet	TR-2002-F-019	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	85	5.9	80.5	0.102	0.020	Fillet	TR-2002-F-018	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	87	6.5	78	0.102	0.022	Fillet	TR-2002-F-017	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	92	7.6	79.6	0.161	0.033	Fillet	TR-2002-F-016	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	93	7.6	78	0.141	0.031	Fillet	TR-2002-F-015	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	100	9.0	79.9	0.164	0.033	Fillet	TR-2002-F-014	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	124	16.8	78.6	0.214	0.046	Fillet	TR-2002-F-013	U
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	146	25.8	78.4	0.182	0.039	Fillet	TR-2002-F-012	F
8/27/2002	Rainbow trout	<i>Oncorhynchus mykiss</i>	147	28.2	79.2	0.203	0.042	Fillet	TR-2002-F-011	F