Alaska Department of Environmental Conservation
Office of the State Veterinarian Fish Monitoring Program
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Selenium in Fish and Shellfish Caught in Alaskan Waters

Fish Samples collected: 2001-2021

Concentration in mg/Kg wet weight

ND = Non-detect in greater then 50% of fish samples

Visit the Fish Monitoring Program webpage for more information:
http://www.dec.alaska.gov/eh/vet/fish-monitoring-program

For State of Alaska fish consumption recommendations visit:
http://www.dhss.alaska.gov/dph/Epi/eph/Pages/fish/default.aspx

Table 1: Selenium in Marine Fish

				mg/Kg wet weight					
Species	Tissue	n	ND	Mean	SD	SEM	Median	Min	Max
Alaska Plaice	Fillet	31	0	1.029	0.305	0.055	0.995	0.616	2.1
Arctic Flounder	Whole Body	4	0	0.823	0.068	0.034	0.81	0.76	0.91
Arctic Sculpin	Whole Body	1	0	0.92	NA	NA	0.92	0.92	0.92
Arrowtooth Flounder	Fillet	14	0	0.361	0.045	0.012	0.356	0.266	0.459
Atka Mackerel	Fillet	4	0	0.36	0.057	0.028	0.38	0.28	0.4
Atka Mackerel	Whole Body	5	0	0.546	0.091	0.041	0.58	0.41	0.65
Big Skate	Fillet	112	0	0.332	0.078	0.007	0.34	0.063	0.686
Big Skate	Liver	20	0	1.046	0.347	0.078	0.955	0.56	1.8
Black Rockfish	Fillet	84	0	0.564	0.198	0.022	0.506	0.19	1.1
Black Rockfish	Whole Body	7	0	0.589	0.216	0.082	0.58	0.33	0.97
Blue Shark	Fillet	1	0	0.229	NA	NA	0.229	0.229	0.229
Butter Sole	Whole Body	1	0	0.34	NA	NA	0.34	0.34	0.34
China Rockfish	Fillet	1	0	0.78	NA	NA	0.78	0.78	0.78
Copper Rockfish	Fillet	4	0	0.435	0.05	0.025	0.41	0.41	0.51
Dusky Rockfish	Fillet	64	0	0.451	0.091	0.011	0.452	0.23	0.79
Dusky Rockfish	Whole Body	20	0	0.619	0.122	0.027	0.605	0.41	0.94
Flathead Sole	Fillet	15	0	0.359	0.126	0.033	0.301	0.215	0.582
Fourhorn Sculpin	Whole Body	6	0	0.729	0.278	0.113	0.855	0.371	1
Fourhorn Sculpin	C-Whole Body	1	0	0.625	NA	NA	0.625	0.625	0.625
Great Sculpin	Whole Body	2	0	0.395	0.035	0.025	0.395	0.37	0.42
Kelp Greenling	Fillet	1	0	0.34	NA	NA	0.34	0.34	0.34
Kelp Greenling	Whole Body	18	0	0.337	0.081	0.019	0.365	0.18	0.43
Lamprey	Whole Body	10	0	0.385	0.041	0.013	0.394	0.311	0.431
Lingcod	Fillet	297	0	0.44	0.16	0.009	0.398	0.17	1
Longnose Skate	Fillet	114	0	0.32	0.045	0.004	0.32	0.22	0.44
Longnose Skate	Liver	20	0	0.661	0.306	0.069	0.54	0.3	1.2
Northernrock Sole	Fillet	20	0	0.6	0.16	0.036	0.593	0.329	0.933
Northernrock Sole	Whole Body	18	0	0.517	0.298	0.07	0.41	0.26	1.3
Pacific Cod	Fillet	175	0	0.246	0.074	0.006	0.238	0.1	0.53
Pacific Halibut	Fillet	3593	0	0.446	0.203	0.003	0.395	0.07	2.6
Pacific Halibut	Comp	1	0	0.445	NA	NA	0.445	0.445	0.445
Pacific Ocean Pearch	Fillet	78	0	0.505	0.184	0.021	0.466	0.252	1.028
Quillback Rockfish	Fillet	22	0	0.606	0.198	0.042	0.525	0.38	1.2
Red Irish Lord	Whole Body	11	0	0.383	0.043	0.013	0.4	0.32	0.44
Rock Greenling	Whole Body	16	0	0.349	0.07	0.017	0.335	0.25	0.55
Rougheye Rockfish	Fillet	72	0	0.436	0.106	0.012	0.456	0.22	0.713
Sablefish	Fillet	342	1	0.25	0.084	0.005	0.24	0.025	0.497
Sablefish	Whole Body	3	0	0.373	0.091	0.052	0.36	0.29	0.47
Salmon Shark	Fillet	109	0	0.317	0.072	0.007	0.304	0.15	0.69
Shortraker Rockfish	Fillet	8	0	0.436	0.067	0.024	0.44	0.33	0.55
Silvergray Rockfish	Fillet	10	0	0.462	0.07	0.022	0.453	0.38	0.58

Table 1: Selenium in Marine Fish *(continued)*

				mg/Kg wet weight					
Species	Tissue	n	ND	Mean	SD	SEM	Median	Min	Max
Sleeper Shark	Fillet	1	0	0.3	NA	NA	0.3	0.3	0.3
Southernrock Sole	Whole Body	1	0	0.21	NA	NA	0.21	0.21	0.21
Spiny Dogfish	Fillet	68	0	0.254	0.13	0.016	0.198	0.146	0.67
Starry Flounder	Fillet	1	0	0.34	NA	NA	0.34	0.34	0.34
Starry Flounder	Whole Body	1	0	0.27	NA	NA	0.27	0.27	0.27
Starry Flounder	C-Whole Body	3	0	0.628	0.086	0.05	0.616	0.549	0.72
Walleye Pollock	Fillet	256	3	0.222	0.074	0.005	0.23	0.025	0.62
Walleye Pollock	Comp	5	0	0.324	0.028	0.012	0.321	0.29	0.353
Yellow Irish Lord	Fillet	2	0	0.35	0.099	0.07	0.35	0.28	0.42
Yellow Irish Lord	Whole Body	10	0	0.46	0.095	0.03	0.445	0.34	0.62
Yelloweye Rockfish	Fillet	126	0	0.555	0.141	0.013	0.531	0.28	1.118
Yellowfin Sole	Fillet	45	0	0.451	0.219	0.033	0.401	0.235	1.51
Yellowtail Rockfish	Fillet	7	0	1.004	0.317	0.12	1.1	0.537	1.3

Note:

n= sample size

ND = non-detect

Mean = arithmetic mean

SD = standard deviation

SEM = standard error

C = Composite of multiple individuals

Reporting limits: As, Cd, Cu, Pb = 0.05 mg/Kg; Se = 0.25 mg/Kg; Hg = 0.01 mg/Kg

Table 2: Selenium in Salmonids (Salmon, Whitefish, Grayling, Char)

				mg/Kg wet weight					
Species	Tissue	n	ND	Mean	SD	SEM	Median	Min	Max
Arctic Char	Fillet	30	0	0.243	0.059	0.011	0.227	0.15	0.35
Arctic Char	Whole Body	10	0	0.577	0.782	0.247	0.335	0.28	2.8
Arctic Cisco	Fillet	21	0	0.361	0.045	0.01	0.367	0.305	0.478
Arctic Cisco	Whole Body	1	0	0.85	NA	NA	0.85	0.85	0.85
Arctic Grayling	Fillet	120	1	0.628	0.522	0.048	0.435	0.025	3.45
Arctic Grayling	Whole Body	4	0	0.502	0.351	0.175	0.376	0.245	1.01
Arctic Grayling	C-Whole Body	11	0	0.909	0.532	0.16	0.973	0.263	1.5
Bering Cisco	Fillet	5	0	0.366	0.073	0.033	0.366	0.271	0.471
Broad Whitefish	Fillet	48	0	0.392	0.38	0.055	0.27	0.19	2.3
Chum Salmon	Fillet	304	0	0.267	0.06	0.003	0.26	0.09	0.435
Chum Salmon	Whole Body	2	0	0.39	0.003	0.002	0.39	0.388	0.392
Coho Salmon	Fillet	321	2	0.235	0.074	0.004	0.237	0.025	0.549
Coho Salmon	Whole Body	62	0	0.449	0.161	0.02	0.43	0.29	1.27
Coho Salmon	Eggs	20	0	2.09	0.342	0.076	2.1	1.5	2.8
Cutthroat Trout	Whole Body	7	0	0.387	0.106	0.04	0.426	0.208	0.477
Dolly Varden	Fillet	65	0	0.493	0.143	0.018	0.497	0.15	0.832
Dolly Varden	Whole Body	49	0	1.04	0.484	0.069	0.843	0.476	2.3
Humpback Whitefish	Fillet	110	0	0.354	0.277	0.026	0.265	0.13	2.3
Humpback Whitefish	Whole Body	24	0	0.404	0.083	0.017	0.39	0.25	0.54
King Salmon	Fillet	252	0	0.235	0.079	0.005	0.226	0.07	0.59
King Salmon	Whole Body	20	0	0.58	0.392	0.088	0.415	0.23	1.66
Lake Trout	Fillet	55	0	0.344	0.139	0.019	0.295	0.1	0.68
Lake Trout	Whole Body	33	0	0.493	0.098	0.017	0.48	0.36	0.77
Least Cisco	Fillet	42	0	0.324	0.163	0.025	0.322	0.104	0.768
Least Cisco	Whole Body	1	0	0.64	NA	NA	0.64	0.64	0.64
Pink Salmon	Fillet	206	0	0.251	0.108	0.008	0.232	0.06	0.71
Pygmy Whitefish	Whole Body	1	0	1.1	NA	NA	1.1	1.1	1.1
Rainbow Trout	Fillet	137	3	0.262	0.122	0.01	0.244	0.025	0.95
Rainbow Trout	Whole Body	11	0	0.636	0.143	0.043	0.68	0.25	0.75
Round Whitefish	Fillet	14	0	0.98	0.773	0.207	0.472	0.28	2.4
Round Whitefish	Whole Body	1	0	0.591	NA	NA	0.591	0.591	0.591
Sheefish	Fillet	44	0	0.384	0.123	0.019	0.43	0.14	0.57
Sheefish	Whole Body	5	0	0.562	0.05	0.022	0.53	0.52	0.63
Sheefish	Eggs	1	0	1.1	NA	NA	1.1	1.1	1.1
Sockeye Salmon	Fillet	341	0	0.284	0.111	0.006	0.261	0.09	0.569
Sockeye Salmon	Whole Body	56	0	0.846	0.397	0.053	0.835	0.3	3
Sockeye Salmon	Eggs	2	0	1.9	0.849	0.6	1.9	1.3	2.5
Sockeye Salmon	C-Whole Body	1	0	0.46	NA	NA	0.46	0.46	0.46

Table 2: Selenium in Salmonids (Salmon, Whitefish, Grayling, Char) *(continued)*

				mg/Kg wet weight					
Species	Tissue	n	ND	Mean	SD	SEM	Median	Min	Max

Note:
n= sample size
ND = non-detect
Mean = arithmetic mean
SD = standard deviation
SEM = standard error
C = Composite of multiple individuals
Reporting limits: As, Cd, Cu, Pb = 0.05 mg/Kg; Se = 0.25 mg/Kg; Hg = 0.01 mg/Kg

Table 3: Selenium in Marine Forage Fish

				mg/Kg wet weight					
Species	Tissue	n	ND	Mean	SD	SEM	Median	Min	Max
Capelin	C-Whole Body	1	0	0.37	NA	NA	0.37	0.37	0.37
Eulachon	C-Whole Body	7	0	0.169	0.023	0.009	0.17	0.14	0.21
Pacific Herring	Fillet	30	0	0.385	0.144	0.026	0.352	0.212	0.665
Pacific Herring	Eggs	1	0	0.836	NA	NA	0.836	0.836	0.836
Pacific Herring	C-Whole Body	16	0	0.616	0.267	0.067	0.485	0.34	1.1
Rainbow Smelt	Whole Body	10	0	0.449	0.077	0.024	0.425	0.34	0.58
Saffron Cod	Whole Body	22	0	0.773	0.182	0.039	0.702	0.629	1.3
Sand Lance	C-Whole Body	1	0	0.86	NA	NA	0.86	0.86	0.86

Note:
n= sample size
ND = non-detect
Mean = arithmetic mean
SD = standard deviation
SEM = standard error
C = Composite of multiple individuals
Reporting limits: As, Cd, Cu, Pb = 0.05 mg/Kg; Se = 0.25 mg/Kg; Hg = 0.01 mg/Kg

Table 4: Selenium in Marine Invertebrates

				mg/Kg wet weight					
Species	Tissue	n	ND	Mean	SD	SEM	Median	Min	Max
Bairdi Crab	Comp	1	0	0.957	NA	NA	0.957	0.957	0.957
Blue Mussel	Invert Whole Tissue	4	0	1.327	0.666	0.333	1.2	0.66	2.25
Blue Mussel	C-Invert Whole	38	0	1.313	0.498	0.081	1.3	0.356	2.5
Butter Clam	Invert Whole Tissue	5	0	0.366	0.179	0.08	0.36	0.19	0.65
Butter Clam	C-Invert Whole	4	0	0.428	0.452	0.226	0.236	0.139	1.1
Chiton	Invert Whole Tissue	2	0	0.58	0.057	0.04	0.58	0.54	0.62
Cockle	Invert Whole Tissue	5	0	1.2	0.141	0.063	1.3	1	1.3
Cockle	C-Invert Whole	16	0	0.484	0.33	0.083	0.282	0.232	1.4
Coonstriped Shrimp	C-Invert Whole	2	0	0.265	0.037	0.026	0.265	0.239	0.291
Decorator Crab	Invert Whole Tissue	1	0	8.6	NA	NA	8.6	8.6	8.6
Dungeness Crab	Invert Whole Tissue	2	0	6.95	5.728	4.05	6.95	2.9	11
Golden King Crab	Invert Muscle	2	0	0.322	0.033	0.023	0.322	0.299	0.345
Hairytriton Snail	Invert Whole Tissue	1	0	2.4	NA	NA	2.4	2.4	2.4
Hermit Crab	Invert Whole Tissue	1	0	2.8	NA	NA	2.8	2.8	2.8
Horse Clam	C-Invert Whole	1	0	0.402	NA	NA	0.402	0.402	0.402
Little Neck Clam	Invert Whole Tissue	4	0	0.616	0.125	0.063	0.591	0.511	0.769
Little Neck Clam	C-Invert Whole	2	0	1.041	1.073	0.759	1.041	0.282	1.8
Neptunea hero	Invert Whole Tissue	3	0	0.948	0.111	0.064	0.964	0.83	1.05
Opilio Crab	Comp	1	0	0.838	NA	NA	0.838	0.838	0.838
Opilio Crab	Invert Muscle	27	0	0.822	0.207	0.04	0.793	0.492	1.23
Oysters	Invert Whole Tissue	16	0	0.552	0.103	0.026	0.516	0.444	0.804
Razor Clam	Invert Muscle	2	0	0.525	0.054	0.038	0.525	0.487	0.563
Ribbon Worm	Invert Whole Tissue	2	0	1.6	0.141	0.1	1.6	1.5	1.7
Scallop	Invert Whole Tissue	20	0	0.906	0.271	0.061	0.86	0.5	1.3
Sea Cucumber	Invert Whole Tissue	3	0	1.06	0.069	0.04	1.1	0.98	1.1
Softshell Clam	Invert Whole Tissue	4	0	1.051	0.713	0.356	1.065	0.175	1.9
Softshell Clam	C-Invert Whole	10	0	1.211	0.89	0.281	0.97	0.293	2.9
Squid	C-Invert Whole	5	0	0.78	0.076	0.034	0.77	0.67	0.88

Note:

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SEM = standard error

C = Composite of multiple individuals

Reporting limits: As, Cd, Cu, Pb = 0.05 mg/Kg; Se = 0.25 mg/Kg; Hg = 0.01 mg/Kg

Table 5: Selenium in Freshwater Fishes

				mg/Kg wet weight					
Species	Tissue	n	ND	Mean	SD	SEM	Median	Min	Max
Alaska Blackfish	Whole Body	3	0	0.24	0.045	0.026	0.254	0.19	0.277
Alaska Blackfish	C-Whole Body	3	0	0.381	0.165	0.095	0.391	0.211	0.54
Burbot	Fillet	58	0	0.445	0.204	0.027	0.424	0.083	1.16
Burbot	Liver	5	0	1.258	0.616	0.276	0.906	0.755	2.14
Longnose Sucker	Fillet	3	0	0.96	0.294	0.17	0.79	0.79	1.3
Longnose Sucker	Whole Body	2	0	2.26	0.24	0.17	2.26	2.09	2.43
Northern Pike	Fillet	535	12	0.242	0.15	0.006	0.21	0.025	1.39
Northern Pike	Whole Body	40	0	0.368	0.157	0.025	0.32	0.21	0.94
NS Stickleback	C-Whole Body	13	0	0.437	0.175	0.049	0.39	0.24	0.851
Slimy Sculpin	Whole Body	66	0	1.084	0.632	0.078	0.9	0.328	4.2
Slimy Sculpin	C-Whole Body	15	0	0.687	0.423	0.109	0.54	0.29	1.8
TS Stickleback	Whole Body	3	0	0.537	0.125	0.072	0.486	0.445	0.679
TS Stickleback	C-Whole Body	8	0	0.52	0.19	0.067	0.508	0.3	0.856

Note:

n= sample size

ND = non-detect

Mean = arithmetic mean

SD = standard deviation

SEM = standard error

C = Composite of multiple individuals

Reporting limits: As, Cd, Cu, Pb = 0.05 mg/Kg; Se = 0.25 mg/Kg; Hg = 0.01 mg/Kg

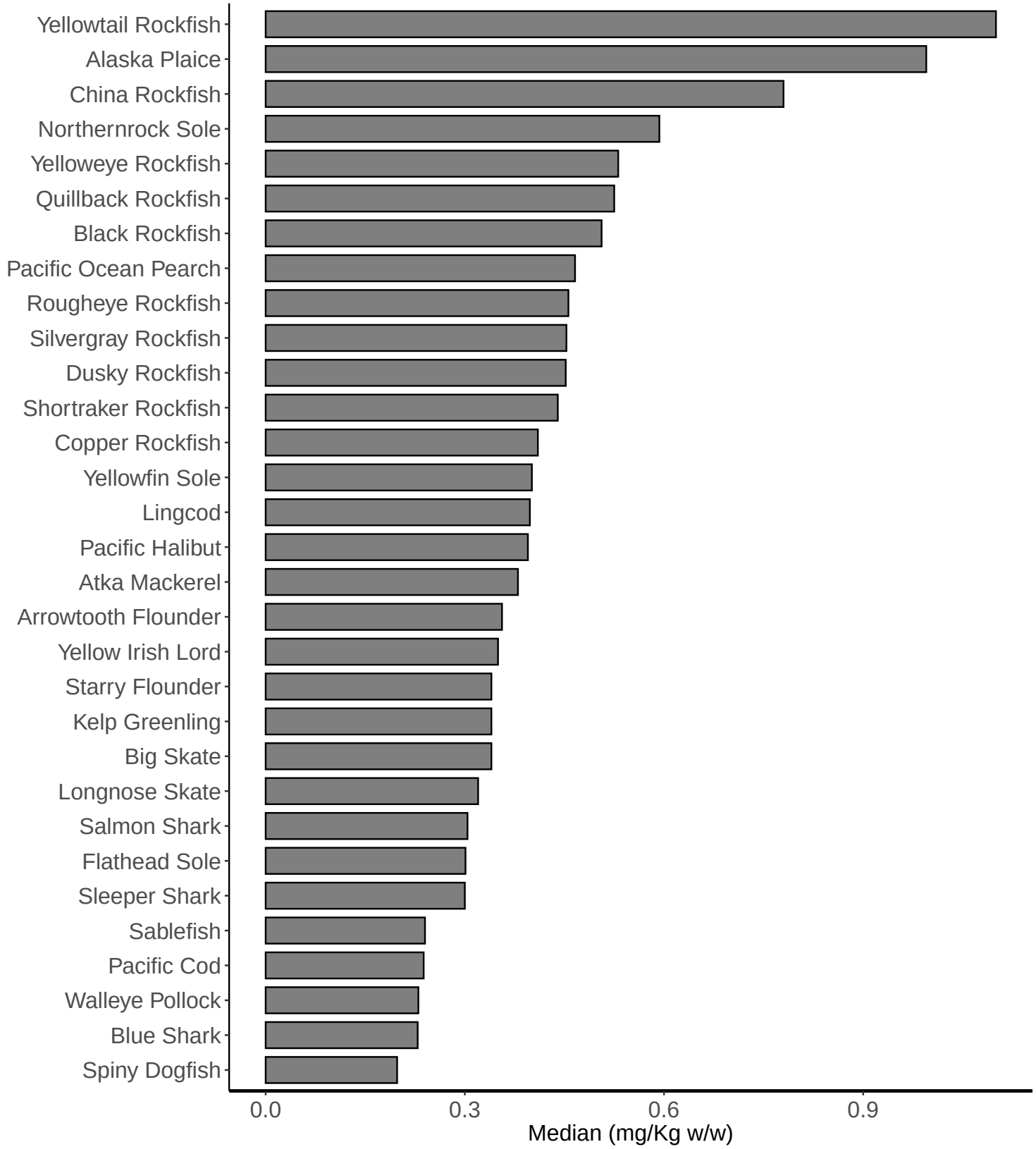

Figure 1: Selenium in Marine Fish

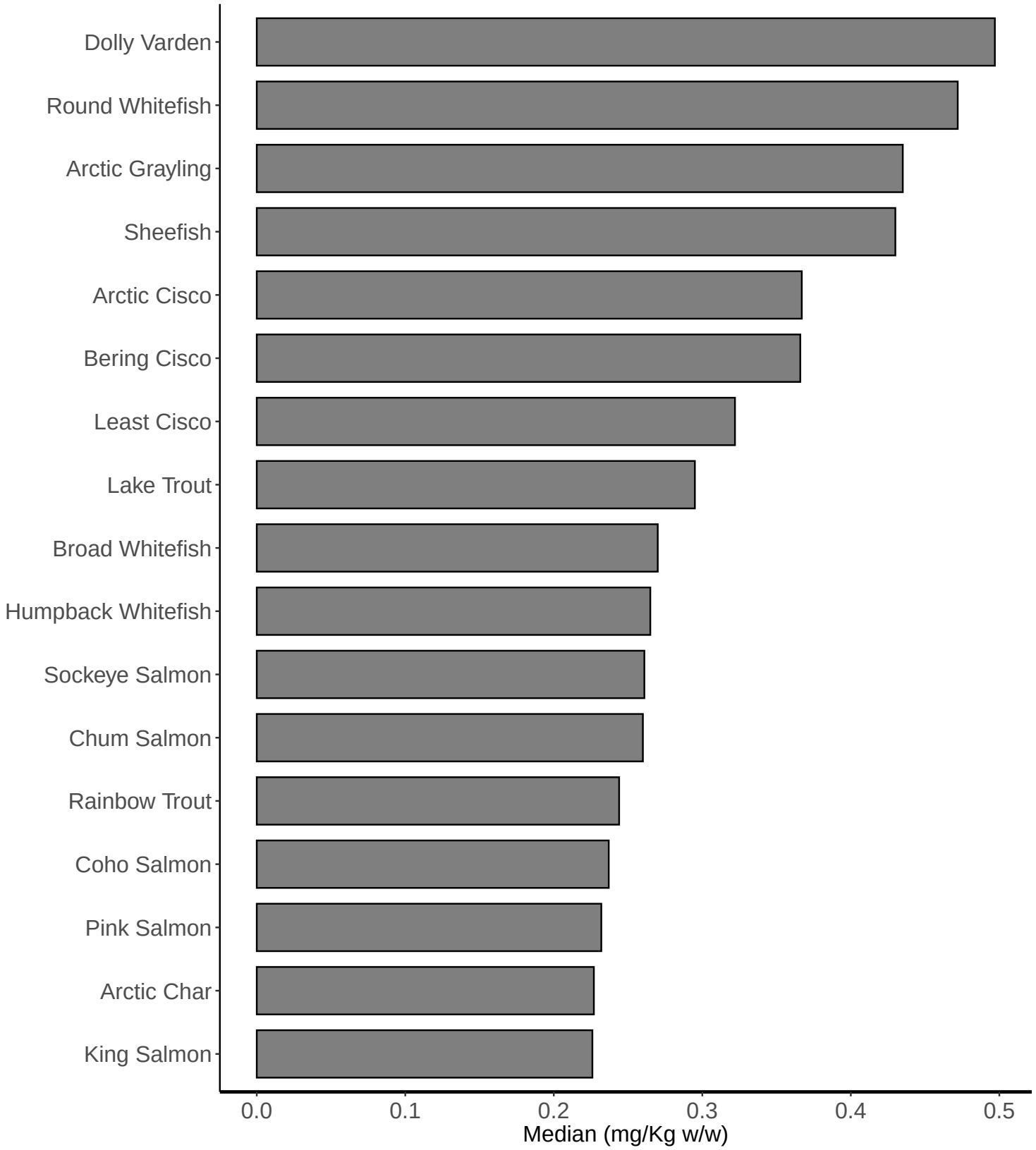

Figure 2: Selenium in Salmonids

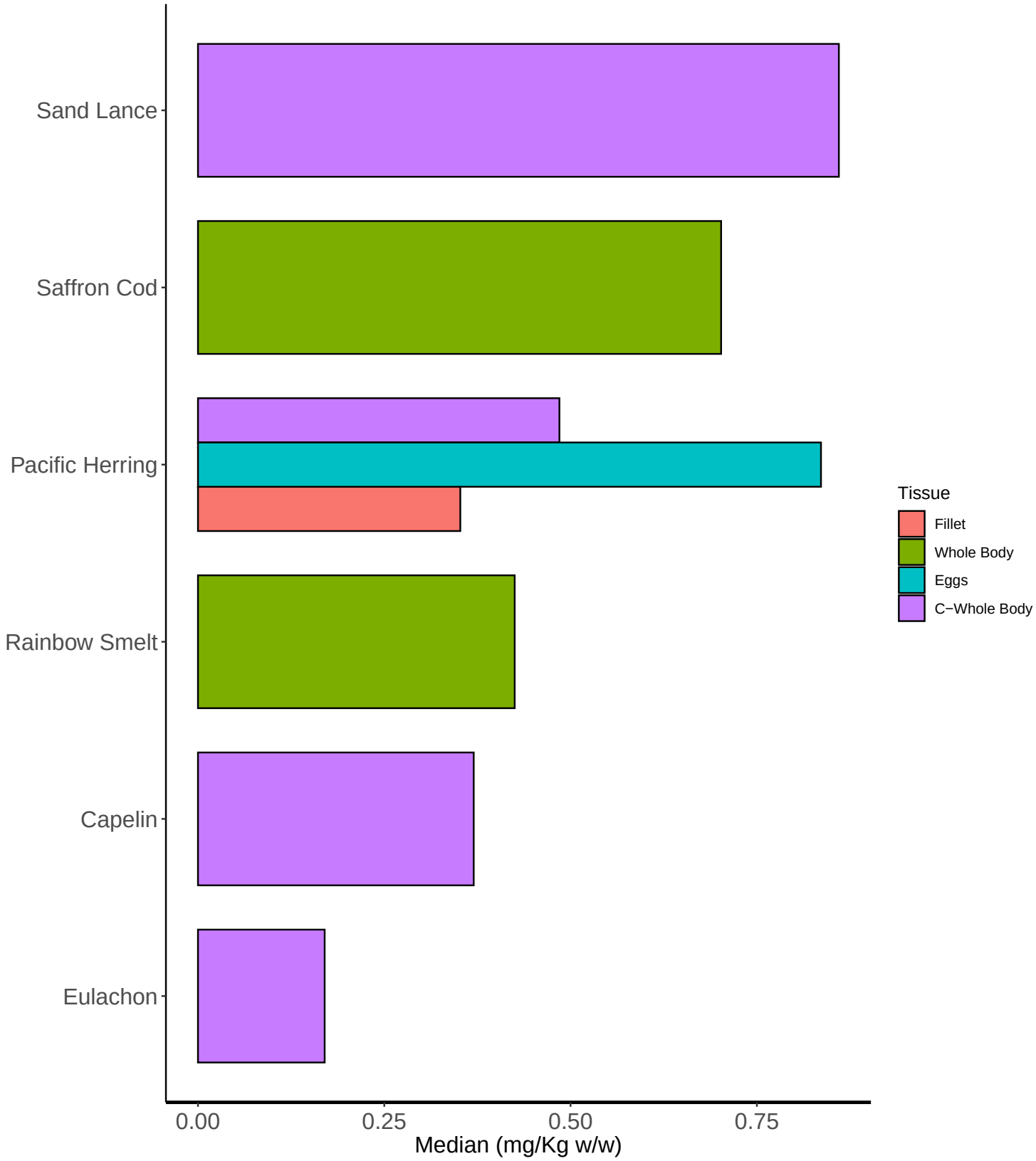

Figure 3: Selenium in Forage Fish

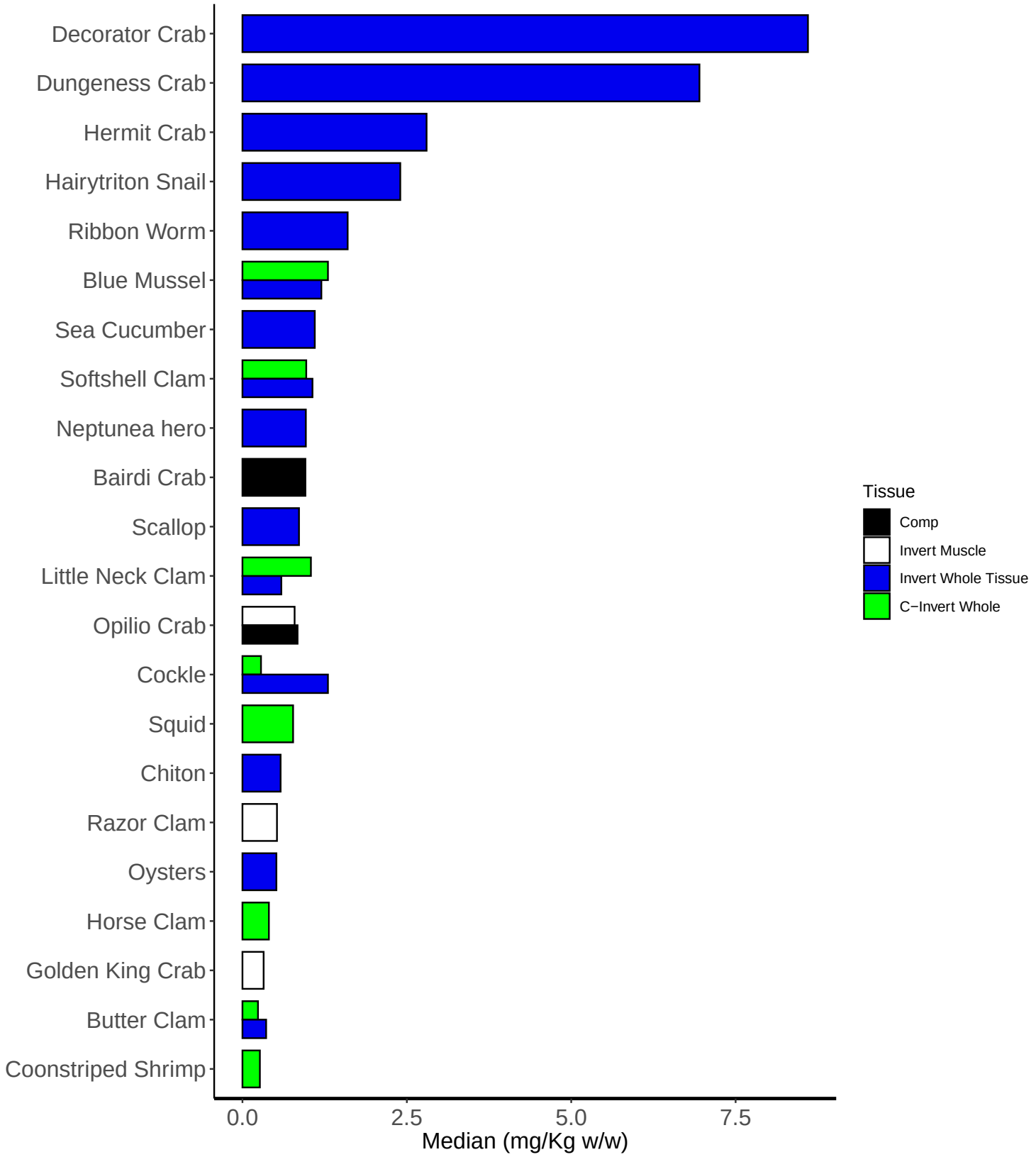

Figure 4: Selenium in Marine Invertebrates

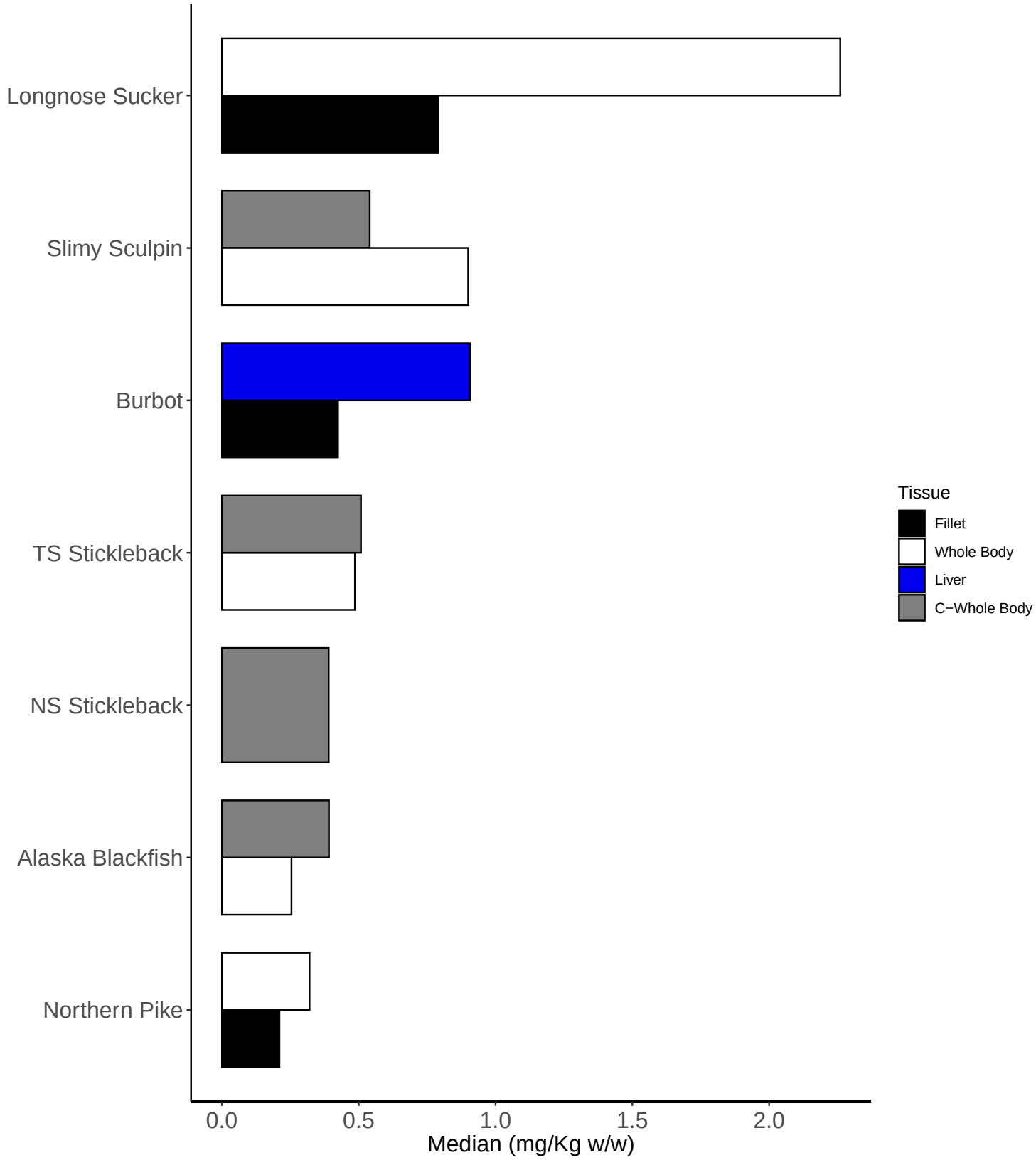

Figure 5: Selenium in Freshwater Fish