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PROJECT REPORT FOR THE YEAR 1956-1957 ON TROUT FOOD STUDIES WITH SPECIAL REFERENCE TO MIDGES IN MICHIGAN TROUT STREAMS

By

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The following report is based upon the analysis of square-foot bottom samples and of samples of sublegal trout taken from three streams in the northern part of the Lower Peninsula of Michigan. The streams are Pigeon River (Otsego County), North Branch Au Sable River (Crawford County), and Hunt Creek (Montmorency County). Stations were established at two points on each stream, and were selected for ecological conditions as diversified as possible. The stations were in Section C and Section Z of Hunt Creek, at Twin Bridges and Kellogg's Bridge on the North Branch Au Sable River, and at Vanderbilt Bridge and Old Camp Bridge on the Pigeon River.

Collecting at field stations extended over a period of thirteen months from June, 1953 to June, 1954. Two bottom samples and approximately 25 trout were collected each month. The bottom sampling was done with a net on a square frame. Fish were collected by electric shocker. One bottom sample was taken in midstream and another at the stream edge, at each station. At the same time, 25 trout were collected in the area; scale samples, lengths, and weights were obtained, and the fish were then tagged and preserved in 10 percent formalin. All bottom samples were taken to the Pigeon River Trout Research Laboratory where they were sorted and preserved in 10 percent formalin.

During the summer of 1956, about one-half of the bottom samples were sorted and the aquatic organisms identified and preserved. The process of sorting and identification of food organisms found in the trout stomachs was initiated late in August 1956, at the completion of the study of bottom samples, and has been continued up to the present date. Stomach analyses have been completed on 275 fish from Section C of Hunt Creek, 325 fish from Section Z of Hunt Creek, 300 fish from Twin Bridges Au Sable River, and 325 fish from Kellogg's Bridge Au Sable River. There are 650 trout stomachs left to analyze from the two stations at Pigeon River and 50 from Section C of Hunt Creek.

During the spring of 1957, a statistical study of the data from the bottom samples was started, with advice from Dr. Don Hayne. This study should be completed by September, 1957. At present there are indications that there is no particular significance between the midstream stations of the Au Sable River. (Statistical analyses for other stations are not yet completed.)

No statistical analysis has been started on the trout stomach study. Dr. Hayne has suggested that the "forage ratio" be investigated, to determine if the concentration of food items in the stomachs is greater or less than that in the bottom samples. The forage ratio is the ratio between the percentage represented numerically by an organism in a fish stomach and its percentage in the bottom fauna.

At present, the stomach contents of the trout are but partially sorted and identified. However, the major food items have been tabulated from samples completed to show their frequency in milliliters of total food contents for each month during the sampling period (Tables 1-4). Only major items are included in the tables. Comparing items in the "total volume" column, it appears that the following organisms constitute most of the food: Ephemeroptera, Oligochaeta, Tipulidae, Amphipoda and Plecoptera for fish at Twin Bridges; Ephemeroptera, Amphipoda, Plecoptera and Trichoptera for fish at Kellogg's Bridge Au Sable River; Oligochaeta, Trichoptera and Dolichopodidae for fish

at Section C; and Oligochaeta, Ephemeroptera, Trichoptera, Plecoptera and Tipulidae for fish taken at Section Z Hunt Creek. The analysis also indicates the seasonal fluctuation of the majority of food items. Immature forms of Ephemeroptera, Trichoptera, Plecoptera, Tendipedidae and Tipulidae appear to have seasonal cycles in their life history that make them available to fish during most of the year.

The analysis of stomach contents will be extended to include a study of species selection as food items by the fish. The family Tendipedidae is proposed for this investigation because of the previous study made at Hunt Creek on the fauna of that stream (Curry, 1952). Other groups of insects can be investigated if time permits.

A rapid survey has been made of the frequency of particular groups of insects occurring in the diet of trout. At Twin Bridges, Au Sable River, brook trout 1.0-2.9 inches long consumed immature forms of Ephemeroptera, Tendipedidae, Amphipoda and Plecoptera; the 3.0- to 4.9-inch trout consumed immature insect forms of Simulidae, Ephemeroptera, Tendipedidae, Amphipoda and Oligochaeta; and the 5.0- to 7(÷)-inch trout consumed Gastropoda, Asilidae, Oligochaeta, Tendipedidae, Ephemeroptera and Mecoptera. The order of importance of the groups appears to be Ephemeroptera, Simulidae, Gastropoda, Tendipedidae, Oligochaeta, Plecoptera, Hymenoptera, Amphipoda, Trichoptera, Isopoda, Mecoptera and Tipulidae. Brown trout of all lengths taken from Kellogg's Bridge Au Sable appeared to consume Ephemeroptera in larger numbers. The order of importance of the groups of food items appears to be Ephemeroptera, Isopoda, Hemiptera, Plecoptera, Trichoptera, Cottidae, Amphipoda, Tipulidae, Oligochaeta, Tendipedidae and Coleoptera. Brook trout 1.0-2.9 inches long taken from Section C Hunt Creek consumed Lepidoptera, Hymenoptera, Oligochaeta, Plecoptera and Ephemeroptera, whereas trout of all other lengths had a majority of Oligochaeta. The apparent order of importance of the various groups is as follows: Oligochaeta, Coleoptera, Lepidoptera, Tipulidae, Hymenoptera,

Plecoptera and Dolichopodidae. Brook trout taken from Section Z Hunt Creek had a wider variety of food items in their stomachs than trout from Section C. Trout of the 1.0- to 2.9-inch length class consumed Tipulidae, Ephemeroptera and Coleoptera. Trout of other lengths had an assortment of Trichoptera, Oligochaeta, Ephemeroptera, Odonata and Gastropoda. The apparent order of importance was Tipulidae, Gastropoda, Nematoda, Coleoptera, Trichoptera and Plecoptera.

It is estimated that the food study should be completed by about September 15, 1957. Additional help would be needed for the statistical study and to do some insect identification on the midge study. There is a series of bottles of legal trout stomachs preserved at the laboratory from (1) Pigeon River taken by fishermen and preserved at the Creel Station and (2) Hunt Creek trout stomachs belonging to Dr. J. W. Leonard. If the above series (1) or (2) or both are to be analyzed along with the insect identification and statistics of this problem, it will require another summer's work. However, the problem alone should be completed and ready to be written for publication by next spring, possibly April or May 1958, depending on class schedule at the college.

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Table 1.--Analysis of stomach contents of trout taken at Twin Bridges North Branch Au Sable River
Figures indicate milliliters of major organisms of total food contents for each month during sampling period

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
Oligochaeta	.....	0.02	0.35		0.380	0.243	1.583	.....	.....	.....	0.24	0.043	.....	2.859
Arachnida	0.008	0.003	0.005		0.021	.....	.....	.....	0.01	.....	.....	0.051	0.002	0.10
Amphipoda	.....	.....	0.004		0.081	0.103	0.044	0.018	0.105	0.025	0.125	0.78	.....	1.285
Dolichopodidae	.....	.....	0.003		0.003	0.004	.....	.....	.....	.....	.....	0.65	0.003	0.663
Chironomidae larvae	0.009	0.051	0.029	LOST IN FIRE	0.018	1.16	0.148	0.04	0.104	0.007	0.025	0.226	0.001	1.818
Simulidae	0.028	0.039	0.023		0.031	0.005	0.009	0.007	.....	.....	.....	0.142	0.002	0.286
Tipulidae	.....	0.02	0.019		0.035	0.039	.....	0.01	0.005	0.34	0.007	0.831	0.153	1.459
Coleoptera	0.065	0.008	0.045		0.025	.....	0.005	.....	.....	.....	.....	0.113	.....	0.261
Ephemeroptera	0.132	0.156	0.17		0.068	0.13	0.038	0.076	0.697	1.384	2.928	3.716	0.122	9.617
Hemiptera	0.05	0.053	0.057		0.002	.....	.....	0.01	0.012	.....	.....	.....	0.056	0.240
Hymenoptera	.....	0.06	0.507		0.013	.....	.....	.....	.....	.....	.....	0.008	0.037	0.625
Odonata	.....	.....	.....		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Plecoptera	0.045	0.004	0.078		0.004	0.01	0.035	0.03	0.175	0.01	0.29	0.397	0.089	1.167
Trichoptera larvae	0.035	0.015	0.027		0.033	0.071	0.044	0.021	0.015	0.02	0.068	0.443	.....	0.792
Cottidae	.....	.....	.....		.....	.....	.....	.....	.....	.....	....	0.50	.....	0.50

Table 2.--Analysis of stomach contents of trout taken at Kellogg's Bridge North Branch Au Sable River. Figures indicate milliliters of major organisms of total food contents for each month during sampling period

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
Oligochaeta	.....	.....	.....	.....	0.151	0.19	.....	.....	.....	.....	0.15	0.03	0.34	0.861
Arachnida	0.018	0.001	0.009	.....	.....	.....	.....	.....	.....	.....	.....	0.195	.....	0.223
Amphipoda	.....	0.003	.....	.....	0.03	0.115	0.62	0.169	0.38	0.65	0.008	0.03	.....	2.005
Dolichopodidae	.....	0.002	0.015	.....	.....	.....	.....	.....	.....	0.01	.....	.....	0.132	0.159
Chironomidae larvae	0.008	0.011	0.008	.....	0.009	.....	0.031	0.001	0.002	0.002	0.016	0.02	0.018	0.126
Simulidae	0.003	0.027	0.022	0.026	0.016	0.001	.....	0.004	.....	0.006	.....	0.02	0.002	0.127
Tipulidae	.....	0.002	.....	0.002	0.004	.....	.....	.....	0.01	0.08	0.02	0.385	0.003	0.506
Coleoptera	0.171	.....	0.005	0.012	0.003	.....	0.002	0.016	.....	.....	.....	0.1	0.377	0.686
Ephemeroptera	0.01	0.043	0.061	0.175	0.446	1.375	0.18	0.351	0.724	0.144	2.187	0.869	0.271	6.836
Hemiptera	0.095	0.002	0.018	.....	.....	.....	.....	.....	.....	.....	.....	0.105	.....	0.217
Hymenoptera	0.015	.....	0.25	0.011	.....	.....	.....	.....	.....	.....	.....	0.08	0.053	0.409
Odonata	0.18	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.092	.....	.....	0.272
Plecoptera	0.089	0.015	.....	0.001	.....	0.05	0.115	0.093	0.25	0.08	0.398	0.522	0.031	1.644
Trichoptera larvae	0.071	0.034	0.056	0.146	0.275	0.083	0.01	0.031	0.066	0.139	0.085	0.285	0.028	1.309
Cottidae	.....	.....	1.1	.....	.....	.....	.....	.....	....	....	.....	0.125	....	1.35

Table 3.--Analysis of stomach contents of trout taken at Section C Hunt Creek
Figures indicate milliliters of major organisms of total food contents for each month during sampling period

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
Oligochaeta	2.01	0.42	3.25	8.542	8.258	9.251	2.346	0.556	0.39	TO BE SORTED AND IDENTIFIED	TO BE SORTED AND IDENTIFIED	0.67	0.16	35.853
Arachnida	0.031	0.016	0.01	0.010	.....	.....	.....	.....	0.001			0.002	0.141	0.211
Amphipoda	0.017	.....	.....	.....	0.001	.....	.....	.....	0.03			.....	.....	0.048
Dolichopodidae	0.001	.....	0.002	.....	.....	.....	0.003	.....	.....			0.99	0.057	1.053
Chironomidae larvae	0.01	0.009	0.002	0.01	0.026	0.015	0.006	0.013	0.009			0.008	0.003	0.111
Simulidae	0.004	0.003	0.002	.....	.....	0.002	0.006	0.013	0.016			0.015	.....	0.061
Tipulidae	0.024	0.062	0.084	0.155	0.011	0.008	0.08	0.02	0.02			0.253	0.014	0.731
Coleoptera	0.19	0.054	0.014	.....	.....	.....	....	0.04	0.06			0.03	0.25	0.638
Ephemeroptera	0.098	0.022	0.005	.....	0.095	.....	0.01	0.018	0.089			0.514	0.01	0.861
Hemiptera	.....	.....	.....	.....	.....	.....	.....	.....	.....			0.125	0.013	0.138
Hymenoptera	0.107	0.046	0.062	.....	0.357	0.017	.....	.....	0.035			0.18	0.128	0.932
Odonata	.....	.....	.....	.....	.....	0.04	.....	.....	.....			.....	.....	0.04
Plecoptera	0.02	0.057	0.129	0.131	0.033	0.118	0.062	0.022	0.126			0.051	0.01	0.759
Trichoptera larvae	0.255	0.101	0.135	0.08	0.119	0.071	0.20	0.005	0.044			0.474	0.215	1.699
Cottidae	.....	.....	.....	.....	.....	.....	.....	.....	.....			.....	.....	.....

Table 4.--Analysis of stomach contents of trout taken at Section Z Hunt Creek
Figures indicate milliliters of major organisms of total food contents for each month during sampling period

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
Oligochaeta	.....	0.10	0.39	1.0	5.8	.....	.....	0.075	.....	0.19	0.156	0.94	0.16	8.811
Arachnida	0.019	0.01	0.009	0.013	0.002	0.012	0.005	0.002	.....	0.001	0.009	0.016	0.043	0.141
Amphipoda	.....	.....	0.004	0.02	.....	.....	.....	0.026	0.007	.....	0.029	0.008	0.008	0.102
Dolichopodidae	0.05	0.012	0.027	.....	.....	.....	.....	.....	.....	0.004	0.004	0.304	0.088	0.669
Chironomidae larvae	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Simulidae	0.044	0.083	0.068	0.065	0.001	0.01	0.007	0.002	.....	.....	0.006	0.008	0.035	0.329
Tipulidae	0.109	0.122	0.079	0.092	0.017	0.023	0.022	0.77	0.218	0.042	0.236	0.09	0.225	2.045
Coleoptera	0.008	0.096	0.116	0.002	0.039	0.02	0.055	.....	0.002	0.015	0.001	0.03	0.146	0.530
Ephemeroptera	0.51	0.226	0.055	0.133	0.015	0.124	0.495	0.696	1.252	1.605	1.186	0.763	0.209	7.269
Hemiptera	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hymenoptera	0.016	0.008	0.077	0.015	0.001	.....	.....	0.04	.....	.....	0.26	0.002	0.078	0.497
Odonata	0.03	0.001	.....	.....	.....	.....	.....	.....	.....	0.03	.....	0.2	0.26	0.52
Plecoptera	.....	.....	.....	0.051	0.01	0.172	0.349	0.438	0.386	0.608	0.203	0.025	0.037	2.279
Trichoptera larvae	0.075	0.055	0.054	0.167	0.105	0.385	0.651	0.40	0.103	0.03	0.102	0.09	0.205	2.422
Cottidae	.....	0.763	.....	.....	.....	.....	.....	.....	.....	....	....	....	....	0.763