

A Biological and Chemical Survey of Selected Surface Waters
in the Lye Brook Wilderness Area, Vermont

By
James H. Kellogg
Steven L. Fiske
Richard W. Langdon

For
The U.S. Forest Service - Green Mountain National Forest

Vermont Agency of Natural Resources
Department of Environmental Conservation
Biomonitoring and Aquatic Studies Unit

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Excerpts from this interim report to the GMNF are included here. A final report will be available in 1996 when this study is completed.

Table 1. Chemistry of Lye Brook Wilderness Study Lakes - 1994

Lake	Depth (m)	Date	TEMP °C	pH Std. U.	ALK mg/l	COND ^a µs/cm	DC ₂ ¹ Pt-Co	TC ² Pt-Co	DCL ³ mg/l	DNO ₃ ⁴ mg/l	DSO ₄ ⁵ mg/l	DCA ⁶ mg/l	DMG ⁷ mg/l	DNA ⁸ mg/l	DK ⁹ mg/l	DAL ¹⁰ µg/l	IMAL ¹¹ µg/l	OMAL ¹² µg/l	DOC ¹³ mg/l
Bourn	1	10-May-94	11.2	5.07	0.01	14.8	64	60	0.25	0.11	3.03	0.82	0.29	0.44	0.33	252	42	69	4.52
Bourn	1	20-Jul-94	22.6	5.28	0.26	14.0	112	>70	0.23	<0.01	3.29	0.70	0.30	0.48	0.32	312	27	63	5.43
Bourn	8	20-Jul-94	8.0	5.34	1.07	14.9	128	>70	0.24	<0.01	3.09	0.79	0.31	0.47	0.36	279	9	77	5.52
Bourn	1	29-Sep-94	13.0	5.36	0.79	15.6	67	>70	0.26	<0.01	3.22	0.76	0.33	0.49	0.34	195	24	49	5.43
Branch	1	10-May-94	9.8	4.67	-0.85	19.0	88	>70	0.28	0.12	3.36	0.74	0.24	0.42	0.34	315	95	68	5.30
Branch	1	20-Jul-94	21.7	4.76	-0.67	19.7	71	55	0.36	0.03	4.02	0.61	0.24	0.53	0.35	252	79	57	4.85
Branch	9	20-Jul-94	4.3	4.76	-0.68	20.3	91	65	0.32	0.12	3.81	0.70	0.24	0.53	0.44	292	99	69	4.88
Branch	1	29-Sep-94	12.4	4.68	-0.74	21.3	77	>70	0.33	0.04	3.97	0.71	0.24	0.50	0.41	270	69	51	5.12

Parameter:

^aCond = Conductivity¹DC₂ = Filtered Color²TC = Unfiltered Color³DCL = Dissolved Chloride⁴DNO₃ = Dissolved Nitrate⁵DSO₄ = Dissolved Sulfate⁶DCA = Dissolved Calcium⁷DMG = Dissolved Magnesium⁸DNA = Dissolved Sodium⁹DK = Dissolved Potassium¹⁰DAL = Dissolved Aluminum¹¹IMAL = Inorganic Monomeric Aluminum (nontoxic form aquatic biota)¹²OMAL = Organic Monomeric Aluminum¹³DOC = Dissolved Organic Carbon

Table 2. Chemistry of Lye Brook Wilderness Study Stream 1994

River	Date	TEMP °C	pH Std. U.	ALK mg/l	COND ^a µs/cm	DC2 ¹ Pt-Co	TC ² Pt-Co	DCL ¹ mg/l	DNO3 ⁴ mg/l	DSO4 ¹ mg/l	DCA ⁴ mg/l	DMG ⁷ mg/l	DNA ⁴ mg/l	DK ² mg/l	DAL ¹⁰ µg/l	IMAL ¹¹ µg/l	OMAL ¹² µg/l	DOC ¹³ mg/l
Bourn (Upper)	20-Sep-94	9.0	5.97	1.85	18.3	169	>70	0.48	0.03	3.46	1.29	0.59	1.04	0.58	348	12	120	9.03
Bourn (Lower)	14-Apr-94	1.5	4.85	-0.41	20.1	84	65	0.23	0.26	3.58	1.13	0.38	0.41	0.46	306	60	91	6.54
Bourn (Lower)	28-Apr-94	4.0	4.80	-0.55	17.7	104	>70	0.20	0.13	3.23	1.01	0.32	0.36	0.33	303	26	107	6.90
Bourn (Lower)	19-May-94	6.5	5.33	0.43	17.2	81	60	0.24	0.07	4.14	1.32	0.44	0.49	0.41	299	55	101	5.91
Bourn (Lower)	08-Aug-94	17.5	6.70	4.92	26.6	97	70	0.40	0.19	4.23	2.31	0.93	0.86	0.65	204	0	80	6.50
Bourn (Lower)	20-Sep-94	10.5	6.76	4.68	24.9	81	55	0.42	0.08	4.39	2.20	0.91	0.93	0.61	80	5	58	5.03
Branch Pond Bk.	06-Apr-94	1.0	4.73	-0.65	22.9	55		0.29	0.28	4.24	1.02	0.36	0.68	0.47	279	79	79	4.30
Branch Pond Bk.	13-Apr-94	1.0	4.66	-1.28	25.2	58	50	0.24	0.32	3.87	0.91	0.31	0.53	0.41	303	82	78	5.07
Branch Pond Bk.	28-Apr-94		4.61	-1.26	19.8	93	>70	0.17	0.20	3.01	0.73	0.24	0.39	0.31	314	61	90	6.56
Branch Pond Bk.	11-May-94	8.5	4.76	-0.72	18.7	84	65	0.23	0.06	3.71	0.87	0.27	0.54	0.38	309	26	127	5.84
Branch Pond Bk.	18-May-94	9.0	4.58	-1.05	20.1	88	70	0.22	0.06	3.84	0.89	0.27	0.52	0.34	315	89	100	6.46
Branch Pond Bk.	01-Aug-94	14.5	5.17	0.47	15.2	155	>70	0.26	0.01	2.73	0.82	0.30	0.88	0.41	312	25	114	8.75
Branch Pond Bk.	14-Sep-94	11.5	5.22	0.45	21.6													
Branch Pond Bk.	19-Sep-94	10.5	5.41	0.53		117												
Branch Pond Bk.	03-Oct-94	5.5	5.22	-0.29	20.8	86	65	0.39	<0.01	4.45	0.98	0.34	0.72	0.44	309	56	108	7.79
Lye (Upper)	28-Apr-94	4.0	4.46	-1.99	22.4	162	>70	0.18	0.09	3.07	0.58	0.20	0.35	0.36	342	89	134	9.31
Lye (Upper)	02-Oct-94	5.5	4.52	-1.56	29.4	194	>70	0.47	0.02	4.59	1.06	0.41	0.62	0.47	504	98	98	13.90
Lye (Lower)	16-Mar-94	1.0	6.10	1.92	24.2			0.42	0.20	4.82	0.95	0.77	0.63	0.61	276			
Lye (Lower)	14-Apr-94	2.0	4.54	-1.36	25.8	139	>70	0.26	0.22	3.65	0.87	0.36	0.37	0.48	456	119	101	9.09
Lye (Lower)	28-Apr-94	5.0	4.70	-0.82	18.8	163	>70	0.56	0.08	3.22	0.81	0.34	0.34	0.35	348	103	109	9.47
Lye (Lower)	19-May-94	6.5	5.46	0.88	18.2	148	>70	0.22	0.07	4.06	1.40	0.64	0.43	0.39	390	84	130	8.88
Lye (Lower)	20-Sep-94	10.5	6.77	5.56	30.6	137	>70	0.50	0.11	4.27	2.42	1.22	0.83	0.54	276	13	83	7.99
Lye (Lowest) ¹⁴	03-Aug-94	17.5	7.43	24.10	58.8	114	>70	0.46	0.21	4.14	6.22	3.28	0.65	0.53	192	15	92	6.77

River	Date	TEMP °C	pH Std. U.	ALK mg/l	COND ⁴ µs/cm	DC2 ¹ Pt-Co	TC ² Pt-Co	DCL ³ mg/l	DNO ₃ ⁵ mg/l	DSO ₄ ⁶ mg/l	DCA ⁷ mg/l	DMG ⁸ mg/l	DNA ⁹ mg/l	DK ¹⁰ mg/l	DAL ¹⁰ µg/l	IMAL ¹¹ µg/l	OMAL ¹¹ µg/l	DOC ¹² mg/l
Winhall	06-Apr-94	1.0	5.68	0.71	18.3	45		0.30	0.26	3.88	1.37	0.42	0.63	0.47	190	35	71	3.74
Winhall	13-Apr-94	1.0	5.40	0.34	18.6	42	45	0.24	0.27	3.52	1.28	0.37	0.55	0.44	214	41	72	4.14
Winhall	28-Apr-94		5.01	0.19	17.3	67	55	0.25	0.17	3.43	1.12	0.30	0.43	0.41	246	63	93	5.41
Winhall	11-May-94	10.0	6.14	1.10	16.2	59	50	0.27	0.07	3.83	1.33	0.35	0.58	0.45	230	10	100	4.56
Winhall	18-May-94	9.0	5.44	0.64	16.5	64	50	0.25	0.06	3.97	1.32	0.35	0.56	0.41	246	70	82	5.27
Winhall	01-Aug-94	18.5	6.56	3.06	18.9	83	60	0.31	0.08	3.14	1.59	0.51	0.95	0.55	168	3	82	6.17
Winhall	14-Sep-94	12.5	6.66	3.42	22.5													
Winhall	19-Sep-94	10.5	6.70	3.39		80												
Winhall	03-Oct-94	4.5	5.98	1.37	19.5	71	50	0.45	0.03	4.30	1.58	0.49	0.73	0.54	231	10	106	6.05

Parameter:

⁴Cond = Conductivity¹DC2 = Filtered Color²TC = Unfiltered Color³DCL = Dissolved Chloride⁵DNO₃ = Dissolved Nitrate⁶DSO₄ = Dissolved Sulfate⁷DCA = Dissolved Calcium⁸DMG = Dissolved Magnesium⁹DNA = Dissolved Sodium¹⁰DK = Dissolved Potassium¹⁰DAL = Dissolved Aluminum¹¹IMAL = Inorganic Monomeric Aluminum (most toxic form to aquatic biota)¹¹OMAL = Organic Monomeric Aluminum¹²DOC = Dissolved Organic Carbon

This Lye Brook sample was collected further downstream near the campsite just upstream from the parking area. The bedrock type is Dunham dolomite and imparts a considerable source of buffering. Lye Brook headwaters are located in an area of profound unconformity dominated by gneiss, quartzite and calc-silicate granulite. The lower site is located in Cheshire quartzite and between the upper and lower sites is the Dalton formation (a conglomerate found at the base of the southern Green Mountains).

Fish Community Summary for Lye Brook Wilderness Streams

Lye Brook (Station 1.8) - The same three species were collected in 1993 and 1994 in the same order of abundance (brook and brown trout and slimy sculpins). The 1994 sample was three times more dense, but still classifies as a low productivity reach.

Lye Brook (Station 3.4) - No fish were collected in either 1993 or 1994 most likely because of this reach's acidity and high levels of aluminum (see Table 2). The USFS sampling of Lye Brook Meadows in July of 1995 will determine if fish do exist upstream of this station. Based on the bedrock geology (see Table 2) chemical conditions should not be expected to be any better.

Bourn Brook (Station 1.6) - The same four species (blacknose dace, brook and brown trout and slimy sculpin) were collected in 1993 and 1994. The two dominant species (slimy sculpin and brook trout) had nearly the same densities both years.

Bourn Brook (Station 4.1) - As was observed in 1993, only brook trout were captured. This site is definitely a very low productivity reach with marginal fish habitat.

Branch Pond Brook (Station 0.1) - As was observed in 1993, only brook trout were captured. The pH and aluminum levels are indicative of an acid stressed environment.

Winhall River (Station 8.1) - Seven species of fish were collected in 1994 with the capture of one creek chub in the final run versus six in 1993. Greater relative abundance of each species was found in 1994 with the exception of atlantic salmon where approximately 50% fewer were captured. The Winhall is the only stream where the VTIBI can be calculated because enough non-salmonids species were collected. The VTIBI was 43 and maintains its excellent population integrity.

Lye Brook Wilderness Area Macroinvertebrate Stream Communities

Four of the six sites sampled in the Lye Brook Wilderness aquatic resources study are in good to excellent conditions. Bourn Brook upper and lower; Lye Brook lower; and the Winhall River. The macroinvertebrate communities from these streams exhibit moderate densities, moderate to high numbers of taxa, and are dominated by clean water indicator taxa from the orders Ephemeroptera, Plecoptera, and Trichoptera (EPT's). The Bio Index and EPT/EPT Chiro ratio biometrics are used to measure a community's tolerance toward organic loading (enrichment). Both metrics were rated in the good to excellent range for the four sites (BI values, < 1.75 and EPT/EPT Chiro ratio, $> .7$), indicating low levels of organic enrichment. Refer to Appendix 2 for an explanation of Vermont's biocriteria indices used for wadeable streams and rivers.

Two sites appear to be in less than optimal condition; Lye Brook upper, and Branch Pond Brook. The upper Lye Brook site rated poor due to very low densities (206), low taxa richness (20) and a low number of EPT taxa (13). The Bio index and EPT/EPT Chiro ratio were in the good-excellent range indicating that enrichment is not the cause for the poor condition of the biota at the upper Lye Brook site. The low densities, taxa richness and EPT values point toward a physical habitat or toxic limitation on the community. The habitat evaluation does not indicate that physical habitat is limiting at the site. The water quality, however, is low in pH ($x = 4.49$ std. units) and alkalinity ($x = -1.78$ mg/l), which is probably the reason for the poor community integrity at the site. This is supported by a very poor showing of the Ephemeroptera: 1-2 species and $\approx 5\%$ composition of the community. Dominance by the pH tolerant Plecoptera ($\approx 72\%$ composition) also points toward acidity as a probable cause for the impaired macroinvertebrate community. The site surprisingly still contains a population of crayfish (Cambarus bartoni bartoni) despite the very low calcium levels ($x = 0.82$ mg/l) in the water.

The Branch Pond site rated only fair primarily due to the lower number of taxa and sensitive EPT species as well as a slightly lower density. The site also seems to be impaired by low pH and alkalinity due to the poor number (1) and % composition (2) of Ephemeroptera in the community. The habitat evaluation also indicates that the substrate is carrying a higher than normal level of sand. Sand can limit the biological potential at a site by burying the cobble substrate and physically limiting the available habitat for invertebrates. Sand embeddedness may also be contributing to the lower biological integrity of Branch Pond Brook.

The functional guild composition of a stream's macroinvertebrate community indicates where the stream community is receiving its energy (food) inputs. All the higher elevation stream sites; Bourn upper, Lye upper and Branch Pond Brook, are dominated by detritus shredders. This indicates that forest leaf breakdown is the most important energy source for these stream sites. The Winhall River contains the highest composition of collector gatherers and fewest percentage of detritus shredders, indicating this community is oriented toward processing fine particulate organic material already broken down in its headwaters and/or produced in the extensive wetlands and lakes in the drainage. To a lesser extent, the lower Lye Brook and Bourn Brook sites also have a higher proportion of collector gatherers. The scraper functional group reaches its greatest dominance in both Bourn Brook sites and Branch Pond Brook, indicating that diatom type periphyton growth is significant in these streams. Both Lye Brook sites contain very few scrapers (1-2%). This is especially unexpected at its lower site and is perhaps again due to the acidic nature of Lye Brook depressing the diatom community.

The biological data for all six sites is found in two attachments. The summary report shows the biometrics and dominant taxa for all dates sampled at a site and the sampling report includes a complete taxa list at each site for 1994.