

Supplementary Information

High mercury concentrations in steelhead/rainbow trout, sculpin, and terrestrial invertebrates in a stream-riparian food web in coastal California.

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Three tables and two figures.

SI Table 1. Taxonomic information, collection information, and mean THg, MeHg, and %MeHg of individual aquatic and terrestrial invertebrate samples from Big Creek, California. Primary consumers (1°) are detritivores and herbivores, and secondary/tertiary consumers (2°/3°) are predators (P). No. spec. is the number of specimens composited per sample. Site codes refer to mainstem Big Creek (MS), upper Big Creek (UB), and Devils Creek (DC). THg and MeHg concentrations are means of replicate runs per sample in ng/g dry weight. Asterisks indicate samples with runs identified as outliers; values in parentheses are means including outliers.

Class	Order	Family	Genus/species	Common Name	Cons. Level	Site	Collection Date	No. Spec.	THg (ng/g)	MeHg (ng/g)	%MeHg
Aquatic											
Insecta	Ephemeroptera	Heptageniidae	<i>Epeorus</i> , <i>Ironodes</i>	Mayfly	1°	UB	6/22/2020	8	69.7	55.30	79
Insecta	Plecoptera	Pteronarcyidae	<i>Pteronarcys californica</i>	Stonefly	1°	UB	6/22/2020	3	15.28	16.56	108
Insecta	Plecoptera	Pteronarcyidae	<i>Pteronarcys californica</i>	Stonefly	1°	MS	6/22/2020	5	17.41	18.18	104
Insecta	Plecoptera	Pteronarcyidae	<i>Pteronarcys californica</i>	Stonefly	1°	MS	8/9/2020	2	19.33	12.89	67
Insecta	Plecoptera	Pteronarcyidae	<i>Pteronarcys californica</i>	Stonefly	1°	UB	8/9/2020	3	19.75	16.27	82
Insecta	Trichoptera	Limnephilidae	<i>Dicosmoecus gilvipes</i>	Caddisfly	1°	UB	6/22/2020	1	19.15	19.71	103
Insecta	Trichoptera	Limnephilidae	<i>Dicosmoecus gilvipes</i>	Caddisfly	1°	MS	6/22/2020	2	37.10	25.23	68
Insecta	Trichoptera	Limnephilidae	<i>Dicosmoecus gilvipes</i>	Caddisfly	1°	MS	8/9/2020	3	40.10	31.87	79
Insecta	Trichoptera	Limnephilidae	<i>Dicosmoecus gilvipes</i>	Caddisfly	1°	MS	8/9/2020	4	45.85	40.44	88
Insecta	Trichoptera	Limnephilidae	<i>Dicosmoecus gilvipes</i>	Caddisfly	1°	UB	8/9/2020	1	32.81	25.89	79
Insecta	Trichoptera	Limnephilidae	<i>Psychoglypha bella</i>	Caddisfly	1°	MS	6/22/2020	8	40.93	36.92	90
Insecta	Trichoptera	Limnephilidae	<i>Psychoglypha bella</i>	Caddisfly	1°	MS	8/9/2020	20	46.44	23.28	50
Insecta	Trichoptera	Thremmatidae	<i>Neophylax rickeri</i>	Caddisfly	1°	UB	6/22/2020	15	13.30	11.11	84
Insecta	Trichoptera	Thremmatidae	<i>Neophylax rickeri</i>	Caddisfly	1°	MS	6/22/2020	20	12.01	10.73	89
Insecta	Trichoptera	Thremmatidae	<i>Neophylax rickeri</i>	Caddisfly	1°	MS	8/9/2020	28	17.05	16.18	95
Insecta	Trichoptera	Thremmatidae	<i>Neophylax rickeri</i>	Caddisfly	1°	UB	8/9/2020	23	10.64	10.84	102
Insecta	Ephemeroptera	Ephemerellidae	<i>Drunella coloradensis</i>	Mayfly	2°/3°	UB	8/9/2020	16	120.03	123.16	103
Insecta	Megaloptera	Corydalidae		Dobsonfly	2°/3°	DC	6/22/2020	2	140.57	108.26* (164.90)	77* (117)
Insecta	Odonata	Aeshnidae	<i>Aeshna</i>	Dragonfly	2°/3°	MS	6/22/2020	1	49.14	35.83	73
Insecta	Odonata	Aeshnidae	<i>Aeshna</i>	Dragonfly	2°/3°	MS	8/9/2020	1	115.22	123.41	107
Insecta	Plecoptera	Perlidae	<i>Calineuria californica</i>	Stonefly	2°/3°	UB	6/22/2020	3	79.79	67.11	84
Insecta	Plecoptera	Perlidae	<i>Calineuria californica</i>	Stonefly	2°/3°	DC	6/22/2020	4	76.98	78.83	102
Insecta	Plecoptera	Perlidae	<i>Calineuria californica</i>	Stonefly	2°/3°	MS	6/22/2020	4	112.18	114.77	102
Insecta	Plecoptera	Perlidae	<i>Calineuria californica</i>	Stonefly	2°/3°	MS	8/9/2020	2	121.35	125.91	104

Class	Order	Family	Genus/species	Common Name	Cons. Level	Site	Collection Date	No. Spec.	THg (ng/g)	MeHg (ng/g)	%MeHg
Terrestrial											
Diplopoda	Callipodida	Tynommatidae		Millipede	1°	UB	6/22/2020	1	359.41	228.11	63
Diplopoda	Callipodida	Tynommatidae		Millipede	1°	MS	6/22/2020	2	368.36	370.92	101
Diplopoda	Polydesmida	Xystodesmidae	<i>Harpaphe haydeniana</i>	Millipede	1°	MS	6/22/2020	4	436.67	40.59	9
Diplopoda	Polydesmida	Xystodesmidae	<i>Harpaphe haydeniana</i>	Millipede	1°	MS	8/9/2020	2	396.31	54.88	14
Diplopoda	Polydesmida	Xystodesmidae	<i>Harpaphe haydeniana</i>	Millipede	1°	UB	8/9/2020	2	704.66* (830.64)	27.53	4* (3)
Gastropoda	Stylommatophora	Arionidae	<i>Prophysaon andersoni</i>	Slug	1°	DC	8/9/2020	4	86.13	46.76	54
Gastropoda	Stylommatophora	Helminthoglyptidae	<i>Helminthoglypta</i>	Snail	1°	MS	6/22/2020	3	56.08	26.75	48
Gastropoda	Stylommatophora	Polygyridae	<i>Vespericola</i>	Snail	1°	DC	6/22/2020	5	76.53	33.77	44
Gastropoda	Stylommatophora	Polygyridae	<i>Vespericola</i>	Snail	1°	MS	6/22/2020	4	70.00	23.39	33
Gastropoda	Stylommatophora	Polygyridae	<i>Vespericola</i>	Snail	1°	MS	8/9/2020	5	48.68	30.15	62
Malacostraca	Isopoda	Armadillidiidae	<i>Armadillidium vulgare</i>	Pillbug	1°	UB	6/22/2020	6	118.99	99.44	84
Malacostraca	Isopoda	Armadillidiidae	<i>Armadillidium vulgare</i>	Pillbug	1°	DC	6/22/2020	7	122.57	114.79	94
Malacostraca	Isopoda	Armadillidiidae	<i>Armadillidium vulgare</i>	Pillbug	1°	DC	8/9/2020	6	190.67	148.36	78
Malacostraca	Isopoda	Armadillidiidae	<i>Armadillidium vulgare</i>	Pillbug	1°	MS	8/9/2020	10	124.48	87.49	70
Malacostraca	Isopoda	Porcellionidae	<i>Porcellio scaber</i>	Sowbug	1°	UB	6/22/2020	15	313.68	319.12	102
Malacostraca	Isopoda	Porcellionidae	<i>Porcellio scaber</i>	Sowbug	1°	MS	6/22/2020	10	379.71	341.88	90
Malacostraca	Isopoda	Porcellionidae	<i>Porcellio scaber</i>	Sowbug	1°	UB	8/9/2020	11	303.96	271.23	89
Malacostraca	Isopoda	Porcellionidae	<i>Porcellio scaber</i>	Sowbug	1°	MS	8/9/2020	18	340.47	266.82	78
Malacostraca	Isopoda	Porcellionidae	<i>Porcellio scaber</i>	Sowbug	1°	DC	6/22/2020	15	310.45	228.74* (326.24)	74* (105)
Arachnida	Araneae	Zoropsidae	<i>Anachemmis</i>	Spider	2°/3°	UB	6/22/2020	1	489.49	493.00	101
Arachnida	Araneae	Zoropsidae	<i>Anachemmis</i>	Spider	2°/3°	MS	6/22/2020	4	972.65	713.18	73
Arachnida	Araneae	Zoropsidae	<i>Anachemmis</i>	Spider	2°/3°	MS	8/9/2020	4	871.68	828.11	95
Arachnida	Scorpiones	Vaejovidae	<i>Vaejovis</i>	Scorpion	2°/3°	MS	6/22/2020	2	627.52	524.01	84
Arachnida	Scorpiones	Vaejovidae	<i>Vaejovis</i>	Scorpion	2°/3°	MS	8/9/2020	1	587.94	559.23	95
Arachnida	Scorpiones	Vaejovidae	<i>Vaejovis</i>	Scorpion	2°/3°	UB	8/9/2020	2	1118.25	1188.57	106
Chilopoda	Scolopendromorpha	Scolopocryptopidae	<i>Scolopocryptops</i>	Centipede	2°/3°	UB	6/22/2020	2	450.31	366.71	81
Chilopoda	Scolopendromorpha	Scolopocryptopidae	<i>Scolopocryptops</i>	Centipede	2°/3°	MS	6/22/2020	2	1462.48	1193.52	82
Chilopoda	Scolopendromorpha	Scolopocryptopidae	<i>Scolopocryptops</i>	Centipede	2°/3°	MS	8/9/2020	3	446.97	498.08	111
Chilopoda	Scolopendromorpha	Scolopocryptopidae	<i>Scolopocryptops</i>	Centipede	2°/3°	UB	8/9/2020	3	383.34	379.69	99

Class	Order	Family	Genus/species	Common Name	Cons. Level	Site	Collection Date	No. Spec.	THg (ng/g)	MeHg (ng/g)	%MeHg
Insecta	Coleoptera	Carabidae	<i>Pterostichus</i>	Beetle	2°/3°	MS	6/22/2020	4	116.02	91.02	78
Insecta	Coleoptera	Carabidae	<i>Pterostichus</i>	Beetle	2°/3°	MS	8/9/2020	7	131.83	133.12	101
Insecta	Coleoptera	Carabidae	<i>Pterostichus</i>	Beetle	2°/3°	DC	8/9/2020	3	79.74	77.57	97
Insecta	Coleoptera	Carabidae	<i>Pterostichus</i>	Beetle	2°/3°	DC	6/22/2020	2	188.02	168.01* (191.79)	89* (102)
Insecta	Coleoptera	Carabidae	<i>Scaphinotus</i>	Beetle	2°/3°	UB	6/22/2020	4	82.59	67.18	81
Insecta	Coleoptera	Carabidae	<i>Scaphinotus</i>	Beetle	2°/3°	MS	6/22/2020	2	133.26	85.69	64
Insecta	Coleoptera	Carabidae	<i>Scaphinotus</i>	Beetle	2°/3°	MS	8/9/2020	2	120.77	114.19	95
Insecta	Coleoptera	Carabidae	<i>Scaphinotus</i>	Beetle	2°/3°	DC	6/22/2020	2	54.46	48.26* (67.66)	89* (124)

SI Table 2. Collection information and mean total mercury (THg) concentration for individual fish samples from Big Creek, California. Length is mm total length (sculpin) or fork length (steelhead/rainbow trout). Site codes refer to mainstem Big Creek (MS), upper Big Creek (UB), and Devils Creek (DC). THg concentrations are means of replicate runs per sample in ng/g dry weight.

Species	Common Name	Age class	Length (mm)	Site	Collection Date	THg (ng/g)	Notes
<i>Cottus aleuticus</i>	Coastrange sculpin	1+	86	MS	9/26/2017	552.91	
<i>Cottus aleuticus</i>	Coastrange sculpin	1+	98	MS	9/26/2017	1410.16	
<i>Cottus aleuticus</i>	Coastrange sculpin	1+	107	MS	9/26/2017	2126.01	
<i>Cottus aleuticus</i>	Coastrange sculpin	1+	110	MS	9/26/2017	2238.27	
<i>Cottus aleuticus</i>	Coastrange sculpin	1+	110	MS	9/26/2017	2336.16	
<i>Cottus aleuticus</i>	Coastrange sculpin	1+	110	MS	9/26/2017	1337.31	
<i>Cottus aleuticus</i>	Coastrange sculpin	1+	110	MS	9/26/2017	421.48	
<i>Cottus aleuticus</i>	Coastrange sculpin	1+	125	MS	9/26/2017	1182.18	
<i>Cottus aleuticus</i>	Coastrange sculpin	1+	126	MS	9/26/2017	1269.35	
<i>Cottus aleuticus</i>	Coastrange sculpin	1+	128	MS	9/26/2017	883.98	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	0	74	DC	9/28/2010	338.43	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	0	75	MS	9/28/2010	351.72	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	0	79	DC	9/28/2010	569.02	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	0	82	DC	9/28/2010	554.68	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	0	90	MS	9/28/2010	461.63	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	0	76	UB	9/29/2010	328.94	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	0	78	UB	9/29/2010	370.23	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	0	81	UB	9/29/2010	329.59	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	0	72	MS	10/5/2010	613.14	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	0	77	MS	10/5/2010	240.44	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	1+	181	UB	4/12/2005	1311.22	1
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	1+	300	MS	8/17/2005	3580.93	1, 2
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	1+	170	DC	10/10/2006	1518.25	1, 2
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	1+	146	MS	9/27/2011	1523.03	2
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	1+	125	MS	9/28/2011	932.95	1
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	1+	128	MS	10/3/2011	1283.69	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	1+	125	MS	10/4/2011	882.12	
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	1+	196	MS	6/6/2016	758.58	1, 2
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	1+	207	MS	9/25/2018	1352.52	1
<i>Oncorhynchus mykiss</i>	Steelhead/rainbow trout	1+	126	DC	9/24/2019	1381.79	2

Notes:

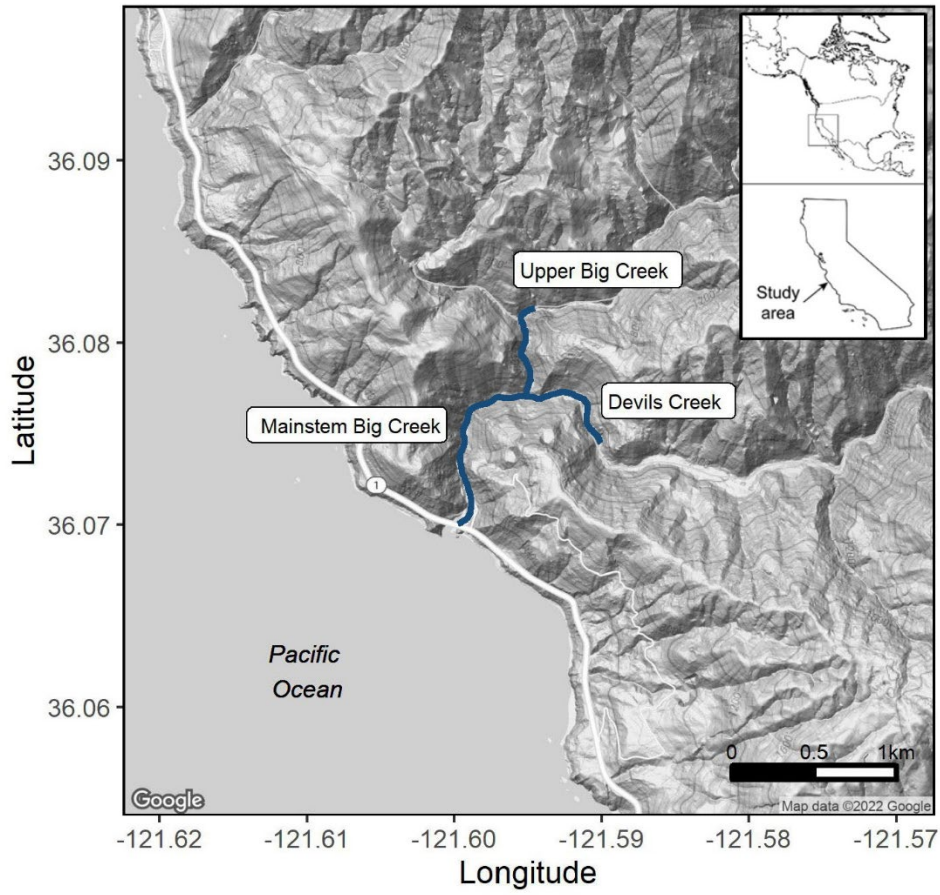
1. Analyzed for selenium (see SI Table 3)
2. Analyzed for THg concentration at Moss Landing Marine Lab for QC (see SI Figure 2)

SI Table 3. Selenium concentrations (ng/g dw)* and Se:Hg molar ratios for invertebrate and trout samples from Big Creek, California. Selenium was analyzed from invertebrates collected in 2016 and 2018 for a different project, and from six age 1+ *O. mykiss* from the current study. For invertebrates, site, collection date, and number of specimens composited refer to samples analyzed for selenium; for fish, site and collection date refer to specimens analyzed for both mercury and selenium. Site codes refer to mainstem Big Creek (MS), upper Big Creek (UB), and Devils Creek (DC). Se:Hg molar ratios were calculated using total mercury concentrations (ng/g dw) from taxa means for invertebrates (from Table 1 in the main text) and from individual trout (from SI Table 2), and molecular weights of 78.96 (Se) and 200.59 (Hg). See SI Table 1 above for full taxonomic information for invertebrates.

Common name	Scientific name	Site	Collection Date	No. Spec.	Se (ng/g)	THg (ng/g)	Se:Hg (molar)
Invertebrates							
<i>Aquatic</i>							
Stonefly (Plecoptera)	<i>Pteronarcys californica</i>	MS	7/26/2018	1	451	17.94	63.9
Caddisfly (Trichoptera)	<i>Dicosmoecus gilvipes</i>	MS	8/2/2016	2	81	35.00	5.9
Mayfly (Ephemeroptera)	<i>Drunella coloradensis</i>	UB	8/2/2016	3	7380	120.03	156.2
Stonefly (Plecoptera)	<i>Calineuria californica</i>	DC	7/26/2018	2	390	97.57	10.2
<i>Terrestrial</i>							
Pillbug (Isopoda)	<i>Armadillidium vulgare</i>	MS	8/2/2016	4	790	139.18	14.4
Pillbug (Isopoda)	<i>Armadillidium vulgare</i>	UB	7/26/2018	3	527	139.18	9.6
Pillbug (Isopoda)	<i>Armadillidium vulgare</i>	UB	7/26/2018	2	580	139.18	10.6
Sowbug (Isopoda)	<i>Porcellio scaber</i>	MS	8/2/2016	8	912	329.65	7.0
Millipede (Diplopoda)	Tynommatidae	UB	7/26/2018	1	464	363.88	3.2
Fish							
Steelhead/rainbow trout	<i>Oncorhynchus mykiss</i>	MS	9/25/2018		3277	1352.52	6.2
Steelhead/rainbow trout	<i>Oncorhynchus mykiss</i>	MS	6/6/2016		2703	758.58	9.1
Steelhead/rainbow trout	<i>Oncorhynchus mykiss</i>	MS	8/17/2005		1706	3580.93	1.2
Steelhead/rainbow trout	<i>Oncorhynchus mykiss</i>	DC	10/10/2006		4160	1518.25	7.0
Steelhead/rainbow trout	<i>Oncorhynchus mykiss</i>	UB	4/12/2005		2246	1311.22	4.4
Steelhead/rainbow trout	<i>Oncorhynchus mykiss</i>	MS	9/28/2011		3927	932.95	10.7

*Selenium concentrations were analyzed at the W.M. Keck Collaboratory for Plasma Spectrometry at Oregon State University. Dried samples were weighed, ashed at 400°C, digested in 2 mL concentrated HNO₃ on a hotplate, and diluted for analysis. Samples were analyzed by inductively coupled plasma mass spectrometry (ICP-MS) on a ThermoElemental iCAP-RQ ICP-MS, calibrated against in-house elemental standards and analyzed at mass 77Se. Internal drift and/or matrix loading was monitored and corrected by spiking all standards and samples with a 0.5 ng/g 115In spike.

SI Figure 1. Map of study area in the Big Creek watershed on the Big Sur coast of central California, USA. Sampling reaches are indicated in blue, and California State Route 1 is shown for reference.



SI Figure 2. Comparison of THg concentrations in five age 1+ trout between samples analyzed by the authors (UCSC) and samples analyzed by the Marine Pollution Studies Laboratory (MPSL) at Moss Landing Marine Laboratory. Dashed line is 1:1.

