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Effects of a Floodwater-Retarding Structure on the Hydrology and Ecology of Trout Creek in Southwestern Wisconsin

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Background
By Steve Baima

Streamflow, Sedimentation, and Channel Morphology
By David J. Graczyk, Stephen J. Field, *and* Dennis A. Wentz

Arthropod Fauna
by William L. Hilsenhoff

Reproduction of Brown Trout
by Eddie L. Avery

Trout Populations
By O. M. Brynildson

Summary of Findings
By David J. Graczyk

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Arthropod Fauna

By William L. Hilsenhoff[1]

INTRODUCTION

In April 1975, a study was initiated to evaluate effects of a floodwater-retarding structure (FRS) on the arthropod fauna of Trout Creek, Iowa County, Wis., and to document the fauna. This research was supported by the College of Agricultural and Life Sciences, University of Wisconsin, Madison, by the U.S. Soil Conservation Service, and by the Wisconsin Department of Natural Resources.

METHODS

Six study sites were established: three upstream from and three downstream from the FRS (fig. 31). All sites were gravel riffles; sites 3 and 4 were the closest riffles to the FRS at the time the study began. Two samples were collected from each site in mid-April, mid-June, mid-August, and mid-October of 1975, 1976, 1977, and 1979. Additional samples were collected on February 25, 1976. In 1978, additional insects were collected for laboratory rearing to enable species determination of some genera whose immature stages could be identified. Representative specimens of all species collected (at least 94) have been deposited in the University of Wisconsin collection.

At each site, two different riffles or different parts of the same riffle were sampled. Each sample was collected by placing a D-frame aquatic net (Wards Scientific Establishment, Rochester, New York) on the bottom, disturbing substrate above the net with one's feet, and allowing arthropods to drift into the net. The contents of the net were emptied in a shallow white pan containing a small amount of water. Arthropods clinging to the net were removed with a curved forceps and placed in a jar of 70 percent ethanol. Arthropods were similarly removed from the pan. Sample size was limited by a 15-minute period for picking arthropods from the net and the pan. Samples were sorted, identified, and enumerated in the laboratory.

A biotic-index value (Hilsenhoff, 1977) was calculated for each sample (table 15). The biotic index is a system for measuring organic pollution and related increases in trophic levels; it is a measure of oxygen depletion in the stream that results from trophism and decomposition of organic matter. Each species of arthropod is assigned a value of 0 to 5 based on its ability to tolerate oxygen depletion. A value of 0 is assigned to species unable to tolerate any oxygen depletion, and a value of 5 is assigned to species able to tolerate almost complete oxygen depletion. Intermediate values are assigned to species of intermediate tolerance. Values were initially assigned as a result of a study of 53 Wisconsin streams (Hilsenhoff, 1977); these values were revised in November 1980 after a study of more than 1,000 additional streams. Biotic-index values are always highest in summer, but adequate seasonal correction factors have not yet been developed. Using an average of spring and autumn biotic-index values, Wisconsin streams can be rated as follows:

Biotic Index	Water quality	State of the stream
0 - 1.75	Excellent	No organic pollution
1.75 - 2.25	Very good	Possible slight pollution
2.25 - 2.75	Good	Some organic pollution
2.75 - 3.50	Fair	Significant pollution
3.50 - 4.25	Poor	Very significant pollution
4.25 - 5.00	Very poor	Severe organic pollution

RESULTS AND DISCUSSION

When the study began, sediment depths in the stream channel between the FRS an site 3 were 1.5 ft or more, apparently a result of obstruction by debris of the inlet of the pipe passing beneath the FRS. When the debris was removed and the inlet was kept free of obstructions, the sediment was washed from the channel upstream from the FRS. This took several weeks and caused the area downstream to be extremely turbid during late summer of 1975; there seemed to be no direct effect on the arthropod fauna. The riffle at site 3, however, enlarged significantly, resulting in an increase of some species subsequent to 1975. This was reflected

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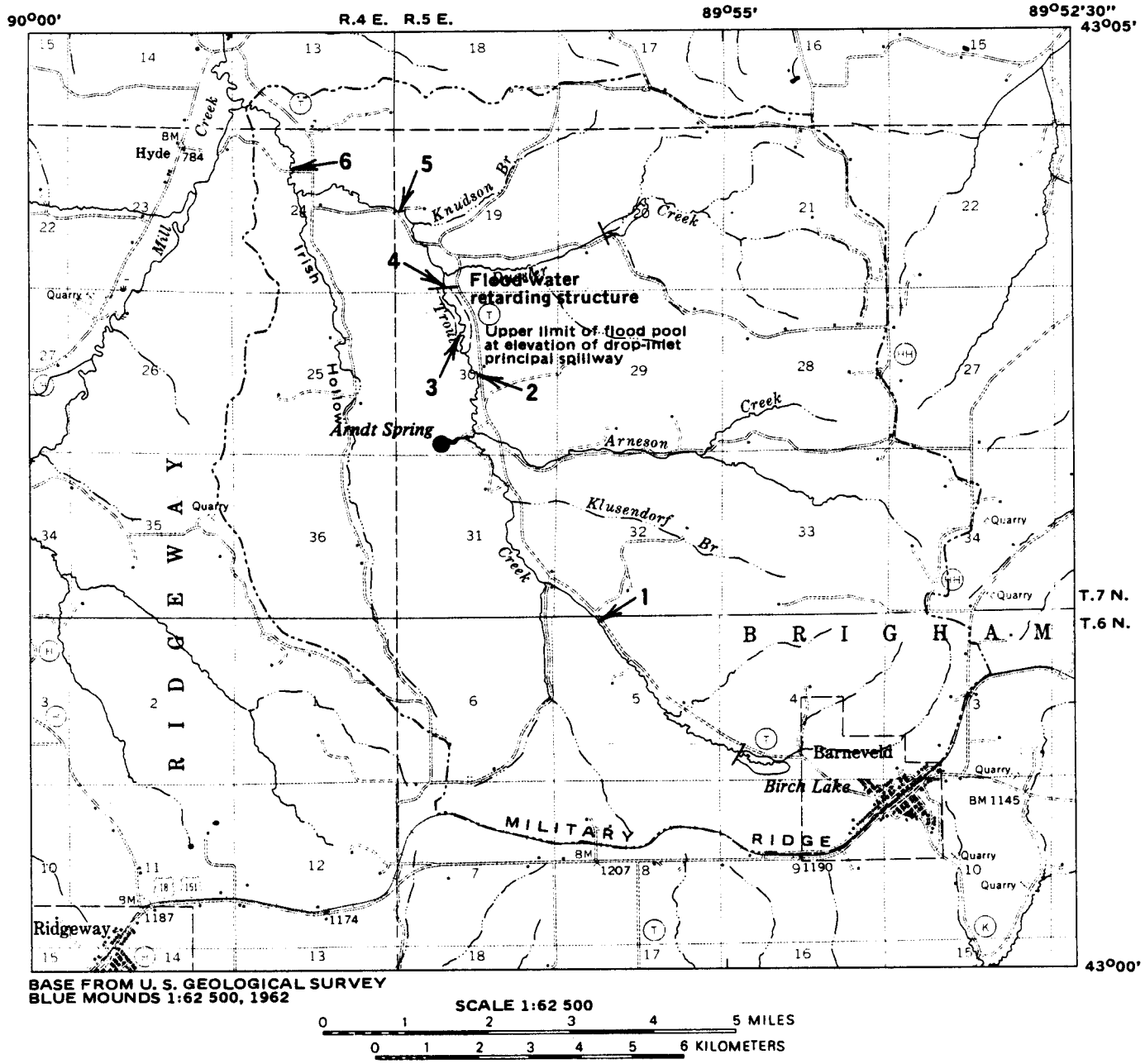

Figure 31. Locations of sampling sites for collection of arthropod fauna.

in the biotic-index values, which decreased after 1975. Considerable sediment also was deposited at site 4 in 1976, which temporarily reduced the fauna at that site and increased biotic-index values.

A yearly average biotic-index value greater than 1.75 indicates less than excellent water quality (Hilsenhoff, 1977, table 6, p.10). This value generally was exceeded at site 1 and, in 1977, at sites 5 and 6. With these exceptions, there seems to be little difference between biotic-index values for the sites upstream from the FRS and those sites downstream. Average index values were always highest at site 1, probably because of cattle pasturing upstream or the effects of Birch Lake. The significant increase in 1979 suggests more pasturing of cattle or some other upstream perturbation. The large volume of water from Arndt Spring just upstream from site 2, eliminated any effect on sites farther downstream. However, in 1977, biotic-index values rose signifi-

Table 15. Biotic-index values.

Month	Year	Site 1	2	3	4	5	6	Average
February	1976	1.79	1.36	1.25	1.10	1.07	1.03	1.27
April	1975	1.61	1.24	1.16	1.03	1.05	1.06	1.19
April	1976	1.45	1.07	1.15	1.14	1.16	1.04	1.17
April	1977	1.52	1.11	1.13	1.02	1.09	1.10	1.16
April	1979	1.78	1.12	1.12	1.10	1.03	1.09	1.21
April	Average	1.59	1.14	1.14	1.07	1.08	1.07	1.18
June	1975	1.70	1.36	1.76	1.18	1.53	1.28	1.47
June	1976	2.00	1.48	1.53	1.38	1.25	1.21	1.48
June	1977	1.80	1.29	1.21	1.10	1.64	2.12	1.53
June	1979	2.42	1.90	1.40	1.30	1.34	1.33	1.62
June	Average	1.98	1.51	1.48	1.24	1.44	1.49	1.52
August	1975	1.73	1.88	1.95	1.93	2.06	1.69	1.87
August	1976	1.95	1.75	1.37	1.70	1.65	2.03	1.74
August	1977	2.18	1.54	1.32	1.88	2.26	2.23	1.90
August	1979	2.41	1.77	1.39	1.61	1.75	1.82	1.79
August	Average	2.07	1.74	1.48	1.78	1.93	1.94	1.82
October	1975	1.91	1.49	1.77	1.85	1.69	1.76	1.75
October	1976	1.95	1.44	1.26	1.72	1.66	1.86	1.65
October	1977	2.04	1.34	1.64	1.76	2.13	2.09	1.83
October	1979	2.16	1.29	1.17	1.74	1.63	1.74	1.62
October	Average	2.02	1.39	1.46	1.77	1.78	1.86	1.71
Average by site		1.92	1.45	1.39	1.47	1.56	1.59	
Average	1975	1.74	1.49	1.66	1.50	1.58	1.45	1.57
Average	1976	1.84	1.44	1.33	1.49	1.43	1.54	1.51
Average	1977	1.89	1.32	1.33	1.44	1.78	1.89	1.61
Average	1979	2.19	1.52	1.27	1.44	1.44	1.50	1.56

cantly in June, August, and October at sites 5 and 6. This suggests some organic pollution, perhaps the result of more intensive cattle pasturing below the FRS. In 1979, the biotic index indicated this section of the stream had returned to its former condition.

SUMMARY AND CONCLUSIONS

Downstream from Arndt Spring, Trout Creek has excellent water quality (biotic indices less than 1.75) and a large diverse arthropod fauna that has not been affected by the FRS. Between Arndt Spring and Birch Lake slight organic pollution is indicated by the arthropod fauna.

The distribution and abundance of the most common arthropods sampled in Trout Creek are summarized in table 16. Because only riffles were sampled, arthropods that inhabit other habitats--such as, the bank vegetation, roots under the bank, pieces of decaying wood, or pools--may not be represented.

Table 16. Numbers of each species of arthropod collected by site, month, and year.

Species	Site						Month					Year			
	1	2	3	4	5	6	Feb.	Apr.	June	Aug.	Oct.	1975	1976	1977	1979
Isoperla signata	98	73	16	32	18	6	256	173	0	0	6	45	61	49	24
Isoperla slossonae	0	24	29	18	39	24	148	22	0	0	75	35	23	23	16
Isoperla transmarina	0	0	6	14	114	82	232	109	0	0	49	28	24	96	10
Baetis brunneicolor	424	195	507	445	356	1,182	0	0	448	692	1,969	881	687	895	646
Baetis flavistriga	147	326	152	335	123	416	0	0	695	556	248	604	212	472	211
Baetis vagans	661	939	966	494	419	507	1,400	1,197	1,300	545	594	797	1,319	509	1,011
Pseudocloeon dubium	0	2	165	21	6	6	0	0	196	3	1	162	27	6	5
Pseudocloeon punctiventris	0	0	0	2	0	40	0	0	3	36	3	10	3	25	4
Ephemerella sp.	1,166	5,410	4,043	6,581	3,962	3,290	11,292	13,799	7,162	27	641	6,755	4,233	6,288	4,353
Heptagenia diabasia	0	2	1	0	64	93	4	5	61	69	24	77	45	14	23
Stenacron interpunctatum	36	1	0	2	53	21	16	6	5	11	87	15	6	68	20
Stenonema terminatum	0	0	2	0	11	17	8	2	3	7	16	5	6	10	7
Brachycentrus occidentalis	181	2,041	2,657	402	502	262	448	13	1,512	1,919	2,489	483	2,293	1,559	1,598
Glossosoma intermedium	0	82	87	2	1	0	4	9	31	49	82	34	66	17	54
Cheumatopsyche spp.	19	122	29	7	32	7	52	16	31	42	114	51	57	22	73
Hydropsyche betteni	328	13	7	11	53	26	100	44	214	49	106	114	88	81	130
Symphitopsyche bifida group	0	8	1	0	3	6	4	2	1	3	11	4	4	7	2
Symphitopsyche slossonae	17	591	83	135	334	55	84	267	248	264	415	449	384	181	180
Symphitopsyche sparna	143	91	32	44	319	237	180	130	61	256	374	258	211	50	302
Helichus striatus	20	5	2	12	7	1	4	4	14	14	14	3	10	26	7
Optioservus fastiditus	739	729	376	381	522	190	548	385	748	825	842	535	662	1,172	431
Stenelmis crenata	299	177	9	42	198	18	132	124	305	204	77	181	162	232	135
Simulium tuberosum	178	304	67	48	166	33	0	89	304	344	59	197	337	137	125
Simulium verecundum	5	1	3	1	4	24	0	0	16	18	4	1	14	21	2
Simulium vittatum	40	216	119	79	105	132	188	20	346	221	57	38	217	156	233
Atherix variegata	62	34	7	48	151	74	228	58	9	148	104	118	83	91	27
Chrysops spp.	0	11	32	4	1	5	12	7	6	15	22	12	6	25	7
Dicranota spp.	8	113	68	15	8	2	108	0	92	69	26	10	122	8	47
Tipula spp.	78	41	21	15	14	10	128	55	25	13	54	50	29	32	36
Cricotopus spp.	1	7	37	0	3	5	0	0	48	5	0	9	40	2	2
Diamesa spp.	99	29	13	9	5	18	32	73	68	16	8	14	15	31	105
Eukiefferiella spp.	1	10	9	4	8	2	0	15	13	2	4	5	11	5	13
Orthocladius spp.	8	5	12	4	0	0	4	13	12	0	3	0	12	9	7
Gammarus pseudolimneus	2,347	712	1,635	697	193	317	2,644	1,275	890	1,327	1,748	1,530	1,467	1,107	1,136
Asellus intermedius	194	0	0	0	27	6	44	25	57	76	58	24	25	35	132