

Supplement B: Full Model Output Results, Mixed Trophic Analysis Results, Effects of Brook Trout Diet Modification, and Food Web Relationships in the Overall Model

Supplementary Table SB.1. Model output results for the final relative change in biomass of food web groups after 20 model iterations. Values greater than 1.0 indicate a net increase proportional to the amount greater than 1.0. Values less than 1.0 indicate a net decrease proportional to the amount less than 1.0. Fish groups include Brook Trout less than 150 mm (BKT < 150); Brook Trout greater than 150 mm (BKT > 150); Bull Trout less than 150 mm (BLT < 150); Bull Trout greater than 150 mm (BLT > 150); juvenile Chinook Salmon less than 150 mm (CH < 150); Rainbow Trout/steelhead less than 150 mm (RBT < 150); Rainbow Trout/steelhead greater than 150 mm (RBT > 150); Cutthroat Trout (CT; all sizes); sculpins (SCLPN; all sizes); whitefishes *Prosopium* spp. (WHTFH; all sizes); and hatchery juvenile Chinook Salmon (CH0). The shaded column highlights the responses of wild juvenile Chinook Salmon—the target species—to model scenarios.

Scenario	Periphyton	Macrophytes	Microbes	Ephemeroptera	Plecoptera	Trichoptera	Chironomidae	Coleoptera	Noninsect aquatics	Other Diptera	BKT < 150
Increase in periphyton production:											
2%	1.025	0.997	1.008	1.022	1.018	1.009	1.009	1.029	1.011	1.017	1.004
5%	1.061	0.993	1.019	1.054	1.045	1.022	1.022	1.072	1.028	1.043	1.010
10%	1.117	0.987	1.037	1.107	1.091	1.046	1.045	1.144	1.056	1.085	1.023
25%	1.262	0.969	1.091	1.267	1.229	1.121	1.116	1.357	1.140	1.208	1.074
50%	1.438	0.942	1.181	1.532	1.465	1.259	1.241	1.704	1.281	1.405	1.197
100%	1.642	0.900	1.356	2.050	1.949	1.571	1.499	2.371	1.569	1.772	1.533
Increase in detrital vulnerability (as a proxy for greater labile standing stocks):											
2%	1.000	0.999	1.004	1.004	1.009	1.005	1.002	1.007	1.009	1.004	1.003
5%	0.999	0.997	1.009	1.011	1.021	1.011	1.006	1.018	1.023	1.010	1.008
10%	0.998	0.995	1.017	1.021	1.042	1.022	1.011	1.035	1.044	1.020	1.016
25%	0.996	0.988	1.037	1.049	1.098	1.054	1.028	1.080	1.102	1.046	1.040
50%	0.993	0.979	1.061	1.093	1.179	1.101	1.053	1.142	1.182	1.083	1.081
100%	0.988	0.965	1.097	1.165	1.309	1.183	1.098	1.236	1.307	1.141	1.158
Reduction in Brook Trout biomass:											
5%	1.000	1.000	1.000	1.000	0.999	1.000	1.000	1.000	1.000	1.000	0.965
25%	1.000	1.000	1.000	0.999	0.995	1.000	0.997	0.998	1.001	1.001	0.818
50%	1.000	0.999	1.000	0.998	0.995	1.021	0.996	0.995	1.001	1.001	0.353
100%	1.000	0.999	1.000	0.997	0.996	1.041	0.995	0.994	1.001	1.001	0.001
Stocking of CH0 at:											
0.02 g/m ²	1.000	1.001	1.000	0.996	0.989	0.993	0.999	0.998	1.001	1.003	0.987
0.05 g/m ²	1.001	1.002	1.001	0.990	0.972	0.983	0.997	0.994	1.001	1.007	0.969
0.08 g/m ²	1.002	1.003	1.001	0.985	0.957	0.973	0.996	0.991	1.002	1.011	0.952
0.11 g/m ²	1.003	1.005	1.001	0.979	0.941	0.964	0.994	0.988	1.003	1.014	0.936
0.15 g/m ²	1.003	1.006	1.002	0.972	0.922	0.951	0.993	0.984	1.004	1.019	0.916
0.20 g/m ²	1.004	1.008	1.002	0.964	0.900	0.937	0.991	0.979	1.005	1.025	0.893
0.25 g/m ²	1.005	1.010	1.003	0.956	0.879	0.923	0.990	0.975	1.007	1.031	0.872
0.50 g/m ²	1.010	1.018	1.004	0.924	0.792	0.865	0.992	0.958	1.016	1.055	0.795
1.00 g/m ²	1.015	1.029	1.005	0.887	0.680	0.788	1.025	0.943	1.035	1.090	0.714
2.00 g/m ²	1.021	1.040	1.002	0.881	0.574	0.731	1.188	0.952	1.068	1.125	0.665

Supplementary Table SB.1. Extended.

Scenario	BLT < 150	BKT > 150	BLT > 150	CH < 150	RBT < 150	RBT > 150	CT	SCLPN	WHTFH	Detritus	Stocked CH0
Increase in periphyton production:											
2%	1.014	1.020	1.022	1.024	1.027						
5%	1.036	1.050	1.055	1.058	1.067	1.020	1.019	1.011	1.027	1.003	
10%	1.074	1.102	1.111	1.116	1.135	1.051	1.047	1.028	1.067	1.008	
25%	1.197	1.267	1.287	1.292	1.340	1.102	1.095	1.058	1.135	1.016	
50%	1.424	1.565	1.602	1.591	1.689	1.260	1.246	1.154	1.337	1.038	
100%	1.926	2.219	2.282	2.201	2.398	1.533	1.511	1.334	1.675	1.074	
						2.109	2.074	1.750	2.351	1.140	
Increase in detrital vulnerability (as a proxy for greater labile standing stocks):											
2%	1.008	1.009	1.010	1.010	1.010						
5%	1.020	1.023	1.024	1.023	1.024	1.007	1.008	1.005	1.012	0.998	
10%	1.039	1.044	1.047	1.044	1.047	1.017	1.019	1.013	1.029	0.995	
25%	1.093	1.107	1.112	1.103	1.111	1.033	1.036	1.026	1.056	0.991	
50%	1.175	1.200	1.210	1.191	1.203	1.077	1.087	1.063	1.131	0.981	
100%	1.314	1.359	1.375	1.336	1.354	1.143	1.165	1.120	1.239	0.974	
						1.253	1.296	1.218	1.411	0.975	
Reduction in Brook Trout biomass:											
5%	1.001	0.855	1.017	1.003	0.999						
25%	1.008	0.206	1.124	1.014	0.994	1.023	1.000	1.048	1.000	1.000	
50%	1.047	0.005	1.151	1.026	1.012	1.126	1.000	1.283	0.998	1.000	
100%	1.084	0.000	1.161	1.034	1.031	1.195	1.036	1.441	1.006	1.000	
						1.226	1.071	1.515	1.014	1.000	
Stocking of CH0 at:											
0.02 g/m ²	0.977	0.980	0.979	0.982	0.981						
0.05 g/m ²	0.943	0.951	0.948	0.956	0.954	0.988	0.978	0.988	0.987	1.000	1.084
0.08 g/m ²	0.911	0.923	0.919	0.931	0.928	0.971	0.947	0.971	0.967	1.000	1.055
0.11 g/m ²	0.880	0.897	0.891	0.906	0.903	0.954	0.917	0.954	0.948	1.000	1.027
0.15 g/m ²	0.841	0.864	0.856	0.875	0.871	0.939	0.888	0.939	0.931	1.000	1.001
0.20 g/m ²	0.796	0.825	0.816	0.839	0.834	0.919	0.851	0.919	0.908	1.000	0.967
0.25 g/m ²	0.754	0.790	0.778	0.805	0.800	0.896	0.809	0.897	0.881	1.001	0.927
0.50 g/m ²	0.581	0.646	0.625	0.663	0.656	0.875	0.769	0.876	0.857	1.001	0.890
1.00 g/m ²	0.363	0.470	0.436	0.479	0.471	0.790	0.607	0.794	0.755	1.001	0.736
2.00 g/m ²	0.156	0.294	0.256	0.294	0.288	0.688	0.400	0.696	0.625	1.000	0.534
						0.597	0.199	0.614	0.500	0.998	0.333

Supplementary Table SB.2. Model output results for the mixed trophic impact analysis of the balanced model. Fish groups are defined in Table A.1. The values represent the proportional changes in each group as a result of the changes in every other group. They range from -1 to $+1$, with the negative values in the matrix representing negative relationships between groups and positive values positive relationships between groups.

Impacted group	Impacting group									
	Periphyton	Macrophytes	Microbes	Ephemeroptera	Plecoptera	Trichoptera	Chironomidae	Coleoptera	Noninsect aquatics	Other Diptera
Periphyton	-0.170	-0.128	-0.073	0.223	0.056	0.114	0.065	0.239	0.020	0.138
Macrophytes	-0.017	-0.033	-0.010	-0.003	0.009	0.061	0.036	-0.003	-0.003	0.034
Microbes	0.123	0.150	-0.425	-0.121	-0.052	-0.175	-0.189	0.059	-0.052	-0.147
Ephemeroptera	-0.302	-0.020	-0.090	-0.147	0.120	-0.085	-0.067	-0.104	0.015	-0.052
Plecoptera	0.084	0.027	0.031	-0.204	-0.440	-0.107	-0.111	-0.028	-0.042	0.050
Trichoptera	-0.027	-0.095	-0.017	-0.022	0.000	-0.138	-0.002	-0.037	-0.007	-0.005
Chironomidae	0.064	-0.059	-0.022	-0.121	0.041	0.025	0.023	-0.349	-0.178	-0.320
Coleoptera	-0.085	-0.021	-0.041	-0.007	0.004	-0.041	-0.090	-0.033	0.015	0.031
Noninsect aquatics	0.088	0.150	0.006	-0.032	-0.005	0.021	-0.222	0.109	-0.266	-0.194
Other Diptera	-0.270	-0.465	-0.129	-0.070	0.009	-0.044	-0.005	-0.097	0.096	-0.067
BKT < 150	0.004	0.007	0.002	0.000	0.001	-0.056	0.003	-0.013	-0.001	-0.001
BKT > 150	-0.008	-0.005	-0.004	0.013	0.010	0.028	0.012	0.013	-0.001	-0.005
BLT < 150	0.000	0.001	0.000	0.000	-0.001	-0.011	0.000	0.000	0.000	0.000
BLT > 150	-0.003	-0.004	-0.001	0.005	0.000	0.023	0.008	-0.007	-0.001	-0.002
CH < 150	0.016	0.010	0.008	-0.028	-0.020	-0.042	-0.024	-0.034	0.000	0.009
RBT < 150	0.025	0.020	0.012	-0.016	-0.004	-0.126	0.002	-0.132	-0.004	0.000
RBT > 150	0.006	0.005	0.003	-0.003	0.000	-0.033	0.003	-0.039	-0.001	-0.001
CT	0.019	0.024	0.008	-0.023	-0.004	-0.184	0.004	-0.004	-0.002	-0.003
SCLPN	-0.021	-0.014	-0.009	0.017	-0.016	0.076	-0.003	0.113	0.004	0.000
WHTFH	0.007	0.007	0.005	0.005	-0.044	-0.043	0.012	-0.071	-0.022	-0.006

Supplementary Table SB.2. Extended.

Impacted group	Impacting group									
	BKT < 150	BKT > 150	BLT < 150	BLT > 150	CH < 150	RBT < 150	RBT > 150	CT	SCLPN	WHTFH
Periphyton	0.050	0.034	0.108	0.064	-0.021	0.047	0.051	0.097	0.058	0.121
Macrophytes	0.025	0.008	0.039	0.015	-0.007	0.003	0.003	0.024	0.014	0.018
Microbes	-0.075	-0.034	-0.135	-0.065	0.022	0.005	-0.008	-0.095	-0.071	-0.094
Ephemeroptera	-0.032	0.034	0.035	0.073	0.002	-0.014	0.002	0.118	0.072	0.093
Plecoptera	-0.067	-0.016	-0.063	-0.001	-0.011	-0.036	-0.052	-0.077	-0.028	-0.028
Trichoptera	0.339	0.083	0.500	0.182	-0.100	0.100	0.026	0.322	0.087	0.118
Chironomidae	0.012	0.026	0.042	0.025	0.034	-0.150	-0.024	-0.036	0.162	0.023
Coleoptera	-0.019	0.013	-0.007	0.016	-0.013	0.156	0.143	0.008	-0.001	0.131
Noninsect aquatics	0.000	0.004	0.011	0.019	-0.027	0.044	-0.003	0.000	-0.038	0.058
Other Diptera	0.010	0.001	0.006	-0.008	-0.011	-0.019	-0.006	0.017	0.010	0.103
BKT < 150	-0.113	0.022	-0.027	0.060	-0.047	0.139	-0.092	-0.022	-0.154	-0.011
BKT > 150	-0.114	-0.184	0.012	-0.083	-0.397	0.066	-0.149	0.013	-0.055	0.006
BLT < 150	-0.014	-0.004	-0.007	-0.006	-0.002	0.002	-0.009	-0.004	-0.004	-0.002
BLT > 150	-0.447	-0.150	0.002	-0.149	-0.139	0.215	-0.404	0.009	-0.210	0.003
CH < 150	-0.114	0.298	-0.025	0.053	-0.171	0.038	-0.120	-0.022	-0.059	-0.011
RBT < 150	-0.050	-0.016	-0.078	-0.033	0.017	-0.043	-0.026	-0.054	-0.011	-0.042
RBT > 150	-0.073	0.059	-0.012	0.088	-0.053	0.017	-0.074	-0.014	-0.032	-0.012
CT	-0.073	-0.020	-0.110	-0.042	0.022	-0.024	-0.008	-0.074	-0.021	-0.032
SCLPN	-0.058	0.043	0.053	0.106	-0.081	-0.771	-0.099	0.035	-0.190	0.029
WHTFH	-0.004	-0.042	-0.029	-0.023	-0.088	-0.021	0.004	-0.018	0.000	-0.022

Supplementary Table SB.3. Initial and altered diets of Brook Trout (BKT) larger than 150 mm. Values represent the proportion of the total diet encompassed by a given group listed in the first column. Fish groups are defined in Table SB.1.

Group	Initial diet of BKT > 150 mm	Altered diet of BKT > 150 mm (increase in juvenile Chinook Salmon up to 40% of summer diet)
Periphyton	0.00	0.00
Macrophytes	0.00	0.00
Microbes	0.05	0.03
Ephemeroptera	0.05	0.04
Plecoptera	0.15	0.08
Trichoptera	0.01	0.01
Chironomidae	0.01	0.08
Coleoptera	0.04	0.04
Noninsect aquatics	0.01	0.01
BKT < 150	0.12	0.06
BKT > 150	0.00	0.00
BLT < 150	0.00	0.01
BLT > 150	0.00	0.00
CH < 150	0.12	0.40
RBT < 150	0.00	0.00
RBT > 150	0.10	0.08
CT	0.00	0.00
SCLPN	0.25	0.08
WHTFH	0.00	0.00
Detritus	0.00	0.00
Import	0.08	0.08

Supplementary Table SB.4. Relative change in biomass (proportional change in biomass after 20 iterations of the Ecopath with Ecosim model) for each food web group after Brook Trout (BKT) removal based on the initial diet composition for BKT larger than 150 mm and based on a modified diet in which juvenile Chinook Salmon constituted 40% of the diet for larger BKT. Fish groups are defined in Table SB.1. The shaded rows highlight the responses of (1) wild juvenile Chinook Salmon and (2) sculpin-to-Brook Trout diet modifications in the initial Ecopath model. Juvenile Chinook Salmon are highlighted because they are the target species and the group that was elevated in trout diet modification. Sculpins are highlighted because this group had the most substantial response to trout removal in the initial model.

Group	Initial model response to BKT removal	Model response to BKT removal after BKT diet manipulation
Periphyton	1.00	1.00
Macrophytes	1.00	1.00
Microbes	1.00	1.00
Ephemeroptera	1.00	0.99
Plecoptera	0.99	0.99
Trichoptera	1.00	1.00
Chironomidae	1.00	1.00
Coleoptera	0.99	0.99
Noninsect aquatics	1.00	1.00
Other Diptera	1.00	1.00
BKT < 150	0.00	0.00
BKT > 150	0.00	0.00
BLT < 150	1.08	1.15
BLT > 150	1.19	1.04
CH < 150	1.02	1.07
RBT < 150	1.02	1.03
RBT > 150	1.18	1.18
CT	1.06	1.06
SCLPN	1.26	1.16
WHTFH	1.01	1.02
Detritus	1.00	1.00

Supplementary Figure SB.1. Image of food web relationships in the overall model. Node size reflects biomass estimates for each group in the initial balanced model. Fish groups include Brook Trout less than 150 mm (BKT < 150); Brook Trout greater than 150 mm (BKT > 150); Bull Trout less than 150 mm (BLT < 150); Bull Trout greater than 150 mm (BLT > 150); juvenile Chinook Salmon less than 150 mm (CH < 150); Rainbow Trout/steelhead less than 150 mm (RBT < 150); Rainbow Trout/steelhead greater than 150 mm (RBT > 150); Cutthroat Trout (CT; all sizes); sculpins (SCLPN; all sizes); and whitefishes *Prosopium* spp. (WHTFH; all sizes).

