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Aquatic Insects of the Pine-Popple River, Wisconsin

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Technical Bulletin No. 54
Department of Natural Resources
Madison, Wisconsin
1972



ABSTRACT

Collections were made from May 1967 through August 1969 on the Pine River, Popple River and Woods Creek in Florence and Forest Counties to document the aquatic insect fauna of these wild rivers.

Distribution and abundance were recorded, and notes summarized on the ecology, life cycles and identification of: Plecoptera (34 species), Ephemeroptera (approximately 60 species), Odonata (39 species), Trichoptera (149 species), Megaloptera (3 species), aquatic and semi-aquatic Hemiptera (47 species), aquatic Coleoptera (54 species), and aquatic Diptera (43 genera).

**Aquatic Insects of the
Pine-Popple River, Wisconsin**

By

**William L. Hilsenhoff, Jerry L. Longridge,
Richard P. Narf, Kenneth J. Tennessen,
and Craig P. Walton**

Technical Bulletin No. 54
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SAMPLING SITES AND PROCEDURES William L. Hilsenhoff

Late in 1965 a committee was formed by the Wisconsin Academy of Sciences, Arts and Letters to plan and initiate studies of wild rivers in northeastern Wisconsin. As plans were formulated, the Pine-Popple River system in Florence and Forest Counties became the focus of most of the research (Fig. 1). The objective was to determine the physical, chemical, cultural, and biological characteristics of the Pine-Popple River's 563-square-mile drainage basin. As part of the research effort, our studies were carried out to document the aquatic insect fauna.

The Pine River is 78 miles long. It arises in marshes and swamps, and flows east 19 miles with a gradient of about 2 ft/mile. Its North Branch has a steeper gradient of about 6 ft/mile. The next 25 miles of the Pine River are more rapid, with a gradient of about 8 ft/mile and the last 22 miles above the dam have an average gradient of 14 ft/mile. The 12 miles of river below the dam have a gradient that averages only 1/2 ft/mile.

Similarly, the 45-mile-long Popple River arises in swamps and marshes with a gradient of 2 ft/mile for the first 10 miles. The gradient increases to 6 ft/mile for the next 22 miles and 16 ft/mile for the final 13 miles. Woods Creek has a steep 14 ft/mile gradient over its entire length of 18 miles.

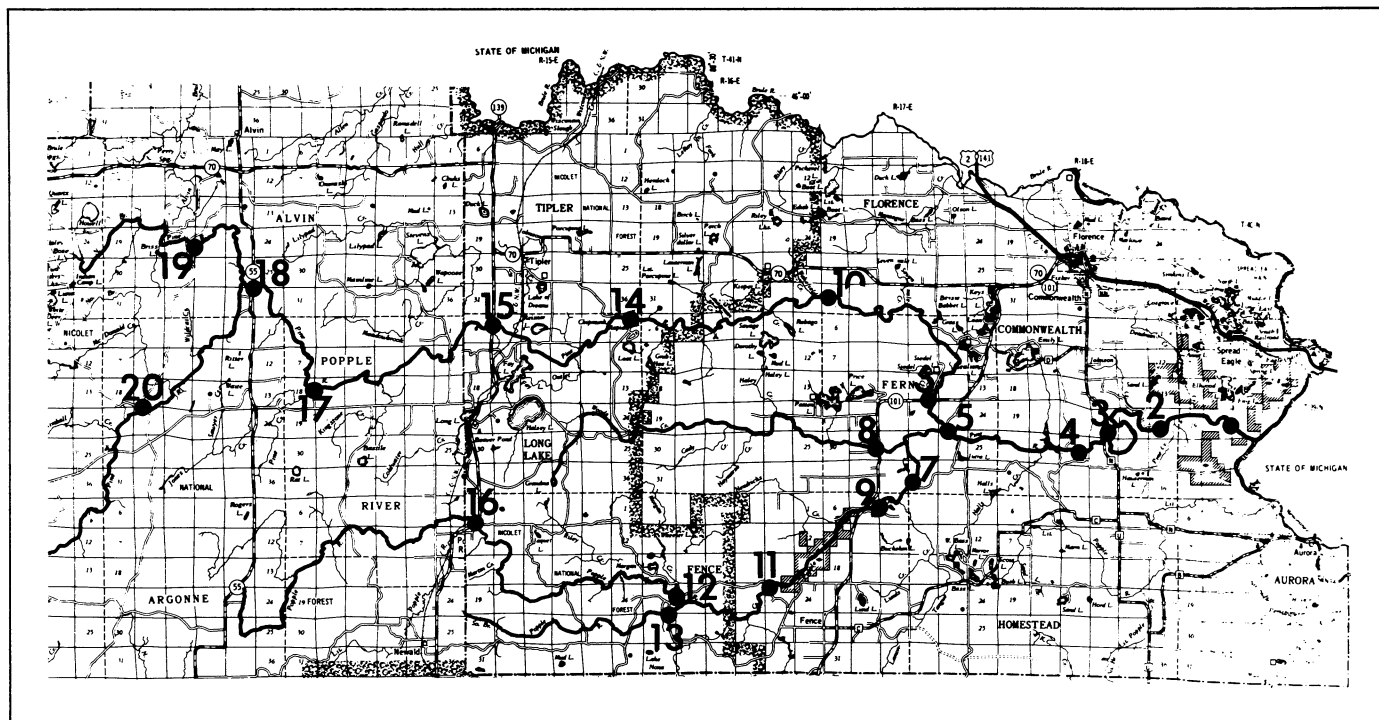
Much of the drainage basin was uninhabited and heavily forested, the western half lying in the Nicolet National Forest (Fig. 1). Because of the forest cover,

runoff (estimated at 11 inches per year) produced only a minimum amount of siltation. Chemical analyses did not reveal any traces of chlorinated hydrocarbon insecticides. Dissolved oxygen levels remained at or near saturation throughout the river system, the only exception being night-time DO sags in portions of the river with heavy growths of aquatic plants. Because of extensive shading, maximum water temperatures remained low in the summer. In 1967 the maximum temperature of Woods Creek (Site 8) was 20 C and the maximum temperature at Site 11 on the Popple River was 24 C (Fig. 1). This latter temperature is probably typical of the maximum summer temperatures throughout most of the Pine and Popple Rivers. Only in the slower, more open headwaters have higher summer maximums been recorded (up to 30 C).

The water in the Pine-Popple River was fairly hard (74-118 ppm CaCO₃) and slightly alkaline (pH 7.1-7.6). Chlorides ranged from 1-2 ppm and nitrates from 0.2-0.7 ppm. As measured by specific conductance, ion concentrations were lowest in the upper reaches of the Popple River (78 u ohms) and in the upper Pine River (110 u ohms), increasing to about 200 u ohms in the lower parts of these rivers. Woods Creek had a higher ion concentration (260 u ohms) than either the Pine or Popple Rivers.

A detailed study of the hydrology and water chemistry of the Pine-Popple River has been com-

Figure 1. The location of sampling sites on the Pine-Popple River.



pleted by the Water Resources Division of the U. S. Geological Survey and will be published. Much of the above information was summarized from the manuscript that was prepared as a result of their studies.

Insects were collected from the river and its principal tributaries from May 1967 through August 1969, the collections being made almost entirely at 20 sites on the Pine River, Popple River, and Woods Creek (Fig. 1). These sites were numbered from east to west and located where roads provided access.

Several methods were used to collect insects. Flying insects, especially Odonata, were captured with an 18-inch diameter aerial net. Adults of Plecoptera, Ephemeroptera, Trichoptera, and Megaloptera were captured by sweeping the shoreline vegetation with a 12-inch sweep net or by capturing them with a forceps or aspirator from stones, trees, bridges, and other substrates. A D-frame aquatic net (Wards Scientific Co., Rochester, N.Y.) was used to collect insects from the stream either by working it into the bank or by placing it downstream and disturbing the substrate above the net and allowing dislodged insects to be carried into the net by the current.

Most of the larval and nymphal insects were captured by artificial substrate samplers (Hilsenhoff, 1969). On May 15, 1967, two of these samplers were placed at each of 15 of the sampling sites, and on June 27 a third sampler was added at each of these sites and three samplers were placed in the remaining five sites. The samplers were placed in the fastest water at each site that was sufficiently deep to cover them at low flow. These samplers proved to be very efficient for collecting certain types of insects, especially Plecoptera and Ephemeroptera. Insects were removed from the samplers on August 8, September 13, and November 9, 1967, and May 10, July 24, and August 12, 1968, after which the samplers were removed from the river. All insects were preserved in 70% ethanol and returned to the laboratory for sorting and identification. Representative specimens of all insects collected in this study have been preserved in the University of Wisconsin Insect Collection.

The location and characteristics of each sampling site are reported below. Observations and measurements were made August 25-27, 1969, after several weeks with no significant rainfall, and again on May 12, 1971 when the flow was above normal. The flow at the Pine River dam (above site 4) was 181 cubic ft/sec (cfs) on August 26, 1969 and 908 cfs on May 12, 1971. The long-term flow at this site (1924-1967) averaged 420 cfs and exceeded 312 cfs 50% of the time and 550 cfs 25% of the time. At site 11 on the Popple River the flow was 34 cfs on August 26, 1969 and 181 cfs on May 12, 1971. The velocity of the current was measured at each site with a Pygmy Current Meter (Scientific Instruments, Milwaukee,

Wis.), these measurements being made 6 inches above the substrate at the point where the samplers had been located. The depth and substrate were recorded every 10 ft across the stream, and the width of the stream was measured from the banks at normal flow. The average depth and greatest depth were determined from readings made at 10-foot intervals at the point where the samplers were located.

A hydroelectric dam above site 4 greatly influenced water levels at sites 2, 3, and 4. When water levels were high, both generators were run day and night, making the water too deep and fast to collect from the samplers at these sites. Also because of the fast, deep water, the current velocities at these sites could not be measured when both generators were in operation. Under normal water conditions, one or both of the generators would be shut down from 8:00 p.m. to 8:00 a.m. to conserve water, and samples could be collected. Under drought conditions, such as August 26, 1969, both generators were shut down at night and only one generator was run from 8:00 a.m. to 8:00 p.m. Site 1 was influenced by the manipulation of a hydroelectric dam 3 miles downstream on the Menominee River, and at times the current was eliminated at this site.

The location and description of each sampling site is summarized as follows:

SITE 1-PINE RIVER



Site 1 on the lower Pine River.

Location: At end of access road south of Elmwood Lake.

Location of Samplers: 20 ft from bank at end of access road.

Width: 175 ft (estimated).

Average Depth: 3.4-4.4 ft (estimated).

Greatest Depth: 4.5-5.5 ft (estimated).

Current: 0.00 ft/sec—1 generator operating; 0.42 ft/sec—2 generators operating.

Description: The bottom was mostly silt, with some debris such as stumps and logs. The south shore was forested with mixed hardwoods, while the north

shore had openings with brush and trees overhanging the banks.

SITE 2—PINE RIVER

Location: At end of road to D'Agastino cabin.

Location of Samplers: 30 ft from north bank and 30 yds downstream from cabin.

Width: 160 ft.

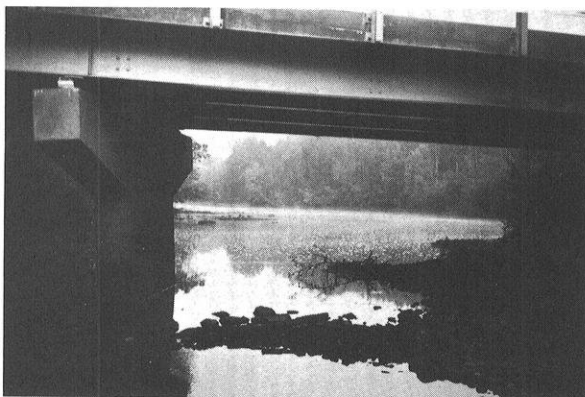
Average Depth: 1.3 ft—generators not operating, 2.7 ft—1 generator operating.

Greatest Depth: 2.4 ft—generators not operating; 3.8 ft—1 generator operating.

Current: 0.25 ft/sec—generators not operating; 0.79 ft/sec—1 generator operating.

Description: The bottom was mostly coarse sand and gravel, although an extensive area in midstream was entirely sand. The shallow shoreline areas had a silt bottom with a sparse growth of *Potamogeton richardsonii* and *Elodea canadensis*. When minimum flow was maintained at the hydroelectric dam, much of the silt bottom along the banks was exposed. Both shores were forested with conifers and hardwoods.

SITE 3—PINE RIVER



Site 3 on the Pine River with the water level being maintained at minimum flow.

Location: Bridge at Highway N.

Location of Samplers: Under north span of bridge.

Width: 103 ft.

Average Depth: 0.7 ft—generators not operating; 1.8 ft—1 generator operating.

Greatest Depth: 1.4 ft—generators not operating; 2.4 ft—1 generator operating.

Current: 0.26 ft/sec—generators not operating; 2.29 ft/sec—1 generator operating.

Description: This site was severely affected by the fluctuation of water levels. When minimum flow was maintained by the dam, much of the rock bottom was exposed. Although the bottom was predominantly rock, downstream from the bridge along the south bank there was a silt-bottomed eddy from

which insects were also collected. Both banks were heavily forested.

SITE 4—PINE RIVER

Location: 100 yds below hydroelectric dam.

Location of Samplers: 10 ft from shale bank on south shore.

Width: 150 ft.

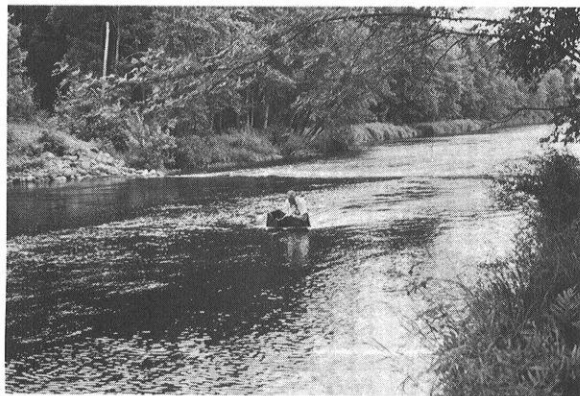
Average Depth: 0.9 ft—generators not operating; 2.0 ft—1 generator operating.

Greatest Depth: 1.5 ft—generators not operating; 2.6 ft—1 generator operating.

Current: 0.17 ft/sec—generators not operating; 1.28 ft/sec—1 generator operating.

Description: The bottom was composed entirely of rocks, and much of it was exposed when minimum flow was maintained. Both banks were forested.

SITE 5—PINE RIVER



Site 5 on the Pine River just below its junction with the Popple River.

Location: Just below confluence of Pine and Popple Rivers.

Location of Samplers: 30 ft from south bank and 30 yds upstream from broken bridge.

Width: 96 ft.

Average Depth: 2.3 ft—August 1969.

Greatest Depth: 2.8 ft—August 1969.

Current: 0.93 ft/sec—August 1969; 1.15 ft/sec—May 1971.

Description: This site had a variety of bottom types. The samplers were on coarse sand, but upstream there were silt-bottomed eddies and downstream there were gravel-bottomed riffles. Large rocks were also present, and logs and snags of debris were common. Hardwoods forested the surrounding terrain.

SITE 6—PINE RIVER

Location: Bridge at Highway 101.

Location of Samplers: 30 ft from south bank and about 30 yds upstream from bridge.

Width: 87 ft.

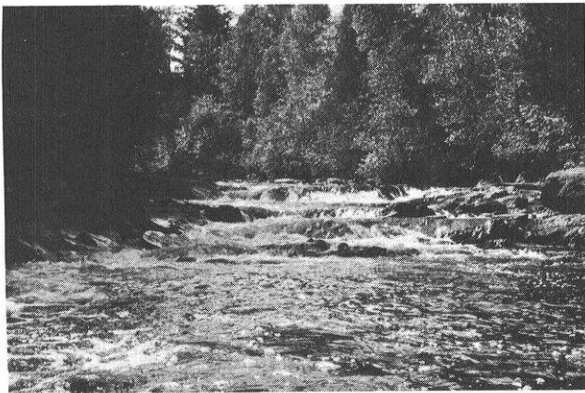
Average Depth: 1.1 ft—August 1969; 2.2 ft—May 1971.

Greatest Depth: 1.7 ft—August 1969; 2.8 ft—May 1971.

Current: 1.14 ft/sec—August 1969; 1.34 ft/sec—May 1971.

Description: The bottom was mostly sand and gravel with some debris. Shallow areas along the north shore had a silt bottom, with *Vallisneria americana* and *P. richardsonii* growing sparsely. The river was deeply shaded by the dense forest growth.

SITE 7—POPPLE RIVER



Site 7 at Washburn Falls on the Popple River.

Location: Just above Washburn Falls.

Location of Samplers: In midstream just above falls.

Width: 50 ft.

Average Depth: 1.7 ft—August 1969.

Greatest Depth: 2.2 ft—August 1969.

Current: 1.03 ft/sec—August 1969; 1.76 ft/sec—May 1971.

Description: The bottom was composed of rocks, varying in size from small to very large. The area was heavily forested, but the canopy did not completely shade the river.

SITE 8—WOODS CREEK

Location: Bridge at Highway 101

Location of Samplers: In concrete culvert under highway.

Width: (above highway) 34 ft.

Average Depth: 0.9 ft—August 1969.

Greatest Depth: 1.0 ft—August 1969.

Current: 0.82 ft/sec—August 1969; 1.68 ft/sec—May 1971.

Description: Below the culvert was a deep silt pool. Downstream from the pool and upstream from the

culvert the bottom was entirely gravel with a few larger stones. Except for the highway right-of-way, the stream was covered with a dense forest canopy.



Site 8 on Woods Creek.

SITE 9—POPPLE RIVER

Location: Off of East River Road 0.65 mi from Highway 101. Additional samples were collected in the vicinity of the bridge at Highway 101.

Location of Samplers: 30 ft from road down embankment from East River Road.

Width: 48 ft + 25 ft (island between channels).

Average Depth: 1.3 ft—August 1969.

Greatest Depth: 1.6 ft—August 1969.

Current: 0.56 ft/sec—August 1969; 1.41 ft/sec—May 1971.

Description: This section of the river was heavily forested and the bottom was composed entirely of small rocks. The habitat in the vicinity of Highway 101 was similar, except for a small area of silt along the south bank below the bridge.

SITE 10—PINE RIVER

Location: At end of Goodman Lumber Co. road off Highway 70.

Location of Samplers: 20 ft from north bank and 30 ft below broken bridge.

Width: 123 ft.

Average Depth: 0.8 ft—August 1969.

Greatest Depth: 2.0 ft—August 1969.

Current: 0.90 ft/sec—August 1969; 2.51 ft/sec—May 1971.

Description: The bottom was mostly sand and stones, but also contained areas of gravel, sand, or silt. *E. canadensis* and *V. americana* grew sparsely in shallow areas with a silt bottom. Gravel riffles were common below the sampling site. Although this site was in a heavily forested area, its width kept it from being completely shaded.

SITE 11—POPPLE RIVER



Site 11 on the Popple River.

Location: Bridge at Forest Road 2159.

Location of Samplers: In midstream, 215 ft upstream from gauge house.

Width: 72 ft.

Average Depth: 1.7 ft—August 1969; 2.2 ft—May 1971.

Greatest Depth: 2.0 ft—August 1969; 2.5 ft—May 1971.

Current: 0.32 ft/sec—August 1969; 0.81 ft/sec—May 1971.

Description: The bottom was sand and coarse gravel, with some large rocks, and during the summer was completely covered with a growth of *V. americana*. Filamentous algae was also encountered in the samplers. In the vicinity of the bridge, the bottom contained rocks and gravel riffles. The terrain adjacent to the river was variously forested or covered with sedge marshes.

SITE 12—POPPLE RIVER



Site 12 on the upper end of the Popple River.

Location: Bridge at Forest Road 2159.

Location of Samplers: Below riffle downstream from bridge and 10 ft from south bank.

Width: 85 ft.

Average Depth: 0.9 ft—August 1969.

Greatest Depth: 2.1 ft—August 1969.

Current: 0.13 ft/sec—August 1969; 0.86 ft/sec—May 1971.

Description: In the area where the samplers were located, the bottom was fine gravel, but rock was the predominant substrate in other parts of the stream. Both banks were forested with mixed conifers and hardwoods.

SITE 13—SOUTH BRANCH POPPLE RIVER

Location: Bridge at Forest Road 2363.

Location of Samplers: Beside large rock near north bank 100 ft downstream from bridge.

Width: 34 ft.

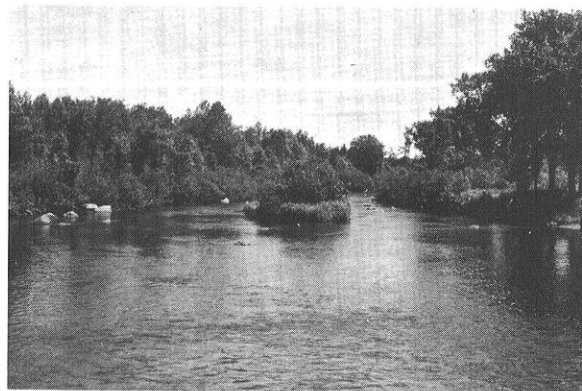
Average Depth: 1.8 ft—August 1969; 2.1 ft—May 1971.

Greatest Depth: 2.4 ft—August 1969; 2.7 ft—May 1971.

Current: 0.68 ft/sec—August 1969; 0.87 ft/sec—May 1971.

Description: The substrate in the vicinity of the samplers was sand and gravel, but silt covered the bottom along the south bank. Near the bridge and above the bridge were gravel and rock riffles. The banks were mostly forested, but an area near the samplers contained only shrubs.

SITE 14—PINE RIVER



Site 14 on the Pine River at the Chipmunk Rapids Campground.

Location: Bridge at Forest Road 2156.

Location of Samplers: In midstream about 30 yds above bridge.

Width: 78 ft.

Average Depth: 1.0 ft—August 1969; 1.5 ft—May 1971.

Greatest Depth: 1.3 ft—August 1969; 1.8 ft—May 1971.

Current: 0.96 ft/sec—August 1969; 1.27 ft/sec—May 1971.

Description: The bottom was mostly gravel, with a few large rocks. *E. canadensis* and a *Potamogeton*

(probably *P. spirillus*) grew along the south side of the river. There was a campground at this area and the forest was open in the vicinity of the sampling site.

SITE 15—PINE RIVER

Location: Bridge at Highway 139.

Location of Samplers: 35 ft from north bank and about 30 yds upstream from bridge.

Width: 78 ft.

Average Depth: 1.3 ft—August 1969.

Greatest Depth: 2.0 ft—August 1969.

Current: 1.23 ft/sec—August 1969; 1.41 ft/sec—May 1971

Description: The bottom in the north half of the stream was gravel and stones, while that in the south half had only stones. Silt was found along the banks. A dense forest completely shaded the river in this area.

SITE 16—POPPLE RIVER

Location: Bridge at Highway 139.

Location of Samplers: In midstream, about 50 ft upstream from bridge.

Width: 70 ft.

Average Depth: 0.4 ft—August 1969.

Greatest Depth: 0.8 ft—August 1969.

Current: 0.05 ft/sec—August 1969; 0.89 ft/sec—May 1971.

Description: In the vicinity of the samplers the substrate was gravel and silt, but in other parts of this site the substrate was sand, sand and gravel, gravel, or silt. Sedges grew in the silt along the south bank. The river was widened above the bridge where the samplers were located, and narrowed considerably both upstream and downstream. The forest grew close to the river, except in the vicinity of the bridge where the banks contained mostly shrubs.

SITE 17—PINE RIVER

Location: Just downstream from confluence with Jones Creek.

Location of Samplers: In midstream 100 ft upstream from bridge.

Width: 45 ft.

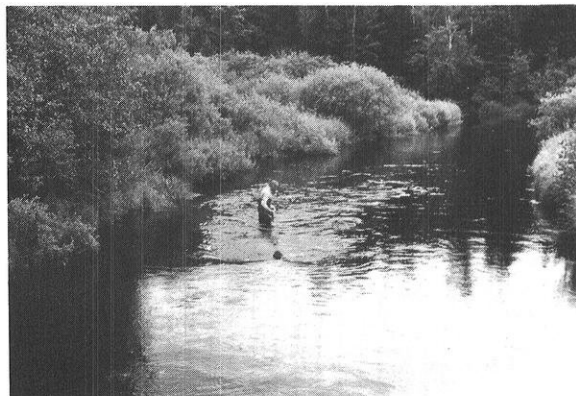
Average Depth: 1.8 ft—August 1969.

Greatest Depth: 2.4 ft—August 1969.

Current: 0.44 ft/sec—August 1969; 0.63 ft/sec—May 1971.

Description: The bottom was mostly gravel and rocks, but in some areas there was sand and silt. The south bank of the river was forested, but the north bank was a large sedge marsh.

SITE 18—PINE RIVER



Site 18 on the slower upper reaches of the Pine River.

Location: Bridge at Highway 55.

Location of Samplers: In midstream about 100 ft downstream from bridge.

Width: 38 ft.

Average Depth: 1.5 ft—August 1969; 2.3 ft—May 1971.

Greatest Depth: 1.8 ft—August 1969; 2.6 ft—May 1971.

Current: 0.66 ft/sec—August 1969; 1.56 ft/sec—May 1971.

Description: The bottom was mostly rocks, with sand along the south bank and silt along the banks in some places just below the bridge. The south bank of the river and the area upstream was a sedge marsh with some shrubs, while the north bank was forested with hardwoods and conifers.

SITE 19—NORTH BRANCH PINE RIVER

Location: Bridge at Forest Road 2174.

Location of Samplers: Downstream from bridge in channel between north bank and island.

Width: 20 ft + 24 ft (intervening island).

Average Depth: 0.9 ft—August 1969.

Greatest Depth: 2.1 ft—August 1969.

Current: 0.48 ft/sec—August 1969; 0.40 ft/sec—May 1971.

Description: In the channel where the samplers were located the bottom was sand, but the channel on the other side of the island was very shallow and had a rock bottom. A small dam was located at the road, and below this dam was a cascade and a wide pool with a silt bottom. The forest was very open in the vicinity of the river because of a campground, and upstream there was a sedge marsh.

SITE 20—PINE RIVER

Location: Bridge at Forest Road 2174.

Location of Samplers: 150 ft upstream and near north bank.

Width: 32 ft.

Average Depth: 1.2 ft—August 1969; 1.6 ft—May 1971.

Greatest Depth: 1.5 ft—August 1969; 1.9 ft—May 1971.

Current: 0.28 ft/sec—August 1969; 0.90 ft/sec—May 1971.

Description: The south bank was forested, but the north bank was open and covered with grasses or sedges. The samplers were on a sand bottom, but elsewhere the bottom was composed of silt, rocks, or a combination of these substrates.

PLECOPTERA (Stoneflies) William L. Hilsenhoff and Richard P. Narf

The Plecoptera were studied from August 1967 to August 1969, with a few additional collections of Perlodidae by Steven Billmyer in 1970 and 1971. Most nymphs were collected by samplers at the 20 sampling sites. Additional nymphs were collected with D-frame aquatic nets from the stream bottom and from along the banks. Adults were collected with a forceps or aspirator from bridges, stones, tree trunks, and vegetation, or by sweeping vegetation with a net. Additional adults were collected at sites 2, 8, 14, and 19 by light traps that were used in the study of Trichoptera. Except where stated otherwise, the keys of Hardin and Mickel (1952) were used to identify nymphs and adults.

The distribution and abundance of the 34 species that were collected are recorded in Table 1. This information and notes on ecology, life cycles, and identification are summarized as follows.

PTERONARCIDAE

Pteronarcys Newman, 1838

Two species occurred in about equal numbers. Only adults and large male nymphs could be identified with certainty; female nymphs and small nymphs were not named. Nymphs were captured throughout the year by the samplers, and from debris with aquatic nets. Both species probably occur throughout the river, but they were most common in areas with rapid current. They have at least a 2-year life cycle, with emergence in May. Larval exuviae were found as early as May 9, but only one adult was collected.

P. dorsata (Say), 1823—Fairly common. Nymphs year-around. Adult June 10.

P. pictetii Hagen, 1873—Fairly common. Nymphs year-around.

TAENIOPTERYGIDAE

All species in this family had a one-year life cycle, with nymphs developing mostly during late fall and winter and adults emerging in late March and early April. Adults were collected from bridges while the

river was still mostly covered with ice and the ground was covered with snow.

Brachyptera Newport, 1851

Two species were collected, and both could be readily identified as adults or mature nymphs. Many nymphs were collected by the samplers in early November, but were too immature to be determined to species. Both species were most numerous in the larger and faster sections of the Pine and Popple Rivers. None were collected from Woods Creek or from May to October.

B. (Strophopteryx) fasciata (Burmeister), 1839—Fairly common. Nymphs Nov. 11—Mar. 28. Adults Mar. 19—Apr. 12.

B. (Oemopteryx) glacialis (Newport), 1848—Fairly common. Nymphs Nov. 11—Mar. 28. Adults Mar. 28. *Taeniopteryx* Pictet, 1841

The key by Ricker and Ross (1968) was used to identify the 3 species. Only adults of *T. burksi* could be separated from *T. nivalis*, but both nymphs and adults of *T. parvula* could be identified. *T. parvula* was the most common and widely distributed species. Although nymphs of all species were found from September to March on rocks, in samplers, or in debris, they were most abundant on vegetation hanging into the stream.

T. burksi Ricker and Ross, 1968—Fairly common. Nymphs Sept. 13—Mar. 28. Adults Mar. 19—Apr. 12. Middle and upper Pine R., Popple R., Woods Cr.

T. nivalis (Fitch), 1847—Fairly common. Nymphs Sept. 13—Mar. 28. Adults Mar. 19—28. Middle and upper Pine R., Popple R., Woods Cr.

T. parvula Banks, 1918—Common. Nymphs Sept. 13—Mar. 28. Adults Mar. 19—Apr. 12. Entire river.

NEMOURIDAE

Nemoura Latrielle, 1796

This genus was extensively revised by Ricker (1952). This revision did not include nymphs, so those in the subgenus *Amphinemura* could not be identified to species.

Table 1. Numbers of Plecoptera Collected at 20 Sites on the Pine-Popple River.

Species	Site No.	Pine River										Popple River					Woods Creek	Total						
		1	2	3	4	5	6	10	14	15	17	18	19	20	7	9	11	12	13	16	8	Adults	Nymphs	
PTERONARCIDAE																								
<u>Pteronarcys dorsata</u>					2			1		1	1					2		1		1*	1	8		
<u>P. pictetii</u>					1			2								1		5				9		
<u>P. spp. (nymphs)</u>	1		1		10	6	5	15	2	9	3			3		5		5	1	3		69		
TAENIOPTERYGIDAE																								
<u>Brachyptera fasciata</u>			1*			4		6	2							2*		1*	1*	3		11	9	
<u>B. glacialis</u>						2		7	1*							1		1				5	7	
<u>B. spp. (nymphs)</u>			1	17	12	18	30	16	13	13	1	4		14	11		6		1				157	
<u>Taeniopteryx burksi</u> (adults)						1		1	1		2					2	5	3		1	10	26		
<u>T. nivalis</u> (adults)										1	1							5	1	1	4	13		
<u>T. nivalis</u> or <u>burksi</u> (nymphs)			3			2	2		1	12	18	27	26	1	1	27		9	18	13		160		
<u>T. parvula</u>			12	3	14	23	51	33	7	1	14	3	34	5	7	7*	39	6	20	10	9	25	273	
NEMOURIDAE																								
<u>Nemoura completa</u>				1*																1		1	1	
<u>N. rotunda</u>	1									3	21		1						11	2	17	2	1	57
<u>N. (Amphinemura)</u> (nymphs)							1	6												1	3		18	
LEUCTRIDAE																								
<u>Leuctra tenuis</u>					3		1	2	1								1			1	11	1	19	
CAPNIIDAE																								
<u>Allocapnia granulata</u> (adults)													1										24	
<u>A. minima</u> (adults)			14	1	26	135	9	121	181	52	40					65	1	19		3	15		802	
<u>A. pygmaea</u> (adults)																8				1	4		14	
<u>Paracapnia angulata</u>	6	58	37	3	32	3	9	15	29	12	6	6	2	15	13	8	1	14	51	317	50		587	
PERLIDAE																								
<u>Acroneuria abnormis</u>					2		1									2	8	1			2*	2	14	
<u>A. internata</u>			9			1*										1	1	3	1	3		3	16	
<u>A. lycorias</u>	1	41	53	80	81	116	197	79	89	96	65	3		95	91	47	67	30	61	53			1,345	
<u>A. spp. (small nymphs)</u>	1	2	1		15	8	13	18	3	5		1		17	5	7	6	3	6	23			134	
<u>Neoperla clymene</u>																							2	
<u>Paragnetina media</u>			13	4	3	4	13	12	57	12	2			6	4	3*	9	3	3	17		9	156	
<u>Perlesta placida</u>						3						3	9			1*						4	12	
<u>Phasganophora capitata</u>		12	37	3	8	34	16	77	43	3	4	1*		8	16	2	4	17	2			30	257	
PERLODIDAE																								
<u>Isoperla cotta</u>					3								1			1		3	1	3	10	2	20	
<u>I. dicala</u>			1	2	2	11	12	2	6	2	1			10	6	6	2*	1*	2	1*		32	35	
<u>I. frisoni</u>			11	5	10	14	21	14	15	14	2	4	8*	5	6	21	8	1	9	5	19		154	
<u>I. lata</u>																					5	1	4	
<u>I. marlynia</u>		33	2						3*	2	1						4					3	42	
<u>I. richardsoni</u>		3	4	1	4		5		1													7	12	
<u>I. signata</u>		69	46	16	33	2	22	2	94	32	28	10	21	2	2	3	2	57	62	19	35		487	
<u>I. slossonae</u>																3	1*			1	1		4	
<u>I. transmarina</u>		1	2																3	22	10		23	
<u>I. spp. (small nymphs)</u>		2	17	2	4	4	10	12	10	24	15	24	6	9	10	2	1	72	18	7			249	
<u>Isogenus olivaceus</u>																					8		8	
CHLOROPERLIDAE																								
<u>Hastaperla brevis</u>			21		1*	3*		8			1*			1*	8*	1*	2*	5*		6*	55		2	

* = only adults.

N. (Prostoia) completa Walker, 1852—Rare. Nymph Mar. 28. Adult Apr. 28.

N. (Shipsa) rotunda Claassen, 1923—Fairly common. Nymphs Mar. 27—May 10. Adults May 13. Mostly Popple R., upper Pine R.

N. (Amphinemura) Ris 1902—(Either *N. delosa* Ricker, 1952, *N. linda* Ricker, 1952, or *N. nigritta* Provancher, 1876). Uncommon. Nymphs May 9—Aug. 8.

LEUCTRIDAE

Leuctra Stephens, 1835

Only one adult was collected. It was found at Woods Creek and identified as *L. tenuis*. Nymphs collected in Woods Creek were all collected August 8 and are probably also this species. Nymphs collected at other sites on other dates were also included as *L. tenuis* in Table 1, but may be another species. The nymphs cannot presently be identified.

L. tenuis (Pictet), 1841—Uncommon. Nymphs May 10—Aug. 8. Adult Aug. 26.

CAPNIIDAE

Allocaupnia Claassen, 1924

These are truly “winter stoneflies”; nymphs develop in the winter and adults emerge in late winter when snow still covers the ground. Only four immature nymphs were collected, all in November. Nymphs cannot be identified to species and were not included in Table 1. Three species of adults were collected, mostly from snow and from bridges. Identification of these adults was confirmed by comparison with specimens identified by Dr. H. H. Ross.

A. granulata (Claassen), 1924—Uncommon. Adults Mar. 19-28. Upper Popple R.

A. minima (Newport), 1851—Abundant. Adults Mar. 19—Apr. 12. Fast water.

A. pygmaea (Burmeister), 1839—Uncommon. Adults Mar. 19—Apr. 12. Mostly Woods Cr., lower Popple R.

Paracupnia Hanson, 1946

Although considered “winter stoneflies”, emergence occurred later than in *Allocaupnia*. Nymphal development was also less rapid, large numbers of nymphs being collected in early November when only a few very immature *Allocaupnia* nymphs could be found. The key by Hanson (1961) was used to identify male adults; females and nymphs cannot be determined. Only one of the two North American species was encountered, and females and nymphs were assumed to be the same species as the males.

P. angulata Hanson, 1961—Very common. Nymphs Sept. 13—Mar. 28. Adults Apr. 9—May 10. Entire river.

PERLIDAE

Acroneuria Pictet, 1841

Three species were collected. Nymphs greater than 8 mm long were identified, but smaller nymphs could not be named. All species probably have a 2-year life cycle. Several adults were captured by light-traps.

A. abnormis (Newman), 1838—Uncommon. Nymphs year-around. Adults June 20. Middle Pine R., middle Popple R., Woods Cr.

A. internata (Walker), 1852—Uncommon. Nymphs year-around. Adults June 20—July 15. Popple R., lower Pine R.

A. lycorias (Newman), 1839—Abundant. Nymphs year-around. Fast water.

Neoperla Needham, 1905

Two males of *N. clymene* were collected by a light-trap at site 2. *N. clymene* has been called a “species of the large rivers” by Harden and Mickel (1952).

N. clymene (Newman), 1839—Rare. Adults July 15. Lower Pine R.

Paragnetina Klapalek, 1907

Only one species was found, and it probably has a 2-year life cycle.

P. media (Walker), 1852—Common. Nymphs year-around. Adults June 11—July 15. Fast water.

Perlesta Banks, 1906

There was only one species and it apparently has a one-year life cycle.

P. placida (Hagen), 1861—Uncommon. Nymphs July 9-24. Adults July 9-15. Mostly upper Pine R.

Phasganophora Klapalek, 1921

The only species had a 2-year life cycle. Adults were frequently captured in light-traps.

P. capitata (Pictet), 1841—Common. Nymphs year-around. Adults June 20—July 16. Fast water, except Woods Cr.

PERLODIDAE

All species had a one-year life cycle, and some were very common.

Isogenus Newman, 1833

The nymphs of the only species that was found were identified by using the key of Ricker (1952) and drawings in Frison (1942). They were found only in Woods Creek.

I. olivaceus (Walker) 1852—Uncommon. Nymphs Oct. 19—Mar. 28. Woods Cr.

Isoperla Banks, 1906

The nymphs and adults were identified by using the key by Harden and Mickel (1952) and by consulting descriptions by Claassen (1931), Frison (1935, 1937, 1942), and Ricker (1952). The keys and descriptions are largely based on color patterns, but these were found to vary considerably. In the Pine-Popple River most specimens were more darkly pigmented than normal. In identifying nymphs,

emphasis was placed on morphological characteristics of the laciniae. Many immature nymphs collected in the fall could not be named. Adult males were identified mostly from the shape of the subanal lobes and the lobe on the eighth sternite, and the shape of the subgenital plate was used extensively to identify females.

This genus comprised a large segment of the stonefly fauna. Most nymphs were collected by the samplers, while adults were collected by sweeping and by light-traps.

I. cotta Ricker, 1952—Uncommon. Nymphs May 9-18. Adults June 6-20. Woods Cr. and Popple R.

I. dicala Frison, 1942—Fairly common. Nymphs Mar. 27—May 10. Adults June 10—Aug. 27. Faster waters.

I. frisoni Illies, 1966—Common. Nymphs May 9-10. Adults May 28—July 15. Entire river.

I. lata Frison, 1942—Rare. Nymphs Nov. 9-May 3. Adults June 24. Woods Cr.

I. marlynia Needham and Claassen, 1925—Fairly common. Nymphs Nov. 9—May 10. Adults May 28. Mostly slow water.

I. richardsoni Frison, 1935—Uncommon. Nymphs Mar. 28—May 10. Adults May 28—July 15. Lower and middle Pine R.

I. signata (Banks), 1902—Very common. Nymphs Nov. 9—May 10. Adults May 18—July 15. Entire river.

I. slossonae (Banks), 1911—Rare. Nymphs Nov. 9—May 3. Adult June 3. Middle Popple R. and Woods Cr.

I. transmarina (Newman), 1838—Uncommon. Nymphs Nov. 9—May 10. Adults May 29—June 29. Popple R., Woods Cr.

CHLOROPERLIDAE

Hastaperla Ricker, 1935

The single species that was collected was fairly common but mostly adults were found. Nymphs may have been overlooked because of an unusual habitat that was not thoroughly sampled, or because of their small size.

H. brevis (Banks), 1895—Fairly common. Nymphs Nov. 9—Mar. 28. Adults June 10-29. Fast waters.

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A survey of Ephemeroptera nymphs of the Pine-Popple River was made from June 1967 to May 1968 (Walton, 1968), and additional nymphs were collected in the summer of 1968. Approximately 60 species were collected at the 20 sites described earlier. Identifications were made with the aid of published keys, but since nymphs of many species have not been adequately described, some determinations must be regarded as tentative. Keys by Burks (1953) were used unless otherwise stated, and many of the identifications were checked by comparison with specimens in the University of Wisconsin collection that were recently identified by Dr. Fred Ide (Krueger, 1969). Whenever possible, nymphs were reared to the adult stage to verify identifications.

Most of the nymphs were collected by the artificial substrate samplers, but many were also collected with an aquatic net to determine more precisely their specific habitat.

The distribution and abundance of the various species is recorded in Table 2. This information and notes on ecology, life cycles, and identification are summarized as follows.

SIPHONURIDAE

Isonychia Eaton, 1871

This genus was very common throughout the river; it was absent only at Woods Creek and at site 1 on the Pine River. Nymphs were collected year-around by samplers and with nets from rocks, debris, and especially from vegetation in slow water along the banks. Although the nymphs were very similar, three species were tentatively separated using Traver's keys (Needham et al., 1935). These were *I. bicolor* (Walker), 1853, *I. sadleri* Traver, 1934, and an undescribed species that was separated as follows: mature nymphs 10 mm; base of antenna light; median dorsal stripes interrupted at posterior margin of each tergite; gills brownish.

Siphonurus Eaton, 1868

Only 6 nymphs were collected, and all appeared to be the same species. Those collected at sites 1 and 2 in spring were small, but the 2 found in August at site 19 were nearly mature and did not fit the description of any known nymphs. These nymphs were designated *Siphonurus* sp. A, since the nymphs of several species are unknown.

Siphonurus sp. A—Uncommon. Nymphs May 5–Aug. 26, mature Aug. 26. Banks, slow water. Description: 13 mm; tan with abdominal tergites 2, 3, and sometimes 6 darker; abdominal tergites 4–10 with tan, submedial bands extending diagonally outward from anterior margin ½-way to posterior margin; abdominal tergites 1–9 with dark brown mark on posterior-lateral corner at mesal edge of flattened lateral margin; sharp, posterior projecting spine and tan, transverse, medial band on each flattened lateral margin; first two pairs of gills double lamellae,

remainder single lamellae; longitudinal brown bands laterally on abdominal sternites; 5 tan bands on each leg; caudal filaments tan on basal half, brown next sixth, white following sixth, and tan distal sixth.

BAETIDAE

Baetis Leach, 1815

This genus was abundant throughout the river during the spring and summer months, but nymphs were encountered infrequently from October to March. Most species had one-year life cycles, with emergence from May through September, depending on the species. One-third of the nymphs were identified, the remainder were named only to genus. Nymphs of several species that may occur in this area are undescribed, so identification of nymphs in this genus must be regarded as tentative.

B. brunneicolor McDunnough, 1925—Uncommon. Nymphs July 27–Aug. 8, mature Aug. 8. Upper Pine R.

B. cingulatus McDunnough, 1925—Uncommon. Nymphs May 9. (May be confused with *B. intercalaris*). Upper Pine R.

B. curiousus (McDunnough), 1923—Rare. Nymphs July 12. Popple R.

B. frondalis (McDunnough), 1925—Common. Nymphs July 23–Sept. 13, mature Aug. 8–Sept. 13. Entire river.

B. intercalaris McDunnough, 1921—Abundant. Nymphs July 12–Sept. 13, mature. Entire river.

B. pluto McDunnough, 1925—Rare. Nymphs June 9. Popple R.

B. pygmaeus (Hagen), 1861—Common. Nymphs May 9–Sept. 13, mature May and Sept. Popple R., upper Pine R.

B. vagans McDunnough, 1925—Common. Nymphs May 5–10, mature. Adult May 13 (reared). Popple R., middle Pine R.

Baetis sp. A.—Fairly common. Nymphs May 9 and Sept. 13, mature. Lower Pine R. Description: Seventh gill pointed like *B. pygmaeus*, but abdominal tergites 2, 6, and 7 dark, 1, 5, 9, and 10 mostly white, 3, 4, and part of 8 shaded.

Baetis sp. B.—Uncommon. Nymphs July 23, mature. Woods Cr. Description: Key to *B. vagans*, and may be a second generation of that species, but mature nymphs only 4 mm instead of 6.5 mm (length of *B. vagans* emerging from Woods Cr. May 9 and confirmed by identification of adults).

Baetis sp. C.—Rare. Nymphs Sept. 13, mature. Upper Pine R. Description: Like *B. brunneicolor*, but tail filaments tan on basal two-thirds followed by dark band and light tips.

Centroptilum Eaton, 1869

This genus was uncommon. Nymphs that were collected were separated into 4 species, 2 of which were tentatively named.

Table 2. Numbers of Ephemeroptera Nymphs Collected at 20 Sites on the Pine-Popple River.

Species	Site No.	Pine River										Popple River					Woods Creek		Total			
		1	2	3	4	5	6	10	14	15	17	18	19	20	7	9	11	12		13	16	8
SIPHONURIDAE																						
<i>Isonychia</i> spp.			39	12	45	34	65	18	42	7	23	9	116	3	20	11	18	24	116	46		648
<i>Siphonurus</i> sp. A.		2	2										2								6	
BAETIDAE																						
<i>Baetis brunneicolor</i>																					8	
<i>B. cingulatus</i>									1												4	
<i>B. curiosus</i>																		1			1	
<i>B. frondalis</i>				7		1	16	22	8	8	5	5	3	2						9	2	
<i>B. intercalaris</i>		2	9	17	9	23	17	38	27	13	25	20	16							11	321	
<i>B. pluto</i>																					1	
<i>B. pygmaeus</i>					3				1		1	1	6	21	9						84	
<i>B. vagans</i>				1	10	3	3	2	4	21	5									7	108	
<i>B. sp. A.</i>			6	11		1		2													21	
<i>B. sp. B.</i>																					5	
<i>B. sp. C.</i>																					2	
<i>B. spp.</i>																					2	
<i>Centroptilum bellum</i>		71	26	17	20	101	95	112	124	181	79	61	148	49	70	149	111	118	57	54	32	1,674
<i>C. convexum</i>			3																		4	
<i>C. sp. A.</i>										2											3	
<i>C. sp. B.</i>							1				1							1			3	
<i>Neocloeon alamance</i>			6	2							2	1	4	1					2	1	19	
<i>Pseudocloeon anoka</i>						1															12	
<i>P. carolina</i>					1				12	6	18	2							8	10	70	
<i>P. dubium</i>					3																7	
<i>P. parvulum</i>			6																		13	
<i>P. punctiventris</i>						4	1	2	1												64	
<i>P. sp. A.</i>			1	7		1	2														20	
<i>P. sp. B.</i>						4	1														9	
<i>P. sp. C.</i>						6		3													32	
<i>P. spp.</i>			1			1	2	2		1											9	
HEPTAGENIIDAE																						
<i>Epeorus rubidus</i>			30	26	32	20	30	11	45	18	9										332	
<i>Heptagenia</i> spp.		140	126	20	36	40	17	1	78	32	18	74	18								863	
<i>Rhithrogena pellucida</i>				1			2	17	12	9											45	
<i>Stenonema femoratum</i>			4																		4	
<i>S. fuscum</i>			27	109	9	22	69	41	47	111	53	61	87	75	5						1,046	
<i>S. interpunctatum</i>			56	13								7	21	2	110						268	
<i>S. mediopunctatum</i>				1	3	23	15	20													63	
<i>S. pulchellum</i>																					1	
<i>S. rubrum</i>						1															2	
<i>S. vicarium</i>			17	16		2	2		1			13	20	74	40						353	
<i>S. spp.</i>			83	144	33	20	56	78	21	124	36	81	180	327	236						2,597	
AMETROPODIDAE																						
<i>Siphonura basale</i>			44	2		1					3	10		7					5		77	
LEPTOPHLEBIIDAE																						
<i>Leptophlebia</i> spp.		976	394	4	17	30	27	8	27	13	67	14	938	258							3,305	
<i>Paraleptophlebia debilis</i>					6																12	
<i>P. mollis</i>			14	128	13	22	399	172	45	372	156	53	83	21	7						2,321	
EPHEMERELLIDAE																						
<i>Ephemerella attenuata</i>																					8	
<i>E. bicolor</i>			2	2							1										9	
<i>E. cornuta</i>						2	1														14	
<i>E. deficiens</i>						1	36	8													461	
<i>E. invaria and rotunda</i>			17	44	14	71	55	91	168	105	58	18	1								1,196	
<i>E. needhami</i>			35	1	1	10	25	3	16	3											122	
<i>E. simplex</i>																					2	
<i>E. sordida</i>										1											4	
<i>E. subvaria</i>					41	12	3	6	1	8	2	32	11	16	5						337	
<i>E. spp.</i>			16	193	136	250	424	374	744	952	511	213	220	30	41						6,569	
TRICORYTHIDAE																						
<i>Tricorythodes</i> spp.			5	2	7	30	81	9	34	1	5		48								373	
CAENIDAE																						
<i>Brachycercus</i> sp.																					1	
<i>Caenis</i> spp.					2	34	83	4	41	9	10	5	40	54							377	
BAETISCIDAE																						
<i>Baetisca obesa</i>			38	11		1				1	8	24	25						3		133	
EPHEMERIDAE																						
<i>Ephemera simulans</i>			4	34	1			13		8	6	28	15	7	21						192	
<i>Hexagenia limbata</i>			40	1			2														48	
POLYMITARCIDAE																						
<i>Ephoron leukon</i>					14	9	1		1	12	11	1									77	

C. bellum McDunnough, 1924—Rare. Nymphs Sept. 11-13, mature. Pine and Popple R.

C. convexum Ide, 1930—Rare. Nymphs Sept. 13, mature. Lower Pine R.

Centroptilum sp. A.—Rare. Nymphs June 28. Pine R. Description: All gills single; abdominal tergites pale, with 2-6 darker, darkest tan along median line and anterior margin.

Centroptilum sp. B.—Rare. Nymphs June 28—Sept. 13, mature Sept. 13. Pine and Popple R. Description: Tarsal claws very long, nearly as long as tarsi.

Neocloeon Traver, 1932

Nymphs were found in slower-flowing sections of the Pine and Popple Rivers.

N. alamanca Traver, 1932—Uncommon. Nymphs May 10—Sept. 13, mature Sept. 11-13. Lower Pine R., upper Pine R., upper Popple R.

Pseudocloeon Klapalek, 1905

All except very immature nymphs were identified by using the keys by Daggy (1941). Eight species were collected, and all appeared to have a one-year life cycle, with nymphs virtually absent from October to March. Nymphs of some species that may occur in the Pine-Popple River are unknown, so determinations must be regarded as tentative.

P. anoka Daggy, 1945—Uncommon. Nymphs June 28—Sept. 13, mature.

P. carolina (Banks), 1924—Fairly common. Nymphs Aug. 8—Sept. 13, mature. Popple R., middle Pine R.

P. dubium (Walsh), 1862—Uncommon. Nymphs Sept. 11. Pine R.

P. parvulum McDunnough, 1932—Uncommon. Nymphs June 28—Sept. 13, mature July 24—Sept. 13. Slower water.

P. punctiventris (McDunnough), 1923—Fairly common. Nymphs June 27—Sept. 13, mature. Woods Cr., Popple R., middle Pine R.

Pseudocloeon sp. A—Uncommon. Nymphs Aug. 8—Sept. 12, mature Sept. 12. Lower Pine R., lower Popple R. Description: Abdominal tergites tan with submedian white dots along posterior of tergites 1-7, obscure dark submedian dots along anterior margins of tergites 2-7, median white area and 2 pairs of lateral white spots on tergites 8-10; gills with pinnately branched tracheae; tail filaments with dark band across middle, white bands on either side of dark band, base and tip of each filament tan, with an additional white band before tip.

Pseudocloeon sp. B—Uncommon. Nymphs June 28—Sept. 13, mature Aug. 12—Sept. 13. Pine and Popple R. Description: Gills with distinct tracheation; abdominal tergites 5-7 brown, 1, 2, 8, and 9 tan, 3 and 4 white; abdominal sternites 5, 6, and 7 also dark, with sternites 8-10 progressively lighter.

Pseudocloeon sp. C—Fairly common. Nymphs June 27—Sept. 13, mature. Middle Pine R., Popple R.,

Woods Cr. Description: Similar to *P. punctiventris*, but lacking the black spots on abdominal sternites.

HEPTAGENIIDAE

Epeorus Eaton, 1881

One species was common. The nymphs were identified by using the key by Needham et al. (1935).

E. (Iron) rubidus Traver, 1933—Common. Nymphs year-around, mature May 10—July 12. Fast water.

Heptagenia Walsh, 1863

All nymphs are included in Table 2 as *Heptagenia* spp. They occurred at all sites except site 20, and were very common in many parts of the river. Tentative identification indicated that most nymphs were *H. aphrodite* McDunnough, 1926, and *H. hebe* McDunnough, 1924. Mature nymphs were present from June to September.

Rhithrogena Eaton, 1881

The nymphs fit the description of *R. pellucida* by Daggy (1945). Some were collected by the samplers, but most were found in gravel riffles, sometimes only in a discrete portion of a riffle.

R. pellucida Daggy, 1945—Fairly common. Nymphs Nov. 9—July 12, mature May 4—July 12. Riffles. Fast water.

Stenonema Traver, 1933

This was one of the most abundant and widely distributed genera of mayflies in the Pine-Popple River. Seven species were found with most nymphs being collected by the samplers. Small nymphs were identified only to genus and included in Table 2 as *Stenonema* spp.

S. femoratum (Say), 1832—Rare. Nymphs Sept. 13—Nov. 9. Lower Pine R.

S. fuscum (Clemens), 1913—Abundant. Nymphs Sept. 13—June 28, mature May 4—June 28. Rocks. Entire river.

S. interpunctatum (Say), 1839—Common. Nymphs Sept. 13—July 12, mature June 28—July 12. Popple R., upper and lower Pine R.

S. mediopunctatum (McDunnough), 1926—(May be *S. nepotellum* (McDunnough), 1933). Fairly common. Nymphs Nov. 9. Lower Pine R.

S. pulchellum (Walsh), 1862—Rare. Nymphs Sept. 13, mature. Upper Pine R.

S. rubrum (McDunnough), 1926—Rare. Nymphs May 5—June 28. Rock riffles. Middle Pine R.

S. vicarium (Walker), 1853—Common. Nymphs July 27—May 21, mature May 21. Rocks and debris. Woods Cr., upper Popple R., upper and lower Pine R.

AMETROPODIDAE

Siphonoplecton Clemens, 1915

Nymphs of *S. basale* and *S. interlineatum* (Walsh), 1863 are almost identical and difficult to separate. Adults that were reared from nymphs collected from the Pine-Popple River were *S. basale*.

S. basale (Walker), 1853—Fairly common. Nymphs Sept. 13—May 10, mature May 5-10. Adults May 4. Slow water along banks. Pine and Popple R.

LEPTOPHLEBIIDAE

Leptophlebia Westwood, 1840

All nymphs were probably either *L. cupida* (Say), 1823, or *L. nebulosa* (Walker), 1853, but reliable characters for separating these species in the nymphal stage have not been found. Adults were reared, but all were females that also cannot be identified. Although nymphs were found throughout the river, they were most abundant where the flow was reduced. They were abundant in samplers in November, but were absent the following May, indicating emergence sometime during April.

Paraleptophlebia Lestage, 1917

Nymphs of this genus were also extremely abundant in the Pine-Popple River, being collected at every site. They were most abundant, however, where the current was at least moderately fast. They were least abundant in areas with reduced current where *Leptophlebia* predominated.

P. debilis (Walker), 1853—Uncommon. Nymphs June 28—July 27, mature July 27.

P. mollis (Eaton), 1871—Abundant. Nymphs July 23—May 10, mature May 10.

EPHEMERELLIDAE

Ephemerella Walsh, 1862

The excellent keys and descriptions by Edmunds (1959) and Allen and Edmunds (1961, 1962a, b, 1963a, b, and 1965) made it possible to identify nymphs of this genus. However, only the mature nymphs of *E. invaria* and *E. rotunda* could be separated, so numbers of these species are combined in Table 2. *E. invaria* was about twice as abundant as *E. rotunda*. *Ephemerella invaria*, *rotunda*, and *subvaria* were among the most abundant mayflies in the Pine-Popple River, and their nymphs were collected in the fall as well as in the spring. Nymphs of these 3 species that were collected in the fall are recorded in Table 2 as *Ephemerella* spp. Most nymphs were collected by the samplers.

E. attenuata McDunnough, 1925—Uncommon. Nymphs July 12-27, mature. Pine and Popple R.

E. bicolor Clemens, 1913—Uncommon. Nymphs Mar. 27—June 28, mature June 28. Slower waters.

E. cornuta Morgan, 1911—Uncommon. Nymphs May 10—June 28, mature June 28. Mostly Woods Cr.

E. deficiens Morgan, 1911—Very common. Nymphs June 27—Aug. 13, mature July 23—Aug. 13. Mostly middle Pine R. and Popple R.

E. invaria (Walker), 1853 and *E. rotunda* Morgan, 1911—Abundant. Nymphs Sept. 9—June 28, mature May 4—June 28. Fast water.

E. needhami McDunnough, 1925—Common. Nymphs May 9—June 28, mature June 28. Except

upper Pine R.

E. simplex McDunnough, 1925—Rare. Nymphs June 28-29. Popple R.

E. sordida McDunnough, 1925—Rare. Nymphs July 23—Aug. 8, mature. Pine and Popple R.

E. subvaria McDunnough, 1931—Abundant. Nymphs Aug. 8—May 21, mature Mar. 27—May 21. Entire river.

TRICORYTHIDAE

Tricorythodes Ulmer, 1920

Unfortunately nymphs could not be identified to species. Three species have been reported from Illinois and Michigan, and at least two of these, *T. atratus* (McDunnough) 1923 and *T. stygiatus* McDunnough 1931, probably occur in Wisconsin. Nymphs were collected mostly by the samplers, and they were most common in sections of the river with a moderate to fast current. They were found only in the summer, with emergence probably occurring in August and September.

CAENIDAE

Brachycercus Curtis, 1834

One nymph was found at site 11 on the Popple River, but it was too immature to identify. *Brachycercus* nymphs inhabit sand and silt in shallow water along the edges of streams. Additional sampling of such habitat in the Pine-Popple River might reveal the presence of more nymphs, but this genus is probably rare in the river. The species most likely to occur in the Popple River are *B. lacustris* (Needham), 1918 and *B. prudens* (McDunnough), 1931.

Caenis Stephens, 1835

Three species are known to occur in Wisconsin, but the nymphs cannot be positively identified to species. The nymphs were found throughout the Popple River and in the Pine River at all the sites above the dam. Some were collected from stagnant areas along the edges of the stream, but most were collected by the samplers. They were most numerous in July and August, at which time they were mature. The life cycle is probably one year, with emergence in August and September.

BAETISCIDAE

Baetisca Walsh, 1862

Only one species was found, and it was common only in sections of the river with a reduced flow. Nymphs were collected from sand, silt, and vegetation near shore, and were not collected by the samplers.

B. obesa (Say), 1839—Common. Nymphs year-around, all sizes.

EPHEMERIDAE

Ephemera Linnaeus, 1758

One species was found throughout the river in

sandy substrate, and was seldom collected by the samplers. The life cycle is probably one year.

E. simulans Walker, 1853—Common. Nymphs year-around. Adults June 20.

Hexagenia Walsh, 1863

The nymphs of one species were found burrowing into silt substrate, especially in the lower Pine River. This large species may have a 2-year life cycle with emergence primarily in June and July. Small nymphs were occasionally found in the samplers.

H. limbata (Serville), 1829—Fairly common. Nymphs year-around. Adults June 28.

POLYMITARCIDAE

Ephoron Williamson, 1802

The only species was distributed throughout the faster portions of the river where it was collected from sand and silt between rocks, and occasionally by the samplers.

E. leukon Williamson, 1802—Fairly common. Nymphs July 12—Sept. 11, mature Aug. 27—Sept. 11.

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Collections were made at 20 sites on the Pine-Popple River. Adults were collected with an 18-inch aerial net, and nymphs were collected mostly with a D-frame aquatic net. Some nymphs were found in samplers at each site, but except for *Boyeria vinosa* (Say) and *Calopteryx* spp., Odonata nymphs were collected infrequently by the samplers.

Thirty-nine species were collected; *Ophiogomphus carolus* Needham, *Lanthus albistylus* (Hagen), *Somatochlora minor* Calvert and *Somatochlora williamsoni* (Walker) are new records for Wisconsin (Ries, 1967). Only 20 species were collected from the river in the nymphal stage and could be definitely classified as breeding in the river. Of the remaining 19 species, some undoubtedly bred uncommonly in the river, but adults of many species typically wander considerable distances and this would account for the collection of species known to breed in ponds, lakes or marshes. Keys by Walker (1953 and 1958) and Needham and Westfall (1955) were used to identify adults and nymphs, with the identity of representatives of all species being confirmed by Dr. Minter J. Westfall, Jr., University of Florida.

Based on collections made from 1967 to 1969, the distribution and abundance of Odonata in the Pine-Popple River is reported in Table 3. This information and notes on the ecology and life cycle of each species are summarized as follows:

CALOPTERYGIDAE

The damselflies in this family completely dominated the zygopteran fauna. Their life cycle was 2 years, so nymphs were present year-around.

Calopteryx Leach, 1815

Nymphs were commonly found throughout the river clinging to vegetation and debris along the banks. Many were also collected by the samplers. Only at sites 3 and 4 just below the dam was this genus not collected. They were probably rare at these sites because of rocky shorelines and large daily fluctuations in the water level during periods of low water. Only the large nymphs could be identified to species, but adults could be readily identified, even in flight. The numbers in Table 3 are totals of identifiable nymphs, collections of adults, and counts of flying adults made in July and August 1968. Hundreds more could have been collected.

C. aequabilis Say, 1839—Abundant. Nymphs year-around. Adults June 20—Aug. 27. Slower water.

C. maculata (Beauvois), 1805—Abundant. Nymphs year-around. Adults June 20—Aug. 27. Fast water.

LESTIDAE

Lestes Leach, 1815

Adults of three species were collected, but since no nymphs were found it is quite possible that they did not develop within the Pine-Popple River but rather in some nearby pond or marsh.

L. disjunctus Selys, 1862—(*L. disjunctus disjunctus*) Uncommon. Adults Aug. 13-27. Upper Pine R., Popple R.

L. dryas Kirby, 1890—Rare. Adults July 9—Aug. 12. Pine R.

L. forcipatus Rambur, 1842—Rare. Adults Aug. 27. Upper Pine R.

COENAGRIONIDAE

Although several species were collected, none were common.

Argia Rambur, 1842

This genus appeared to be uncommon and very limited in its distribution. Two species were collected from widely separated areas.

A. moesta (Hagen), 1861—Uncommon. Nymphs Aug. 9. Adults July 27. Old Pine R. bed below dam.

A. violacea (Hagen), 1861—Uncommon. Adults July 24—Aug. 26. Upper Pine R.

Coenagrion Kirby, 1890

C. resolutum (Hagen), 1876—Rare. Nymphs May 27. Adults June 20. Upper Pine R., Popple R.

Enallagma Selys, 1876

Only 2 species of this normally abundant zygopteran genus were collected, and neither was common. Since both were collected only as adults, it is possible that development did not actually occur within the river.

E. exulans (Hagen), 1861—Rare. Adults July 29. Reservoir above Pine R. dam.

E. hageni Walsh, 1863—Uncommon. Adults June 29—Aug. 26. Popple R., upper Pine R.

Ischnura Charpentier, 1840

I. verticalis (Say), 1839—Rare. Adults June 16. Upper Pine R.

Nehalienia Selys, 1850

It is possible that *N. irene* breeds in the river, but only adults were collected.

N. irene (Hagen), 1861—Rare. Adults July 9-16. Upper Popple R., Woods Cr.

CORDULEGASTRIDAE

Only one species was collected.

Cordulegaster Leach, 1815

C. maculatus Selys, 1854—Uncommon. Nymphs year-around. Adults June 14—July 15. Upper and middle Pine R., Popple R., Woods Cr.

GOMPHIDAE

This was the dominant family of Anisoptera, with one or more species occurring at every site. All species apparently had at least 2-year life cycles, since nymphs of various sizes were found throughout the year.

Hagenius Selys, 1854

H. brevistylus Selys, 1854—Uncommon. Nymphs July 7—Aug. 25. Adults July 16—Aug. 13. Popple R., upper Pine R.

Ophiogomphus Selys, 1854

This genus was commonly represented throughout the entire river, and was probably the dominant anisopteran genus. Nymphs inhabited gravel bottoms and riffles at all sites except 1 and 20; many were too small to be determined to species. Three species were collected, but even the larger nymphs were very difficult to separate to species and some nymphal determinations could be in error.

O. carolus Needham, 1897—Fairly common. Nymphs year-around. Adults July 16—Aug. 13. Pine and Popple R.

O. colubrinus Selys, 1854—Fairly common. Nymphs year-around. Adults Aug. 26-27. Middle and upper Pine R., Popple R., Woods Cr.

O. rupinsulensis (Walsh), 1862—Uncommon. Nymphs year-around. Adults June 14—Aug. 15. Middle Pine R., upper Popple R.

Lanthus Needham, 1897

The distribution of the only species, *L. albistylus*, was restricted to the lower Popple River and the Pine River just below the mouth of the Popple River. In this area there were shallow gravel riffles, and nymphs were collected from these riffles.

L. albistylus (Hagen), 1878—Uncommon. Nymphs year-around. Adults July 15—Aug. 26.

Gomphurus Needham, 1901

G. ventricosus (Walsh), 1863—Rare. Adults June 29. Lower Pine R.

Gomphus Leach, 1815

G. lividus Selys, 1854—Fairly common. Nymphs year-around. Adults May 29—July 16. Sand or silt. Pine and Popple R.

Hylogomphus Needham, 1951

H. brevis (Hagen), 1878—Fairly common. Nymphs year-around. Adults May 29—July 24. Deeper water Pine and Popple R.

Stylurus Needham, 1897

S. scudderi (Selys), 1873—Uncommon. Nymphs probably year-around. Adults Aug. 26-27. Pine and Popple R.

AESHNIDAE

One of the 5 species, *Boyeria vinosa*, was very common throughout the river. All of the species probably have a 2-year life cycle.

Basiaeschna Selys, 1883

B. janata (Say), 1839—Uncommon. Nymphs year-around. Pine and Popple R.

Boyeria McLachlan, 1896

Nymphs were found in trash and under rocks in all parts of the river, and were frequently collected by the samplers. The only species, *B. vinosa*, could be readily identified in flight.

B. vinosa (Say), 1839—Common. Nymphs year-around. Adults Aug. 12—Sept. 13.

Aeshna Fabricius, 1775

Adults of this genus were most frequently observed

in August, although an occasional individual was seen as early as mid-July. The adults were very difficult to capture, and species could not be positively identified in the field.

A. canadensis Walker, 1908—Uncommon. Adults Aug. 26-27. May breed in Upper Pine R.

A. constricta Say, 1839—Rare. Adults Aug. 27. Probably does not breed.

A. umbrosa Walker, 1908—Fairly common. Nymphs year-around. Adults Aug. 25—Sept. 14. Middle and upper Pine R., Popple R., Woods Cr.

MACROMIIDAE

Macromia Rambur, 1842

Nymphs of several sizes were found throughout the year, indicating a 2- or 3-year life cycle for *M. illinoisensis*. Nymphs were found in silt-covered trash along the edges of the river where the current was slow.

M. illinoisensis Walsh, 1862—Uncommon. Nymphs year-around. Adults July 15. Mostly Popple R.

CORDULIIDAE

Although 6 species were collected, all were rare.

Somatochlora Selys, 1871

S. elongata (Scudder), 1866—Rare. Nymphs Aug. 26. Upper Pine R.

S. minor Calvert, 1898—Rare. Nymphs Aug. 26-27. Upper Pine R.

S. williamsoni Walker, 1907—Rare. Adults Aug. 25-26. Popple R.

Tetragoneuria Hagen, 1861

T. canis McLachlan, 1886—Rare. Nymphs May 27. Adults June 14. Upper Pine R.

T. cynosura (Say), 1839—Rare. Adults July 15. Middle Pine R.

T. spinigera Selys, 1871—Rare. Adults June 10 from swarm of 75-100. Middle Pine R. Probably does not breed in river.

LIBELLULIDAE

The species in this family do not normally breed in moving water, and it is unlikely that any develop in the Pine-Popple River. The adults often roam considerable distances, and were present at several sites.

Celithemis Hagen, 1861

The two adult *C. elisa* probably emerged from a nearby lake.

C. elisa (Hagen), 1861—Rare. Adults July 9. Pine R.

Plathemus Hagen, 1861

One adult was captured and 3 others were observed on the Pine River.

P. lydia (Drury), 1770—Rare. Adults June 14—July 16.

Sympetrum Newman, 1833

Numerous adults were captured along the Popple River, Woods Creek, and the upper Pine River, mostly

from sunny banks near roads. Many more were observed, but not collected. None of the species are likely to breed in the river; marshes, small ponds, ditches, etc. represent their normal breeding sites.

S. danae (Sulzer), 1776—Rare. Adults Aug. 27. Pine R.

S. internum Montgomery, 1943—Fairly common. Adults July 23—Aug. 27.

S. obtrusum (Hagen), 1867—Fairly common. Adults July 23—Aug. 27.

ACKNOWLEDGEMENTS

I wish to extend my sincere appreciation to Dr. Minter J. Westfall, Jr. for confirming identifications of adults and nymphs collected in this study. I also wish to thank Mr. Ken Tennesen, Mr. James Brooks, Mr. Steven Billmyer, and Mr. Jerry Longridge for their assistance in making the collections.

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TRICHOPTERA (Caddisflies) Jerry L. Longridge and William L. Hilsenhoff

Since less than 20% of the caddisfly larvae have been associated with adults and can be named, the study of the Trichoptera of the Pine-Popple River from June 1967 through June 1969 emphasized the collection of adults, most of which can be identified. At 20 previously established sites larvae were collected with artificial substrate samplers and aquatic nets, and sweep nets were used to capture adults.

Light-traps were also used to capture adult caddisflies, and played a very significant role in this study. Traps were run overnight at each of four sites (2, 8, 14, and 19) at intervals during the 2-year study period. These traps were 16-inch diameter, 16-inch high funnel traps similar to those described by Hallock (1932). A 1.8-amp incandescent lamp powered by a 12-volt storage battery was the light source. The traps had no top, and a pint jar at the bottom of the funnel contained either cyanide or 70% ethanol.

Keys and descriptions by Ross (1944) were used for most identifications of adults and larvae. Several additional publications (noted below) were consulted to verify identifications of adults, and studies by Vorhies (1909), Lloyd (1921), and Denning (1937) were used to verify larval identifications.

We collected 149 species, many of them only as

adults. Collections of adults by light-traps are reported in Table 4, more than half of the species being collected only by light-traps. Many of these species may not breed in the river, but rather in marshes, ponds, and streams nearby. Collections of larvae and adults from the river and its banks are reported in Table 5, and information on the distribution, abundance, identification, ecology, and biology of each species is summarized below. The designation (LT) indicates that adults were collected only by light-traps.

PHILOPOTAMIDAE

Keys and Descriptions: Ross (1944)

Chimarra Stephens, 1829

C. aterrima Hagen, 1861—Common. Larvae year-around, under stones. Adults June 29 (LT). Entire river.

C. feria Ross, 1941—Common. Larvae July, under stones. Adults May 28—Aug. 27. Pine and Popple R.

C. obscura (Walker), 1852—Common. Larvae Sept.—May, under stones. Adults June 3—Aug. 27. Upper and lower Pine R., upper Popple R.

C. socia Hagen, 1861—Abundant. Larvae Oct.—May, under stones. Adults June 3—Aug. 27. Entire river.

Table 4. Numbers of Adult Trichoptera Collected by Light-Traps at Four Sites on the Pine-Popple River.

Species	Site No.	Pine River			Woods Creek	Total
		2	14	19	8	
PHILOPOTAMIDAE						
<u>Chimarra aterrima</u>				1		1
<u>C. feria</u>				10		10
<u>C. obscura</u>	122			59		181
<u>C. socia</u>	45		22	19	1	87
<u>Dolophilodes distinctus</u>			8		63	71
PSYCHOMYIIDAE						
<u>Lype diversa</u>	45		29	6	48	128
<u>Neureclipsis bimaculatus</u>				2		2
<u>N. crepuscularis</u>	53		4	20	25	102
<u>Nyctiophylax vestitus</u>	22		40	12	26	100
<u>Phylocentropus placidus</u>	12			36	16	64
<u>Polycentropus aureolus</u>	1		1			2
<u>P. cinereus</u>			4	3	2	9
<u>P. confusus</u>			2	1	3	6
<u>P. flavus</u>			8	12	1	21
<u>P. interruptus</u>	1		2	8	3	14
<u>P. pentus</u>					1	1
<u>P. remotus</u>			14	5		19
<u>P. weedi</u>			2	2	4	8
<u>Psychomyia flavida</u>	95		71	374	17	557
HYDROPSYCHIDAE						
<u>Cheumatopsyche analis</u>	66		3	17	2	88
<u>C. aphantha</u>					9	9
<u>C. gracilis</u>	28		66	18	2	114
<u>C. minuscula</u>			7	6		13
<u>C. oxa</u>	48		1	94	7	150
<u>C. speciosa</u>			1	2		3
<u>Hydropsyche betteni</u>	191		7	15	2	215
<u>H. bifida</u>					1	1
<u>H. bronta</u>				22		22
<u>H. cheilonis</u>	10			12		22
<u>H. dicantha</u>	1		7	2		10
<u>H. hageni</u>			3	3		6
<u>H. morosa</u>	697		371	39	11	1,118
<u>H. placoda</u>	6			19		25
<u>H. scalaris</u>	5					5
<u>H. slossonae</u>	109		28	100	154	391
<u>H. sparna</u>			23	98		121
<u>H. vexa</u>	493		184	76	2	755
<u>H. walkeri</u>			89			89
<u>H. spp. (females)</u>				2	1	3
<u>Macronemum zebratum</u>	1					1
GLOSSOSOMATIDAE						
<u>Agapetus spp. (females)</u>					2	2
<u>Glossosoma intermedium</u>					6	6
<u>G. nigrilor</u>	59		82	7	124	272
<u>Protoptila erotica</u>	5		1		1	7
<u>P. maculata</u>	2					2
<u>P. tenebrosa</u>	78		5		3	86
HYDROPTILIDAE						
<u>Agraylea multipunctata</u>			36		10	46
<u>Hydroptila albicornis</u>	47			23	5	75
<u>H. amoena</u>	1		1	283		285
<u>H. consimilis</u>			1	3		4
<u>H. grandiosa</u>			2	27		29
<u>H. hamata</u>	2		30	5	62	99
<u>H. waubesiana</u>				1	1	2
<u>Mayatrichia ayama</u>			14	10		24
<u>Neotrichia spp.</u>	1					1
<u>Orthotrichia cristata</u>	1					1
<u>Oxyethira forcipata</u>	2		37			39
<u>O. serrata</u>	1		3			4
<u>O. spp. (females)</u>	68		135		121	324
<u>Stactobiella delira</u>	13		2	2	1	18

Table 4 - continued

Species	Site No.	Pine River			Woods Creek	Total
		2	14	19	8	
PHRYGANEDIDAE						
<u>Agrypnia straminea</u>			1			1
<u>Banksiola crotchi</u>	3		11	5	2	21
<u>B. smithi</u>			1			1
<u>Fabria complicata</u>				1	1	2
<u>Hagenella canadensis</u>	1		2	1	4	8
<u>Phryganea cinerea</u>			1			1
<u>Ptilostomis ocellifera</u>				4		4
<u>P. semifasciata</u>			1	4	1	6
GOERIDAE						
<u>Goera stylata</u>			28		1,045	1,073
BRACHYCENTRIDAE						
<u>Brachycentrus americanus</u>					8	8
<u>B. numerosus</u>					1	1
<u>Micrasema wataga</u>				1		1
<u>M. spp. (females)</u>	2		3		1	6
LIMNEPHILIDAE						
<u>Anabolia bimaculata</u>			7	14	5	26
<u>A. consocia</u>	1		1	3	1	6
<u>A. ozburni</u>	1		1	4		6
<u>Asynarchus montanus</u>				5	3	8
<u>Frenesia missa</u>				1	1	2
<u>Glyphopsyche irrorata</u>					1	1
<u>Hesperophylax designatus</u>				1	24	25
<u>Hydatophylax argus</u>	1		11	6	91	109
<u>Lenarchulus pulchellus</u>				1		1
<u>Leptophylax gracilis</u>					2	2
<u>Limnephilus argenteus</u>				4		4
<u>L. externus</u>				4		4
<u>L. hyalinus</u>				1		1
<u>L. indivisus</u>				2		2
<u>L. infernalis</u>			1	9		10
<u>L. janus</u>	1		1		1	3
<u>L. moestus</u>			2	13	2	17
<u>L. ornatus</u>			1	2		3
<u>L. parvulus</u>			1	16	2	19
<u>L. rhombicus</u>					2	2
<u>L. sericeus</u>	7		9	15	11	42
<u>L. submonilifer</u>			4	2	6	12
<u>Neophylax concinnus</u>	2		3			5
<u>N. fuscus</u>	2					2
<u>N. oligius</u>	1		2	31	1	35
<u>Onocosmoecus quadrinotatus</u>	1				2	3
<u>Platycentropus amicus</u>			1	3	1	5
<u>P. radiatus</u>				2		2
<u>Pycnopsyche aglona</u>				9		9
<u>P. guttifer</u>	4		16	13	5	38
<u>P. lepida</u>	18		10	4	33	65
<u>P. limbata</u>			1	1		2
<u>P. scabripennis</u>					2	2
<u>P. subfasciata</u>	5		13			18
LEPIDOSTOMATIDAE						
<u>Lepidostoma bryanti</u>	3		2	10	125	140
<u>L. griseum</u>			1			1
<u>L. sackeni</u>					1	1
<u>L. togatum</u>	1,120		48	15	180	1,363
<u>L. spp. (females)</u>	9		18	19	66	112
HELICOPSYCHIDAE						
<u>Helicopsyche borealis</u>	15		53	37		105
ODONTOCERIDAE						
<u>Psilotreta indecisa</u>	2					2
SERICOSTOMATIDAE						
<u>Sericostoma distinctum</u>	5		1	43		49

Table 4. - continued

Species	Site No.	Pine River			Woods Creek	Total
		2	14	19	8	
LEPTOCERIDAE						
<u>Athripsodes alagmus</u>		2				2
<u>A. ancylus</u>		2	1			3
<u>A. angustus</u>		6		1		7
<u>A. annulicornis</u>				5		5
<u>A. cancellatus</u>		1				1
<u>A. dilutus</u>		32	5	7		44
<u>A. erraticus</u>			1	1		2
<u>A. resurgens</u>				5		5
<u>A. tarsi-punctatus</u>		7		5		12
<u>A. transversus</u>		3		2		5
<u>Leptocerus americanus</u>			2	1		3
<u>Mystacides sepulchralis</u>				3		3
<u>Oecetis avara</u>		63	9	8	1	81
<u>O. inconspicua</u>		34	15	22		71
<u>O. ochracea</u>				1		1
<u>O. persimilis</u>		1	3			4
<u>O. spp. (females)</u>		1		1		2
<u>Setodes incerta</u>		1	11			12
<u>S. oligia</u>		3	4		2	9
<u>Triaenodes baris</u>		1		3		4
<u>T. injusta</u>			3	7	1	11
<u>T. marginata</u>			1			1
<u>T. sp. A.</u>			1	3		4
MOLANNIDAE						
<u>Molanna blenda</u>		1			2	3
<u>M. flavicornis</u>			6	5	1	12
<u>M. tryphena</u>		1	3	51		55
<u>M. uniophila</u>		100	13	26		139
<u>M. spp. (females)</u>		20	3	10	2	35

Dolophilodes Ulmer, 1909

D. distinctus (Walker), 1852—Common. Larvae year-around, fast water. Adults Mar. 27—Nov. 1. Woods Cr., middle Pine R., lower Popple R.

PSYCHOMYIIDAE

Keys and Descriptions: Ross (1941a, 1944); Bickle and Morse (1955); Flint (1964); Wiggins (1961).

Lype McLachlan, 1879

L. diversa (Banks), 1914—Common. Larvae Aug. and Oct., debris. Adults June 10—July 15. Entire river.

Neureclipsis McLachlan, 1864

The adults of 2 species were collected. Many larvae were also collected (Table 5), but could not be named and were recorded only as *Neureclipsis* spp. Larvae were present year-around, but were most commonly found in the fall.

N. bimaculatus (Linnaeus), 1758—Uncommon. Adults June 29—July 15 (LT).

N. crepuscularis (Walker), 1852—Very common. Adults June 10—Aug. 12. Entire river.

Nyctiophylax Brauer, 1865

N. vestitus (Hagen), 1861—Common. Larvae July

24. Adults June 29—Aug. 12. Entire river.

N. sp. A—Rare. Larvae July 24. Upper and lower Pine R.

Phylocentropus Banks, 1907

P. placidus (Banks), 1905—Common. Larvae Nov. Adults May 29—Aug. 27. Entire river.

Polycentropus Curtis, 1835

The larvae could be identified only to genus.

P. aureolus (Banks), 1930—Rare. Adults July 8-18 (LT).

P. cinereus Hagen, 1861—Uncommon. Adults June 10—Aug. 12. Except lower Pine R.

P. confusus Hagen, 1861—Uncommon. Adults June 10—July 15 (LT).

P. flavus (Banks), 1908—Fairly common. Adults June 10—July 15. Upper Pine R., Woods Cr.

P. interruptus (Banks), 1914—Fairly common. Adults June 10—July 15 (LT).

P. pentus Ross, 1941—Rare. Adults June 10 (LT).

P. remotus Banks, 1911—Fairly common. Adults June 10—Aug. 12 (LT).

P. weedi Bickle and Morse, 1955—Uncommon. Adults June 29—July 15 (LT).

Table 5. Numbers of Trichoptera Collected at 20 Sites on the Pine-Popple River.

Species	Site No.	Pine River										Popple River					Woods Creek	Total					
		1	2	3	4	5	6	10	14	15	17	18	19	20	7	9	11	12	13	16	8	Adults	Larvae
PHILOPOTAMIDAE																							
<u>Chimarra aterrima</u>		2			1	5	15	5	4	11	3		29			5	2	7	3	4	113		209
<u>C. feria</u>					1	1*	1*	3*					149			2*	15	25*	12*			194	15
<u>C. obscura</u>			1	1*	1								37					6				8	38
<u>C. socia</u>	1	7	36	3	165	73	108	50	39	3			11	14	57	5	33	14	2	2	171	452	
<u>Dolophilodes distinctus</u>					3	1	1	1						2	9						192	189	20
PSYCHOMYIIDAE																							
<u>Lyte diversa</u>	2		7*		2*	2*			1									1*	2	1*	7*	22	3
<u>Neureclipsis crepuscularis</u>										1*		2*										3	
<u>N. spp. (larvae)</u>	22	159			12	22	1			2	9	47	16	9	1	11	4	14	5	18			352
<u>Nyctiophylax sp. A</u>	1											1	1										3
<u>N. vestitus</u>										1*			1										1
<u>Phyllocentropus placidus</u>	15	1*	1*		10*	18*				1*	18*	2*	6*		1*			1*		1*	3*	77	1
<u>Polycentropus cinereus</u>																1*						1	1
<u>P. flavus</u>																					5*	5	
<u>P. spp. (larvae)</u>	15	5								2	1	47	33			6	1	2	9				121
<u>Psychomyia flavida</u>			3	2	6*		1*	1*	8	3	3				12*	1*	1				5*	38	8
HYDROPSYCHIDAE																							
<u>Cheumatopsyche analis</u>		1*	22*		5*	2*			2*		1*										2*	35	
<u>C. gracilis</u>			10*		2*	1*		3*	1*		1*					2*		1*				21	
<u>C. minuscula</u>			2*														1*		2*			5	
<u>C. spp. (larvae)</u>	2	94	31	86	608	595	300	334	225	126	44	310	661	352	216	60	80	172	227	194			4,717
<u>Hydropsyche betteni</u>			1*	10	6	15	11	20	4	6	12	11	34	6	12	9	5	43	16		8	1	228
<u>H. bronta</u>																					1*	1	
<u>H. hageni</u>																	1*					1	
<u>H. morosa</u>		1*	5*		1*			1*	2*	1*						1*						12	
<u>H. placoda</u>			2*																			2	
<u>H. slossonae</u>		5	3	3	12	129	94	17	14	10	31	8	11	22	5	7	8	75	17	236			707
<u>H. sparna</u>												1*										1	
<u>H. spp. (females)</u>																					2*	2	
<u>H. spp. (larvae)</u>	14	55	48	171	145	256	509	566	463	114	39	232	31	216	138	39	34	185	100	90			3,445
<u>Macronemum zebratum</u>			70																			52	18
RHYACOPHILIDAE																							
<u>Rhyacophila acropedes</u>									1														1
<u>R. fuscula</u>															1*							1	
GLOSSOSOMATIDAE																							
<u>Glossosoma intermedium</u>																				3*		3	
<u>G. nigrior</u>			4*		2*	2*	1*	5*	7*			1*		1*	29*	2*	8*		3*			65	
<u>G. spp. (larvae)</u>	4		14	4	61	2	42	57	81			2		27	21	9	22				27		373
<u>Protoptila erotica</u>			1*																			1	
<u>P. tenebrosa</u>				4*				1*	1*						39*		1*	2*				48	
HYDROPTILIDAE																							
<u>Hydroptila consimilis</u>					1							30	20		7	4		28	1				91
<u>H. grandiosa</u>									1			1											2
<u>H. hamata</u>												1											1
<u>H. waubesiana</u>																			1				1
<u>H. spp. (larvae)</u>												2											2
<u>Leucotrichia pictipes</u>	1*							6*	1*						4*	1*	11					22	2
<u>Oxyethira serrata</u>									1*													1	
<u>O. spp. (larvae)</u>									2														12
PHRYGANEIDAE																							
<u>Agrypnia straminea</u>																						1	1
<u>Ptilostomis spp. (larvae)</u>	1	7	1					7	5	4	3	13		1	1	3			5				51
BRACHYCENTRIDAE																							
<u>Brachycentrus americanus</u>					3					2	2				5			1		11	5		19
<u>B. lateralis</u>																				53	13		40
<u>B. numerosus</u>									7	4	1	8						5	12	4	33	29	81
<u>B. occidentalis</u>																					1*	1	
<u>B. spp. (larvae)</u>																		1		1			2
<u>Micrasema rusticum</u>																		5	1*	4		1	10
<u>M. spp. (larvae)</u>						2		1										1	2		2		9

Table 5. - continued

Species	Site No.	Pine River										Popple River					Woods Creek	Total						
		1	2	3	4	5	6	10	14	15	17	18	19	20	7	9	11	12	13	16	8	Adults	Larvae	
LIMNAPHILIDAE																								
<u>Anobolia consocia</u>				3*																			3	
<u>Asynarchus</u> spp. (larvae)										1													1	
<u>Glyphopsyche irrorata</u>																							3	
<u>Hydatophylax argus</u>	1					1	2	3	3	2	1	4	2	1		1	1	1		12			37	
<u>Ironoquia punctatissima</u>			1																				1	
<u>Limnephilus argenteus</u>																				1*	1			
<u>L. spp.</u> (larvae)	4	9	14			6	22	20	10	6	9	32	38		12			31	13	5		231		
<u>Nemotaulius hostilis</u>												2				1	1					4		
<u>Neophylax consimilis</u>																				1		1		
<u>N. fuscus</u>	1*	58*	3		3	3*		12*								1*	2	13*	1*	94	3			
<u>N. oligius</u>			3					1*	3				3*			1*	2	8	2	9	14			
<u>N. spp.</u>																		1			1			
<u>Onocosmoeus quadrinotatus</u>																				2		2		
<u>Platycentropus amicus</u> or																								
<u>radiatus</u>	1		3		7	31	2	3	7	21	4	37	28	1		84	17	3	40			289		
<u>Pycnopsyche aglona</u>										4*			1*									5		
<u>P. guttifer</u>	1*												3*									4		
<u>P. lepida</u>		1*								1*												2		
<u>P. subfasciata</u>	2*	11*			2*	4*	2*	1*								5*						27		
<u>P. spp.</u> (larvae)	1		3		7	31	2	3	7	21	4	37	28	1		84	17	3	40			289		
LEPIDOSTOMATIDAE																								
<u>Lepidostoma togatum</u>			3*																			3		
<u>L. spp.</u> (larvae)	2	74	14	1	211	126	19	32	9	1		4		33	19		4	2	3	164			718	
HELICOPSYCHIDAE																								
<u>Helicopsyche borealis</u>		3	24		3				11	1		3	2	1	5	8	1*	3	1	1*	29	38		
ODONTOCERIDAE																								
<u>Psilotreta indecisa</u>			6																			2		
SERICOSTOMATIDAE																								
<u>Sericostoma distinctum</u>								1					1*	1				1			1			
LEPTOCERIDAE																								
<u>Athripsodes ancylus</u>													1					2			3			
<u>A. dilutus</u>		1			1																	2		
<u>A. flavus</u>												2										2		
<u>A. sp. A</u>												2										2		
<u>Leptocella pavida</u>									13*		1*						1*	2*			17			
<u>Mystacides sepulchralis</u>						1				2		6	5			2	1	10	19			36		
<u>Oecetis avara</u>		16*	2		2*		1	1									2	1	10	10			17	
<u>O. spp.</u> (larvae)		2				13	3	2	2			3	12	8				3	7	1	1			57
<u>Setodes incerta</u>															2*							2		
<u>S. spp.</u> (larvae)						1	1	1	1									3			7			
<u>Trienodes marginata</u>																		1			1			
<u>T. spp.</u> (larvae)		2									2											4		
MOLANNIDAE																								
<u>Molanna tryphena</u>																			1*			1		
<u>M. spp.</u> (larvae)			2							2	1						1	1			7			

* = adults only.

Psychomyia Pictet, 1834

P. flavida Hagen, 1861—Very common. Larvae year-around, gravel, debris. Adults June 10—Sept. 13. Entire river.

HYDROPSYCHIDAE

Keys and Descriptions: Ross (1938b, 1944).

Members of this family were abundant throughout the river.

Cheumatopsyche Wallengren, 1891

Adults were readily identified by the structures of their genitalia, but no reliable keys or descriptions were available to separate larvae.

C. analis (Banks), 1903—Abundant. Adults May 28—Aug. 12. Pine R., Woods Cr.

C. aphanta Ross, 1938—Fairly common. Adults Aug. 12 (LT).

C. gracilis (Banks), 1899—Abundant. Adults June 29—Aug. 13. Entire river.

C. minuscula (Banks), 1907—Common. Adults June 10—July 15. Entire river.

C. oxa Ross, 1938—Abundant. Adults June 10—July 15 (LT).

C. speciosa (Banks), 1904—Uncommon. Adults July 15—Aug. 12 (LT).

Hydropsyche Pictet, 1834

Although larvae of several species have been described, many remain inseparable or unknown and are included in Table 5 as *Hydropsyche* spp.

H. betteni Ross, 1938—Common. Larvae Mar.—Nov., under stones. Adults July 8—Aug. 12. Entire river.

H. bifida Banks, 1905—Rare. Adults June 10 (LT).

H. bronta Ross, 1938—Fairly common. Adults June 3—Aug. 12. Woods Cr; upper Pine R.

H. cheilonis Ross, 1938—Fairly common. Adults June 3—Aug. 12 Woods cr., upper Pine R.

H. dicantha Ross, 1938—Uncommon. Adults June 29—July 15 (LT).

H. hageni Banks, 1905—Uncommon. Adults May 28—July 15. Pine and Popple R.

H. morosa Hagen, 1861—Abundant. Adults May 28—Sept. 11. Mostly Pine R.

H. placoda Ross, 1941—Fairly common. Adults July 8-27. Pine R.

H. scalaris Hagen, 1861—Uncommon. Adults July 15 (LT).

H. slossonae Banks, 1905—Abundant. Larvae Nov.—May. Adults June 3—Nov. 15 (LT).

H. sparna Ross, 1938—Common. Adults May 28—Aug. 26. Middle and upper Pine R.

H. vexa Ross, 1938—Abundant. Adults June 29—Aug. 12 (LT).

H. walkeri Betten and Mosely, 1940—Common. Adults June 29—Aug. 12 (LT).

Macronemum Burmeister, 1839

M. zebratum (Hagen), 1861—Fairly common. Larvae Nov.—July, rapids. Adults June 29—July 16. Lower Pine R.

RHYACOPHILIDAE

Keys and Descriptions: Ross (1938b, 1944); Nimmo (1971); Flint (1962).

Rhyacophila Pictet, 1834

R. acropedes Banks, 1914—Rare. Larvae July 14—Sept. 13, riffles. Pine R. (One larva from the Pine R., Florence Co., but site number not recorded).

R. fuscata (Walker), 1852—Rare. Adults Aug. 27. Popple R.

GLOSSOSOMATIDAE

Keys and Descriptions: Ross (1944); Leonard and Leonard (1949).

Agapetus Curtis, 1834

Only adult males can be named; both records were adult females captured by a light-trap on June 15.

Glossosoma Curtis, 1834

Two species of adults were collected. The larvae are undescribed, but probably were mostly *G. nigrior*.

G. intermedium (Klapalek), 1892—Uncommon. Adults May 28—June 10. Woods Cr.

G. nigrior Banks, 1911—Abundant. Adults Apr. 28—Sept. 13. Entire river.

Protoptila Banks, 1904

Three species of adults were collected. The larvae probably inhabit the river but were overlooked because of their small size.

P. erotica Ross, 1938—Uncommon. Adults June 10—July 15. Pine R., Woods Cr.

P. maculata (Hagen), 1861—Rare. Adults July 15 (LT).

P. tenebrosa (Walker), 1852—Common. Adults June 10—Aug. 13. Entire river.

HYDROPTILIDAE

Keys and Descriptions: Ross (1944).

Agraylea Curtis, 1834

No larvae were collected, probably because of their small size.

A. multipunctata Curtis, 1834—Fairly common. Adults May 28—Aug. 15 (LT).

Hydroptila Dalman, 1819

Six species were collected as adults. The most common species, *H. amoena*, is not known in the larval stage, so its larvae may have been mistaken for some other species such as *H. consimilis*. The larvae of other species were identified by color patterns (Ross, 1944). Two larvae were not named.

H. albicornis Hagen, 1861—Fairly common. Adults June 10—Aug. 12 (LT).

H. amoena Ross, 1938—Common. Adults May 28—June 10 (LT).

H. consimilis Morton, 1905—Uncommon. Larvae Nov.—July, riffles. Adults July 8—Aug. 12 (LT). Pine and Popple R.

H. grandiosa Ross, 1938—Fairly common. Larvae Nov.—Aug., riffles. Adults June 10—Aug. 12 (LT). Mostly upper Pine R.

H. hamata Morton, 1905—Common. Larvae July,

riffles. Adults May 29–Aug. 12 (LT). Entire river, especially fast water.

H. waubesiana Betten, 1934—Rare. Larvae Sept., riffles. Adults May 28–June 29(LT).

Leucotrichia Mosely, 1934

L. pictipes (Banks), 1911—Uncommon. Larvae Nov.–Mar., rocks in rapids. Adults June 10–Aug. 3. Pine and Popple R.

Mayatrichia Mosely, 1937

M. ayama Mosely, 1937—Uncommon. Adults Aug. 12 (LT).

Neotrichia Morton, 1905

One female was collected, but could not be positively identified.

Neotrichia spp.—Rare. Adult Aug. 12 (LT).

Orthotrichia Eaton, 1873

O. cristata Morton, 1905—Rare. Adult July 15 (LT).

Oxyethira Eaton, 1873

Only adult males were named; larvae and females could not be identified and were included in Tables 4 and 5 as *Oxyethira* spp. Larvae were collected from backwaters from November to March. Adult females were present from June to August.

O. forcipata Mosely, 1934—Common. Adults June 10 (LT).

O. serrata Ross, 1938—Fairly common. Adults June 10–July 15. Mostly middle Pine R.

Stactobiella Martynov, 1924

S. delira (Ross), 1938—Uncommon. Adults June 10–July 15 (LT).

PHRYGANEIDAE

Keys and Descriptions: Ross (1944); Wiggins (1960, 1961).

Agrypnia Curtis, 1835

A. straminea Hagen, 1873—Rare. Larvae Sept. 12, near shore. Adults Aug. 12 (LT). Middle and upper Pine R.

Banksiola Martynov, 1924

B. crotchii Banks, 1944—Uncommon. Adults June 29–July 15 (LT).

B. smithi (Banks), 1914—Rare. Adults Aug. 12 (LT).

Fabria Milne, 1934

F. complicata (Banks), 1924—Rare. Adults June 10 (LT).

Hagenella Martynov, 1924

H. canadensis (Banks), 1907—Uncommon. Adults June 10–July 15 (LT).

Ptilostomis Kolenati, 1859

The larvae cannot be identified (Wiggins, 1960). They were fairly common in vegetation along the banks of the river from October to May and are probably either *P. ocellifera* or *P. semifasciata*.

P. ocellifera (Walker), 1852—Uncommon. Adults June 10 (LT).

P. semifasciata (Say), 1828—Fairly common.

Adults May 28–July 8 (LT).

Phryganea Linnaeus, 1758

P. cinerea Walker, 1852—Rare. Adult July 8 (LT).

GOERIDAE

Keys and Descriptions: Ross (1944).

Goera Curtis, 1834

Although no larvae were found, the large number of adults collected by light-traps suggests that larvae were probably present in Woods Creek and other fast water areas that are typical of their known habitat (Ross, 1944).

G. stylata Ross, 1938—Abundant. Adults May 28–June 29 (LT). Mostly Woods Cr.

BRACHYCENTRIDAE

Keys and Descriptions: Ross (1938b, 1944).

Brachycentrus Curtis, 1834

All species emerged in late May and early June, with *B. americanus* also emerging in August. Only the larvae of *B. americanus*, *B. lateralis*, and *B. numerosus* have been described (Ross, 1944). The undescribed larvae may be those of *B. occidentalis*.

B. americanus (Banks), 1899—Fairly common. Larvae May–Aug., logs, submerged vegetation. Adults May 18–Aug. 27. Mostly Woods Cr.

B. lateralis (Say), 1823—Fairly common. Larvae Aug.–Mar., riffles. Adults May 29–June 3. Woods Cr.

B. numerosus (Say), 1823—Common. Larvae Sept.–June, pools. Adults May 28–June 3. Upper Pine R., upper Popple R., Woods Cr.

B. occidentalis Banks, 1911—Rare. Adults May 29. Woods Cr.

Micrasema McLachlan, 1876

Two species were identified from adult males; females collected July 8-15 could not be named. Undescribed larvae with light-brown heads that lacked muscle scars were found from September to May in addition to the larvae of *M. rusticum*, and may be the larvae of *M. wataga* (Table 5).

M. rusticum (Hagen), 1868—Uncommon. Larvae Oct.–May, under stones. Adults June 11. Mostly upper Popple R.

M. wataga Ross, 1938—Rare. Adults July 15 (LT).

LIMNEPHILIDAE

Keys and Descriptions: Ross (1938a, 1938b, 1941b, 1944, 1946); Betten (1934, 1950); Kimmins and Denning (1951); Nimmo (1971); Flint (1960).

Anabolia Stephens, 1837

Adults of 3 species were collected, but no larvae were found.

A. bimaculata (Walker), 1852—Fairly common. Adults July 15–Aug. 12 (LT).

A. consocia (Walker), 1852—Uncommon. Adults July 15–Aug. 12.

A. ozburni (Milne), 1935—Uncommon. Adults June 29–July 17 (LT).

Asynarchus McLachlan, 1880

Adults of only one species were found, and the single larvae collected Aug. 19 may also be this species.

A. montanus (Banks), 1907—Uncommon. Adults June 29—July 16 (LT).

Frenesia Betten and Mosely, 1940

F. missa (Milne), 1935—Rare. Adults Oct. 19 (LT).

Glyphopsyche Banks, 1904

G. irrorata (Fabricius), 1781—Rare. Larvae July, near shore. Adults Aug. 27 (LT). Upper Pine R., Woods Cr.

Hesperophylax Banks, 1916

H. designatus (Walker), 1857—Uncommon. Adults June 10-29 (LT).

Hydatophylax Wallengren, 1891

H. argus (Harris), 1869—Common. Larvae Aug.—May, rocks. Adults June 10—July 8 (LT). Entire river.

Ironoquia Banks, 1916

I. punctissima (Walker), 1852—Rare. Larvae Oct. 19, aquatic vegetation. Lower Pine R.

Lenarchulus Schmid, 1952

L. pulchellus (Banks), 1908—Rare. Adults June 29 (LT).

Leptophylax Banks, 1900

L. gracilis Banks, 1900—Rare. Adults July 8 (LT).

Limnephilus Leach, 1815

Twelve species were collected as adults. The larvae of only 4 of these have been described (Flint, 1960), so all of the many larvae that were found could not be reliably identified and are reported in Table 5 as *Limnephilus* spp.

L. argenteus Banks, 1908—Uncommon. Adults June 3—10. Upper Pine R., Woods Cr.

L. externus Hagen, 1981—Uncommon. Adults Sept. 13 (LT).

L. hyalinus Hagen, 1861—Rare. Adults Aug. 12 (LT).

L. indivisus Walker, 1852—Rare. Adults Aug. 12—Sept. 13 (LT).

L. infernalis (Banks), 1914—Fairly common. Adults Sept. 13 (LT).

L. janus Ross, 1938—Uncommon. Adults July 14—Aug. 12 (LT).

L. moestus Banks, 1908—Fairly common. Adults June 10—Sept. 12 (LT).

L. ornatus Banks, 1897—Uncommon. Adults May 28—Aug. 12 (LT).

L. parvulus (Banks), 1905—Fairly common. Adults May 28—June 29 (LT).

L. rhombicus (Linnaeus), 1758—Rare. Adults June 10-29 (LT).

L. sericeus (Say), 1824—Common. Adults June 10—Sept. 13 (LT).

L. submonilifer Walker, 1852—Fairly common. Adults May 28—June 29 (LT).

Nemotaulius Banks, 1906

N. hostilis (Hagen), 1864—Rare. Larvae Nov.

Popple R., upper Pine R.

Neophylax McLachlan, 1871

N. concinnus McLachlan, 1871—Rare. Adults Sept. 13 (LT).

N. consimilis Betten, 1934—Rare. Larvae Nov. 16, riffles. Woods Cr.

N. fuscus Banks, 1903—Common. Larvae May 18, rapids. Adults Sept. 13. Entire river.

N. ologius Ross, 1938—Fairly common. Larvae Mar.—May, riffles. Adults Aug. 26—Sept. 19. Entire river.

Onocosmoecus Banks, 1943

O. quadrinotatus (Banks), 1908—Rare. Larvae May 15, pool. Adults Aug. 27—Sept. 13 (LT). Woods Cr., lower Pine R.

Platycentropus Ulmer, 1905

The larvae were common throughout the Pine and Popple River, from September to May, but they could not be identified to species. Two species of adults were encountered.

P. amicus (Hagen), 1861—Common. Adults July 17—Sept. 13 (LT).

P. radiatus (Say), 1824—Fairly common. Adults June 29 (LT).

Pycnopsyche Banks, 1905

The larvae were found throughout the year, but could not be identified with certainty, and are included in Table 5 as *Pycnopsyche* spp. Adults of 6 species were collected.

P. aglona Ross, 1941—Fairly common. Adults Aug. 26—Sept. 14. Upper Pine R.

P. guttifer (Walker), 1852—Common. Adults Aug. 26—Sept. 14. Entire river.

P. lepida (Hagen), 1861—Common. Adults May 12—Sept. 13. Entire river.

P. limbata (McLachlan), 1871—Rare. Adults Aug. 12—Sept. 13 (LT).

P. scabripennis (Rambur), 1842—Rare. Adults Aug. 12 (LT).

P. subfasciata (Say), 1828—Common. Adults Aug. 12—Sept. 13. Middle and lower Pine R., lower Popple R.

LEPIDOSTOMATIDAE

Keys and Descriptions: Ross (1946); Leonard and Leonard (1949).

Lepidostoma Rambur, 1842

Females of some species and all of the larvae could not be identified. Unidentified females were collected from June to August, and larvae were found from August to May.

L. bryanti (Banks), 1908—Common. Adults June 10 (LT).

L. griseum (Banks), 1911—Rare. Adults Aug. 12 (LT).

L. sackeni (Banks), 1936—Rare. Adults Aug. 12 (LT).

L. togatum (Hagen), 1867—Abundant. Adults June 10—Sept. 13. Mostly lower Pine R.

HELICOPSYCHIDAE

Keys and Descriptions: Ross (1944).

Helicopsyche Hagen, 1866

H. borealis (Hagen), 1861—Common. Larvae May–Sept., stones. Adults June 29–Aug. 27. Entire river.

ODONTOCERIDAE

Keys and Descriptions: Ross (1944).

Psilotreta Banks, 1899

P. indecisa (Walker), 1852—Uncommon. Larvae Nov. 16, rapids. Adults June 10. Lower Pine R.

SERICOSTOMATIDAE

Keys and Descriptions: Betten (1934).

Sericostoma Berthold, 1827

The larvae were assumed to be *S. distinctum* since this was the only species collected as an adult but larval identification must be considered tentative.

S. distinctum (Ulmer), 1905—Fairly common. Larvae Nov.–May. Adults July 8–Aug. 12. Pine and Popple R.

LEPTOCERIDAE

Keys and Descriptions: Ross (1944); Yamamoto and Wiggins (1964).

Athripsodes Billberg, 1820

Adults of 10 species were collected by the light traps, but none were common. Nine larvae were found from November to May, but they were difficult to collect because of their small size and protective coloration. Since half of the species collected as adults have undescribed larvae, larval identifications must be regarded as tentative.

A. alagmus Ross, 1938—Rare. Adults July 15 (LT).

A. ancyllus (Vorhies), 1909—Uncommon. Larvae Nov.–May, riffles, Adults June 29–July 15 (LT). Pine and Popple R.

A. angustus (Banks), 1914—Uncommon. Adults July 15–Aug. 12 (LT).

A. annulicornis (Stephens), 1836—Rare. Adults June 10–29 (LT).

A. cancellatus (Betten), 1934—Rare. Adults July 15 (LT).

A. dilutus (Hagen), 1861—Fairly common. Larvae Nov., slow water. Adults June 10–July 15 (LT). Pine R.

A. erraticus Milne, 1936—Rare. Adults May 28–June 10 (LT).

A. flavus (Banks), 1904—Rare. Larvae Nov., riffles. Upper Pine R.

A. resurgens (Walker), 1852—Rare. Adults June 10–Aug. 12 (LT).

A. tarsi-punctatus (Vorhies), 1909—Uncommon. Adults July 8–Aug. 12 (LT).

A. transversus (Hagen), 1861—Rare. Adults June 29–Aug. 12 (LT).

A. sp. A of Ross, 1944—Rare. Larvae Nov.–May,

riffles. Upper Pine R.

Leptocella Banks, 1899

Adults of one species were collected as they swarmed over the stream.

L. pavida (Hagen), 1861—Uncommon. Adults Aug. 26–Sept. 11. Pine and Popple R.

Leptocerus Leach, 1815

L. americanus (Banks), 1899—Rare. Adults July 15 (LT).

Mystacides Berthold, 1827

M. sepulchralis (Walker), 1852—Fairly common. Larvae May–Sept., slow water, under stones. Adults June 10–Aug. 26. Pine and Popple R.

Oecetis McLachlan, 1877

Larvae of several species are undescribed and are included in Table 5 as *Oecetis* spp. Two adult females that could not be named were also collected and are included in Table 4 as *Oecetis* spp.

O. avara (Banks), 1895—Common. Larvae Sept.–June, rapids. Adults June 10–Aug. 12. Entire river.

O. inconspicua (Walker), 1852—Common. Adults June 10–Aug. 12 (LT).

O. ochracea (Curtis), 1852—Rare. Adults July 15–Aug. 12 (LT).

O. persimilis (Banks), 1907—Rare. Adults July 8–15 (LT).

Setodes Rambur, 1842

Two species were collected as adults. Larvae were found from November to July, but could not be named.

S. incerta (Walker), 1852—Uncommon. Adults July 16–Aug. 12. Pine and Popple R.

S. oligia (Ross), 1938—Uncommon. Adults July 8–Aug. 12 (LT).

Triaenodes McLachlan, 1865

Four species were collected as adults, one of which is undescribed. Four larvae that could not be identified were also found; they may be the larvae of *T. baris* or *T. sp. A*.

T. baris Ross, 1938—Rare. Adults June 29–July 15 (LT).

T. injusta (Hagen), 1861—Uncommon. Adults July 8–Aug. 12 (LT).

T. marginata Sibley, 1926—Rare. Larvae June 27, riffles. Adult July 15 (LT). Pine and Popple R.

T. sp. A—Rare. Adults July 8–15 (LT).

MOLANNIDAE

Molanna Curtis, 1834

Characters have not been found by which adult females and larvae can be identified to species. They are recorded as *Molanna* spp. Adult males of 4 species were collected.

M. blenda Sibley, 1926—Rare. Adults July 8–Aug. 12 (LT).

M. flavicornis Banks, 1914—Uncommon. Adults May 28–Aug. 12 (LT).

M. tryphena Betten, 1934—Fairly common. Adults

June 10–Sept. 13. Pine and Popple R.

M. uniophila Vorhies, 1909—Common. Adults June 10–Aug. 12 (LT).

ACKNOWLEDGEMENTS

We wish to thank Dr. Oliver Flint, Jr., U. S. National Museum, for verifying and correcting identifications of adult Limnephilidae, and Dr. Glenn B. Wiggins and Mr. Toshio Yamamoto, Royal Ontario Museum, for verifying and correcting identifications in other families. We also wish to thank Mr. James Searles for constructing the light-traps and making many of the initial collections used in this study.

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MEGALOPTERA (Fishflies and Alderflies) Wm.L. Hilsenhoff and K.J. Tennesen

Only 2 genera and 3 species were collected, but all were encountered frequently. Collections were made from August 1967 to August 1969. Larvae were collected by artificial substrate samplers or with a D-frame aquatic net from 20 sites, and since all the species have 2- or 3-year life cycles, larvae were found throughout the year. Adults were collected by sweeping shoreline vegetation with a net or by netting flying individuals.

The distribution and abundance of each species is reported in Table 6. This information and notes on the identification, ecology, and life cycle of each species are summarized as follows:

CORYDALIDAE

Keys and Descriptions: Davis (1903); Banks (1908); (adults); Neunzig (1966) (larvae).

Nigronia Banks, 1908

N. serricornis (Say), 1824—Common. Larvae year-around. Adults June 10—July 16. Entire river, especially in fast water with large rocks.

SIALIDAE

Keys and Descriptions: Ross (1937) (adults).

Sialis Latreille, 1802

Larvae cannot be identified to species. They were collected only from the upper and lower sections of the Pine River, and from the upper reaches of the

Popple River at sites where the bottom contained sand or silt and the current was not extremely rapid.

S. itasca Ross, 1937—Uncommon. Adults June 20. Pine R.

S. vagans Ross, 1937—Fairly common. Adults May 28—June 20. Upper Pine R. and upper Popple R.

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Table 6. Numbers of Megaloptera Collected at 20 Sites on the Pine-Popple River.

Species	Site No.	Pine River										Popple River					Woods Creek	Total					
		1	2	3	4	5	6	10	14	15	17	18	19	20	7	9	11	12	13	16	8	Adults	Larvae
<i>Nigronia serricornis</i>		1	3	17		44	11	5	4	3	4	2	3		3	6	2	7	3	5	18	45	96
<i>Sialis itasca</i> (adults)						2	1															3	
<i>S. vagans</i> (adults)											4		1							1		6	
<i>Sialis</i> larvae		3	15	3		1					1	2	2	3					4		1		35

Although aquatic insects were collected from June 1967 through August 1969, a concerted effort was made to collect Hemiptera only from March to November 1968, and again in August 1969. Collections were made at the 20 sites previously described. The semi-aquatic Hemiptera (those living on the surface of the water) were captured with an aquatic net when they were sighted. Aquatic Hemiptera (those living under the water's surface) and some semi-aquatic species were captured by working a D-frame aquatic net into the bank or upstream through debris along the bank.

Four families of aquatic Hemiptera (Belostomatidae, Corixidae, Nepidae, and Notonectidae) and four families of semi-aquatic Hemiptera (Geridae, Hydrometridae, Mesoveliidae, and Veliidae) were collected. Riparian families such as Saldidae were not included in this study. Most aquatic Hemiptera used the river as an overwintering site and reached a peak of abundance in late fall and early winter. The semi-aquatic Hemiptera, however, bred in the river and reached a peak of abundance in mid or late summer.

I collected 47 species of aquatic and semi-aquatic Hemiptera. Their distribution and abundance are reported in Tables 7 and 8. This information and notes on ecology, biology, and identification are summarized as follows:

BELOSTOMATIDAE (Giant Water Bugs)

Keys and Descriptions: Cummings (1933); Lauck (1964).

Only 10 individuals in 2 genera were collected (Table 7). Since 9 were adults that were collected in late fall or early spring, it indicates that this family used the river mostly as an overwintering site, the adults flying into the river from nearby ponds. However, one nymph of *Belostoma flumineum* was collected at site 17, establishing that species as a breeder in the Pine-Popple River. All Belostomatidae were collected from debris underneath the banks, and because of their large size it is unlikely that they could have occurred in numbers without being collected.

Belostoma Latreille, 1807

B. flumineum Say, 1831—Uncommon Oct. 31—Nov. 16. Rare Aug. 27 (nymph). Pine and Popple R.

Lethocerus Mayr, 1852

L. americanus (Leidy), 1845—Rare Nov. 1—May 2. Popple R., upper Pine R.

CORIXIDAE (Water Boatmen)

Keys and Descriptions: Hilsenhoff (1970); Hungerford 1948.

Four genera and 28 species were collected. Many species used the river only as an overwintering site, flying into the river in October, and leaving in the

spring. Corixidae were collected at all sampling sites except 4 and 7. These sites had only rocky substrate and were unsuitable habitat for corixids. The Corixidae inhabited shoreline areas, especially where the current was slow and the bottom was covered with leaves or other debris. They were often collected in numbers from under the banks, and were especially numerous at sites 2, 5 and 20. In November thousands could have been collected at several of the sites, and they undoubtedly provided an excellent supply of food for fish during the winter months.

Callicorixa B. White, 1873

The single species probably uses the river only as an overwintering site.

C. audeni Hungerford, 1928—Rare June 29—Aug. 27. Common Oct. 18—Mar. 28. Entire river.
Hesperocorixa Kirkaldy, 1908

Five species overwintered in the Pine-Popple River, but there was no evidence of breeding. Only 14 individuals were collected outside the October to March winter period, and all but 2 of these were collected August 25-27, 1969 during a drought that probably dried up their normal habitat. *H. michiganensis* and *H. minorella* were the two most common overwintering corixids, and all species of *Hesperocorixa* were well distributed.

H. atopodonta (Hungerford), 1927—Rare Aug. 25-27. Common Oct. 18—Mar. 28. Entire river.

H. kennicottii (Uhler), 1897—Uncommon Oct. 31—Nov. 1. Pine and Popple R.

H. michiganensis (Hungerford), 1926—Rare May 27—Aug. 26. Very common Oct. 18—Mar. 28. Entire river.

H. minorella (Hungerford), 1926—Uncommon July 9—Aug. 27. Abundant Oct. 18—Mar. 28. Entire river.

H. vulgaris (Hungerford), 1925—Fairly common Oct. 31—Nov. 1. Entire river.

Palmacorixa Abbott, 1912

Although rarely encountered, all the records were from July 9, 1968, indicating that those present developed in the river. The members of this genus are normally flightless, and it is unlikely that they would be found in a body of water in which they did not breed.

P. gillettei Abbott, 1912—Rare July 9. Pine R.

P. nana Walley, 1930—Uncommon July 9. Upper Pine R., upper Popple R.

Sigara Fabricius, 1775

A few of the 20 species collected bred in the river, but most were found only in the late fall when they entered the river to overwinter.

S. alternata (Say), 1825—Common Oct. 18—Mar. 28. Pine and Popple R.

S. bicoloripennis (Walley), 1936—Fairly common Oct. 31—Nov. 1. Mostly lower Pine R.

S. compressoidea (Hungerford), 1928—Rare July 9—Aug. 27. Common Oct. 19—Nov. 9. Entire river.

S. conocephala (Hungerford), 1926—Common Oct. 18—Mar. 28. Entire river.

Table 7. Numbers of Aquatic Hemiptera Collected at 20 Sites on the Pine-Popple River.

Species	Site No.	Pine River										Popple River						Woods Creek	Total					
		1	2	3	4	5	6	10	14	15	17	18	19	20	7	9	11	12		13	16	8		
BELOSTOMATIDAE																								
<i>Belostoma flumineum</i>		1					1		3		1							1			7			
<i>Lethocerus americana</i>													1			1	1				3			
CORIXIDAE																								
<i>Callicorixa audeni</i>		7	43	14		24	12	1	5	3	6	2	2	25			1	2	1	2	2	6	158	
<i>Hesperocorixa atopodonta</i>		10	55	20		44	22	3	3	1	6	6	12	18			2	1	4	6	10	3	226	
<i>H. kennicottii</i>			1			3								1	1			1	1	1			9	
<i>H. michiganensis</i>		14	40	50		144	19	18	28	7	9	13	40	121			2	11	24	8	32	4	584	
<i>H. minorella</i>		29	100	7		17	38	2	105	25	50	116	140	141			77	114	14	131	64	172	1,342	
<i>H. vulgaris</i>		2	3			2				1	1			2	4	4			1	8	2	2	32	
<i>Palmaeorixa gillettei</i>		1									1												2	
<i>P. nana</i>														7							1		8	
<i>Sigara alternata</i>		8	61	49		4	6	1	2	4			2	3				2	6		2		150	
<i>S. bicoloripennis</i>			27	51		2	1				1			1									83	
<i>S. compressoidea</i>		35	26	26		11	1	2	2	12				3				19	22	2	3		164	
<i>S. conocephala</i>			2	16		41	18	7	8		5			2					1	1	3	2	107	
<i>S. decorata</i>																				1			1	
<i>S. decoratella</i>		5	8	13		7	2	1	1	1	3	1	6	3					2	1		1	55	
<i>S. defecta</i>			1	5	2	1							1	1						1	1		13	
<i>S. dolabra</i>		1	18										1						1	1			21	
<i>S. douglasensis</i>			1	1						3			3									1	9	
<i>S. grossolineata</i>		9	5	7		9			2		1	26	5								21	1	86	
<i>S. johnstoni</i>				1										4									5	
<i>S. knighti</i>																		1	1		8	2	12	
<i>S. lineata</i>		338	709	19		1	1																1,068	
<i>S. mackinacensis</i>		1	9						1	1		1	9						1				23	
<i>S. mathesoni</i>		4								1				3								1	9	
<i>S. mullettensis</i>													1										2	
<i>S. penniensis</i>		2	3	2			1						1								1		10	
<i>S. signata</i>		15	28	8		2	2		8	6		3	3	3				6	5	4	5	4	8	110
<i>S. solensis</i>			1	7		16	3	2	4	1				1								2	37	
<i>S. trilineata</i>		11	143	316								2											472	
NEPIDAE																								
<i>Ranatra fusca</i>			1			2	2		1	3		2		4				4	1	4	1	5	30	
NOTONECTIDAE																								
<i>Notonecta lunata</i>																					1		1	
<i>N. undulata</i>		1																				3	4	

Table 8. Numbers of Semi-Aquatic Hemiptera Collected at 20 Sites on the Pine-Popple River.

Species	Site No.	Pine River										Popple River						Woods Creek	Total						
		1	2	3	4	5	6	10	14	15	17	18	19	20	7	9	11	12		13	16	8			
GERRIDAE																									
<i>Gerris buenoi</i>			1	1*			2*	4	1				2*	4	2			1		3		2*		23	
<i>G. comatus</i>			3										1								1		5		
<i>G. dissortis</i>							2						1*	6					1				3	13	
<i>G. insperatus</i>			3	2*			2	2					3	6					1	1	1*	4	2	27	
<i>G. remigis</i>		4	2	15	2	2	6	4	14	20	5	22	1*	14				7	12	6	2	27	5	12	182
<i>Metrobates hesperius</i>		38	42	52	89	38	22	11	48	23	4		13						25	16	3			424	
<i>Rheumatobates rileyi</i>		91	5				3																	99	
HYDROMETRIDAE																									
<i>Hydrometra martini</i>										1														1	
MESOVELIIDAE																									
<i>Mesovelia mulsanti</i>										1											1			2	
VELIIDAE																									
<i>Microvelia americana</i>		11				12	23	26	6	5		10						2	1	2	5	11		115	
<i>M. fontinalis</i>													1											1	
<i>M. buenoi</i>													1											1	
<i>M. borealis</i>																							1	1	
<i>Rhagovelia obesa</i>				1				1	10	39	15		28					46	7	41	1	50	11	250	

* = Only females.

S. decorata (Abbott), 1916—Rare Nov. 1. Popple R.

S. decoratella (Hungerford), 1926—Rare May 27—Aug. 27. Fairly common Oct. 18—Mar. 28. Mostly Pine R.

S. defecta Hungerford, 1948—Uncommon Oct. 31—Mar. 28. Pine and Popple R.

S. dolabra Hungerford and Sailer, 1942—Uncommon Nov. 1—Mar. 28. Mostly lower Pine R.

S. douglasensis (Hungerford), 1926—Uncommon Oct. 18—Nov. 1. Pine R. and Woods Cr.

S. grossolineata Hungerford, 1948—Fairly common May 28—Aug. 27. Fairly common Oct. 18—Mar. 28. Entire river. Probably breeds in river.

S. johnstoni Hungerford, 1948—Rare May 27. Rare Oct. 31—Nov. 1.

S. knighti Hungerford, 1948—Rare May 28. Uncommon Oct. 18. Popple R. and Woods Cr.

S. lineata (Forster), 1771—Abundant year-around. Many nymphs. Lower Pine R.

S. mackinacensis (Hungerford), 1928—Rare. Aug. 25-27. Uncommon Oct. 19—Mar. 28. Pine and Popple R.

S. mathesoni Hungerford, 1948—Uncommon May 27—Aug. 26. Entire river.

S. mullettensis (Hungerford), 1928—Rare Mar. 28—Apr. 12. Upper Pine R., lower Popple R.

S. penniensis (Hungerford), 1928—Rare July 9. Uncommon Oct. 31—Nov. 1. Pine and Popple R.

S. signata (Fieber), 1851—Rare July 8—Aug. 26. Common Oct. 18—Mar. 28. Entire river.

S. solensis (Hungerford), 1926—Rare May 21—Aug. 27. Fairly common Oct. 19—Nov. 1. Mostly Pine R.

S. trilineata (Provancher), 1872—Very common year-around. Many nymphs. Lower Pine R.

NEPIDAE (Water Scorpions)

Keys and Descriptions: Hungerford (1922).

Only one species was collected, and it was found throughout the entire river in the fall.

Ranatra Fabricius, 1790

All but one were collected from debris along the banks between October 15 and November 1, 1968. Their apparent absence on November 15, 1968, suggests that they had burrowed into overwintering sites and could no longer be collected with an aquatic net. No nymphs were found, and collection records indicate that *R. fusca* flies to the river and uses it only as an overwintering site.

R. fusca Palisot Beauvois, 1805—Rare Aug. 27 (see below). Fairly common Oct. 31—Nov. 1. Entire river.

On August 27, 1969, while I was standing mid-stream at site 18, an individual dropped from the sky and landed within one foot of me. It was promptly captured. This, I believe, is the first documented record of flight for this species. A drying of its normal habitat due to drought probably forced this individual to fly in an effort to find water.

NOTONECTIDAE (Backswimmers)

Keys and Descriptions: Hungerford (1933).

The members of this family were rare in the Pine-Popple River, probably because of lack of quiet, weedy waters in which they normally breed. Only 2 species were collected, and their presence only late in the year suggests that they use the river as an overwintering site.

Notonecta Linnaeus, 1758

N. lunata Hungerford, 1926—Rare Oct. 31. Upper Popple R.

N. undulata Say, 1832—Rare Aug. 26—Oct. 31. Upper and lower Pine R.

GERRIDAE (Water Striders)

Keys and Descriptions: Anderson (1932); Drake and Harris (1934); Hungerford (1954).

This family of surface bugs occurred in abundance in July and August, but in late fall and early spring they were extremely difficult to find. All species that were collected probably bred in the river. Many nymphs were collected.

Gerris Fabricius, 1794

G. buenoi Kirkaldy, 1911—Uncommon. May 27—Aug. 27. Pine and Popple R.

G. comatus Drake and Hottes, 1925—Rare. Aug. 13-27. Pine and Popple R.

G. dissortis Drake and Harris, 1930—Uncommon. July 9—Aug. 27. Entire river.

G. insperatus Drake and Hottes, 1925—Fairly common. July 9—Oct. 18. Entire river.

G. remigis Say, 1832—Common. Mar. 28—Oct. 18. Entire river.

Metrobates Uhler, 1871

M. hesperius Uhler, 1871—Abundant. Aug. 12—Sept. 14. Nymphs in July. Mostly middle and lower Pine R., lower Popple R.

Rheumatobates Bergroth, 1892

R. rileyi Bergroth, 1892—Fairly common. Aug. 13-27. Lower Pine R.

HYDROMETRIDAE (Marsh Treaders)

Only one species is known to occur in this region. The shorelines of the river were not suitable habitat, and this is undoubtedly the reason only one individual was collected.

Hydrometra Lamarck, 1801

H. martini Kirkaldy, 1900—Rare. Aug. 26. Middle Pine R.

MESOVELIIDAE (Water Treaders)

Keys and Descriptions: Hungerford (1924).

The members of this family normally inhabit quiet water with much vegetation, so the Pine-Popple River cannot be considered suitable habitat.

Mesovelia Mulsant and Rey, 1852

M. mulsanti White, 1879—Rare. Aug. 26-27. Pine and Popple R.

VELIIDAE (Small Water Striders)

Two genera and 5 species were collected; 2 species were common.

Microvelia Westwood, 1834

Keys and Descriptions: Bacon (1956); Blatchley (1926).

Individuals probably occurred in greater numbers than presented in this study, but their extremely small size permits them to pass through the meshes of an aquatic net, and those that were captured can be easily overlooked. Four species were identified from quiet water along the banks of the river, but this genus needs revision.

M. americana (Uhler), 1884—Common. Aug. 25—Sept. 14. Several Nymphs. Pine and Popple R.

M. borealis Bueno, 1916—Rare. Aug. 26. Woods Cr.

M. buenoi Drake, 1920—Rare. May 27. Upper Pine R.

M. fontinalis Bueno, 1916—Rare. May 27. Upper Pine R.

Rhagovelia Mayr, 1865

Small schools were most often encountered in the shade of overhanging bushes.

R. obesa Uhler, 1871—Common. Aug. 12-27. Nymphs July 9. Popple R., upper Pine R.

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AQUATIC COLEOPTERA (Beetles) William L. Hilsenhoff

Aquatic Coleoptera in 6 families were collected at 20 established sites from June 1967 through August 1969. Elmidae and Psephenidae were collected by the samplers and from rocks and debris in the current. Other families were collected with a D-frame aquatic net from shoreline areas, and occasionally by light-traps.

The distribution and abundance of the various species are reported in Table 9. This information and notes on identification, ecology, and biology are summarized as follows:

GYRINIDAE (Whirligig Beetles)

Keys and Descriptions: Roberts (1895) (*Dineutus*); Hatch (1929) (*Dineutus*); Fall (1922) (*Gyrinus*).

Although Gyrinidae were found throughout most of the year, they reached a peak of abundance in late summer and fall when large schools appeared on the surface near shore in areas where there was reduced current. Large numbers of adults could be collected by sweeping through whirling schools sighted on the surface, or by running an aquatic net through vegetation under the stream banks. On August 26, 1969, tremendous numbers were seen at site 1 on the Pine River. A scoop through one school netted 877 individuals and 13 species as follows: 5 *Gyrinus aeneolus*, 1 *G. aquiris*, 428 *G. affinis*, 40 *G. bifarius*, 101 *G. confinis*, 35 *G. dichrous*, 5 *G. frosti*, 94 *G. latilimbus*, 2 *G. lecontei*, 43 *G. lugens*, 4 *G. maculiventris*, 5 *G. pugionis*, and 114 *G. ventralis*.

Only one larva was collected, an unidentified *Gyrinus* at site 2 on August 27, 1968. The absence of larvae indicates that very few individuals actually develop in the river and that the majority fly to the river from nearby breeding sites in lakes, ponds, and marshes. Most individuals probably use the river as an overwintering site, the concentration in late August of 1969 being due to drought conditions in the area. *Dineutus* MacLeay, 1825

This genus was relatively rare in the Pine-Popple River.

D. hornii Roberts, 1895—Rare. Nov. 1. Middle Pine R.

D. nigror Roberts, 1895—Uncommon. May 28—Sept. 14. Pine R.

Gyrinus Geoffroy, 1764

The male genitalia were distinctive, but the females of some species were difficult to separate. Fifteen species were collected.

G. aeneolus LeConte, 1868—Common. May 27—Nov. 1. Pine and Popple R. (Whenever this species was collected, a distinctive odor was apparent).

G. affinis Aube, 1838—Very common. Year-around. Pine R.

G. aquiris LeConte, 1868—Rare. Aug. 26—Nov. 1. Lower Pine R.

G. bifarius Fall, 1922—Common. July 9—Nov. 1. Pine and Popple R.

G. confinis LeConte, 1868—Common. May 27—Nov. 1. Mostly lower Pine R.

G. dichrous LeConte, 1868—Fairly common. Aug. 26—Nov. 1. Mostly lower Pine R.

G. frosti Fall, 1922—Rare. Aug. 26. Lower Pine R.

G. latilimbus Fall, 1922—Common. May 27—Nov. 1. Pine R., upper Popple R.

G. lecontei Fall, 1922—Fairly common. Aug. 13—Nov. 1. Entire river.

G. lugens LeConte, 1868—Fairly common. Aug. 26—Nov. 1. Pine R.

G. maculiventris LeConte, 1868—Uncommon. Year-around. Pine R.

G. marginellus Fall, 1922—Fairly common. Aug. 25—Mar. 28. Upper Pine R., upper Popple R.

G. minutus Fabricius, 1801—Rare. July 9—Aug. 26. Lower Pine R.

G. pugionis Fall, 1922—Uncommon. Aug. 26—Nov. 1. Pine R.

G. ventralis Kirby, 1837—Common. Aug. 26—Nov. 1. Pine R.

HALIPLIDAE (Crawling Water Beetles)

Keys and Descriptions: Wallis (1933).

Haliplus Latreille, 1802

Adults were occasionally collected among shoreline vegetation out of the current.

H. cribrarius Agassiz and Cabot, 1850—Rare. Aug. 27. Pine R.

H. immaculicollis Harris, 1828—Uncommon. May 27—Aug. 27. Slow water. Mostly upper Pine R.

DYTISCIDAE (Predaceous Water Beetles)

Keys and Descriptions: Anderson (1971) (*Hygrotus*); Blatchley (1910) (*Laccophilus*); Fall (1923) (*Hydroporus*); Gordon and Post (1965) (*Hydaticus* and *Laccophilus*); Hatch (1928) (*Bidessus*, *Colymbetes*, and *Rhantus*); Hatch (1933) (*Hydroporus*); Wallis (1939) (*Ilybius*).

Eight genera and 12 species were collected, mostly with an aquatic net from shoreline vegetation. A few were collected by light-traps and may not be inhabitants of the river. None of the species were common. *Bidessus* Sharp, 1882

B. affinis (Say), 1823—Uncommon. Aug. 26—Apr. 12. Except lower Pine R.

Colymbetes Clairville, 1806

C. sculptilis LeConte, 1862—Rare. Mar. 27. Woods Cr.

Hydaticus Leach, 1817

H. modestus Sharp, 1882—Rare. May 28 (light-trap). Upper Pine R.

Hydroporus Clairville, 1806

H. dichrous Melsheimer, 1844—Rare. Aug. 25. Pine R.

H. griseostriatus DeGeer, 1774—Rare. Aug. 25. Pine R.

H. striola (Gyllenhal), 1808—Rare. Aug. 26. Popple R.

Table 9. Numbers of Coleoptera Collected at 20 Sites on the Pine-Popple River.

Species	Site No.	Pine River										Popple River					Woods Creek	Total				
		1	2	3	4	5	6	10	14	15	17	18	19	20	7	9	11		12	13	16	8
GYRINIDAE																						
<u>Dineutus hornii</u>						1															1	
<u>D. nigror</u>	5							1						2							8	
<u>Gyrinus aeneolus</u>	79	10			5	30	16		6		4				20	6					176	
<u>G. affinis</u>	429	10			38	30	1*		2	2			31								543	
<u>G. aquiris</u>	1				1																2	
<u>G. bifarius</u>	48	7			1*	3		3		20			2	3		3*	10	5			105	
<u>G. confinis</u>	101	7																1*	1*		110	
<u>G. dichrous</u>	37				2			1													40	
<u>G. frosti</u>	5																				5	
<u>G. latilimbus</u>	95	5			68	8		3		5	11		3	24				1*	5	3	231	
<u>G. lecontei</u>	2	1*			25	7		1	1*	7	2			13		1*	1*	1	6	2*	1*	71
<u>G. lugens</u>	43				4	1*								6							54	
<u>G. maculiventris</u>	5	2			11	1					1										20	
<u>G. marginellus</u>										20	3			56				2	7		88	
<u>G. minutus</u>	1		1																		2	
<u>G. pugionis</u>	2				18									4							24	
<u>G. ventralis</u>	114	4			11			5						2							136	
HALIPLIDAE																						
<u>Haliphus cribrarius</u>						1															1	
<u>H. immaculicollis</u>	1									1	11	1							1		15	
DYTISCIDAE																						
<u>Bidessus affinis</u>						2	1		2	2			1		6			2	3	2	21	
<u>Colymbetes sculptilis</u>																				1	1	
<u>Hydaticus modestus</u>													1								1	
<u>Hydroporus dichrous</u>					1																1	
<u>H. griseostriatus</u>					1																1	
<u>H. striola</u>															1						1	
<u>H. vittatus</u>									1	1											2	
<u>Hygrotus sayi</u>													1								1	
<u>Ilybius biguttulus</u>													1								1	
<u>I. laramaeus</u>						1							1								2	
<u>Laccophilus maculosus</u>								1					1								2	
<u>Rhantus binotatus</u>					1									2	2						5	
HYDROPHILIDAE																						
<u>Anacaena limbata</u>						1	1	1	3	1			4		3	1		4		1	20	
<u>Cymbiodyta vindicata</u>							1													3	4	
<u>Enochrus cinctus</u>													1								1	
<u>E. consortus</u>													1								1	
<u>E. diffusus</u>													1								1	
<u>E. ochraceus</u>													1								1	
<u>Helophorus lacustris</u>						1	1						1						1		4	
<u>Hydrobius fuscipes</u>							1	1	1	1			4		3	1			1	6	18	
<u>H. melaenus</u>					1																1	
<u>Hydrochara obtusata</u>								1													1	
<u>Hydrochus inaequalis</u>													1								1	
<u>H. squamifer</u>								2													2	
<u>Laccobius agilis</u>								4		2								3			9	
<u>Paracymus subcupreus</u>							1													2	3	
<u>Tropisternus mixtus</u>			1					1					1	1							4	
PSEPHENIDAE																						
<u>Ectopria nervosa</u> (larvae)						1		1													2	
<u>Psephenus herricki</u> (larvae)	3		24			3			1	1											32	
EILMIDAE																						
<u>Ancyronyx variegatus</u>													1								1	
<u>Dubiraphia</u> spp.	1				7	5	1	4	4	3	1	2	26		2	2	5	4	1	25	93	
<u>Macronychus glabratus</u>					2		1	1		1							1	6	1		13	
<u>Optioservus fastiditus</u> (adults)							1		1	2						1	2	2		1	3	
<u>O. trivittatus</u> (adults)		4	1	1	9	4	8	4		1					8	5				2	47	
<u>Optioservus</u> larvae	5	6	4	43	219	45	210	101	3	4	7	2		29	18		5	5	9	28	743	
<u>Stenelmis crenata</u> (adults)	5	1	6	6	13	8	15	2	2	1	10			4	1	2	3	19	5		103	
<u>Stenelmis</u> larvae	1	13	5	58	128	37	99	9	9		9			2	1		2	2	12	6	393	

* = only females.

H. vittatus LeConte, 1855—Rare. Upper Pine R.
Hygrotus Stephens, 1828
H. sayi Balfour-Browne, 1944—Rare. May 29
(light-trap). Upper Pine R.
Ilybius Erichson, 1832
I. biguttulus Germar, 1824—Rare. May 27. Upper
Pine R.
I. laramaeus LeConte, 1859—Rare. Aug. 26-27.
Pine R.
Laccophilus Leach, 1817
L. maculosus (Germar), 1824—Rare. Aug. 27. Pine
R.
Rhantus DeJean, 1833
Two of the beetles were collected by a light-trap.
R. binotatus (Harris), 1828—Rare. Apr. 11—May
28. Pine R.

HYDROPHILIDAE (Water Scavenger Beetles)

Keys and Descriptions: Winters (1926, 1927);
Wooldridge (1967); Blatchley (1910) (*Helophorus*
and *Hygrotus*).

This family was represented in the Pine-Popple
River by 15 species, none of which were common. All
were collected from shoreline areas or by light-traps.
Only adults were collected and identified.

Anacaena Thomson, 1859
A. limbata (Fabricius), 1792—Uncommon. May
27—Aug. 27. Except lower Pine R.
Cymbiodyta Bedel, 1881
C. vindicata Fall, 1924—Rare. Aug. 26-27. Woods
Cr., middle Pine R.
Enochrus Thomson, 1859
E. cinctus (Say), 1824—Rare. May 28 (light-trap).
Upper Pine R.
E. consortus Green, 1946—Rare. May 28 (light-
trap). Upper Pine R.
E. diffusus (LeConte), 1855—Rare. Aug. 27. Upper
Pine R.
E. ochraceus (Melsheimer), 1844—Rare. May 28
(light-trap). Upper Pine R.
Helophorus Fabricius, 1775
H. lacustris LeConte, 1850—Rare. May 27—Aug.
27. Upper Popple R., middle and upper Pine R.
Hydrobius Leach, 1815
H. fuscipes (Linnaeus), 1758—Uncommon. Aug.
25—Oct. 31. Except lower Pine R.
Hydrochara Berthold, 1827
H. obtusata (Say), 1823—Rare. May 28 (light-trap).
Middle Pine R.
Hydrochus Leach, 1817
H. inaequalis LeConte, 1855—Rare. May 27. Upper
Pine R.
H. squamifer LeConte, 1855—Rare. Aug. 27.
Middle Pine R.
Laccobius Erichson, 1837
L. agilis (Randall), 1838—Uncommon. May 27—
Aug. 27. Upper Popple R., middle and upper Pine R.
Paracymus Thomson, 1867

P. subcupreus (Say), 1825—Rare. Aug. 26-27.
Woods Cr., middle Pine R.
Tropisternus Solier, 1834
T. mixtus (LeConte), 1855—Rare. Oct. 19—May
28. Pine R.

PSEPHENIDAE (Water Penny Beetles)

Only the larvae are aquatic; no adults were
collected. Two species were found, but since larval
keys do not exist, the identifications are tentative.
The larvae attach themselves firmly to rocks, and can
be successfully collected only by searching individual
rocks. This was seldom done, so populations of
Psephenidae are probably higher than represented by
this study.

Ectopria LeConte, 1853

Only one species is known from the northeastern
United States (Arnett, 1960).

E. nervosa (Melsheimer), 1844—Rare. Mar. 28—
May 10. Middle Pine R.

Psephenus Haldeman, 1853

The only species known to occur in the central and
eastern portions of the United States and Canada is *P.*
herricki (Brown and Arrington, 1967).

P. herricki (DeKay), 1844—Fairly common. Year-
around. Pine R.

ELMIDAE (Riffle Beetles)

Keys and Descriptions: Collier (1969); Sanderson
(1938).

Both larvae and adults are aquatic and were very
commonly collected throughout the river at all times
of the year. Five genera were found, and they were
easily separated by using the keys by Sinclair (1964).
Only the adults could be identified to species.

Ancyronyx Erichson, 1847

Only one species is known from the eastern United
States.

A. variegatus (Germar), 1824—Rare. Aug. 27.
Upper Pine R.

Dubiraphia Sanderson, 1954

There are no recent keys, and this genus needs to
be revised. A study of the male genitalia and other
morphological characters revealed that 3 or more
species were present. Two of these are probably *D.*
quadrinotata (Say), 1825 and *D. vittata* (Melsheimer),
1844, but the descriptions of these species are not
sufficient to separate them from undescribed species.
For this reason all larvae and adults are reported only
as *Dubiraphia* spp.

Dubiraphia spp.—Fairly common. Year-around.
Pine and Popple R.

Macronychus Muller, 1806

The only species was collected mostly from debris
along the banks of the river.

M. glabratus Say, 1825—Uncommon. July 24—
Aug. 27. Popple R., middle Pine R.

Optioservus Sanderson, 1954

The larvae were much more abundant than the adults, and were especially abundant in the middle reaches of the Pine R.

O. fastiditus (LeConte), 1850—Common. Year-around. Middle Pine R., Popple R., Woods Cr.

O. trivittatus (Brown), 1929—Very common. Year-around. Entire river.

Stenelmis Dufour, 1835

Since adults of only one species were found, it is likely that all the *Stenelmis* larvae were also this species.

S. crenata (Say), 1824—Very common. Year-around. Entire river.

ACKNOWLEDGEMENTS

I wish to thank Dr. Harley P. Brown, University of Oklahoma, for confirming identifications of species of Elmidae, and Dr. David P. Wooldridge, Pennsylvania State University, for confirming and correcting identifications in the family Hydrophilidae. I also wish to thank Dr. Robert Gordon, U.S.D.A. Systematic Entomology Laboratory, for confirming identifications of Gyrinidae, Dytiscidae, and Haliplidae, and for identifying *Hydroporus dichrous*.

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AQUATIC DIPTERA (Flies and Midges) William L. Hilsenhoff

Larvae of aquatic Diptera comprised a significant segment of the fauna of the Pine-Popple River, but most species could not be named because keys do not exist. Larvae were collected at 20 sites with aquatic nets and artificial substrate samplers. Most were identified to genus by using the keys by Wirth and Stone (1956) and James (1959), and when keys were available they were identified to species. Larvae were preserved in 70% ethanol, except for Chironomidae and Culicidae which were mounted in CMC-10 (Turtox, Chicago) on microscope slides.

The distribution and abundance of various taxa are reported in Table 10. This information and notes on ecology, biology, and identification are summarized as follows:

TIPULIDAE (Crane Flies)

None of the larvae could be identified to species. The distribution of known species was reported by Alexander (1965).

Antocha Osten Sacken, 1859

Larvae were fairly common in the Pine and Popple Rivers throughout the year. Three species may occur. *Dicranota* Zetterstedt, 1838

Dicranota was fairly common November 9 to March 28, occurring in the middle Pine River, upper Popple River, and Woods Creek. Several species may have been present.

Helius Lepeletier and Serville, 1828

Two larvae were collected from the upper Pine River on May 27, 1968. Both of the known species may occur in Wisconsin.

Hexatoma Latreille, 1809

Hexatoma was uncommon in the faster waters. Several species may have been present.

Pseudolimnophila Alexander, 1919

The larvae were rare in the Pine River.

Tipula Linnaeus, 1758

Numerous species may occur, but they were uncommon in the Pine-Popple River.

BLEPHARICERIDAE (Net-winged Midges)

Blepharicera Macquart, 1843

Keys to species do not exist. The larvae attach very firmly to substrates in fast water, especially vegetation hanging into the stream, and they may be more abundant than represented in Table 10.

DIXIDAE

Dixella Dyar and Shannon, 1924

At least 2 species may occur (Hubert, 1965). Larvae were fairly common among vegetation along the banks of the river.

CULICIDAE (mosquitoes)

Keys and Descriptions: Barr (1958).

Anopheles Meigen, 1818

Two species were collected from among vegetation

along the river banks in August 1969.

A. earlei Vargas, 1943—Rare. Aug. 25. Popple R.

A. punctipennis (Say), 1823—Fairly common. Aug. 25-27. Middle and upper Pine R., lower Popple R.

SIMULIIDAE (Black Flies)

The larvae were collected by the samplers and from various substrates in the river. Keys by Anderson (1960) were used to identify the various species.

Cnephia Enderlein, 1921

All three species apparently had one generation each year, with emergence in the spring. They occurred throughout the river, and larvae were frequently encountered in the fall.

C. emergens Stone, 1952—Fairly common. May 9. Upper Pine R.

C. mutata (Malloch), 1914—Rare. May 9-10. Upper Pine R., Popple R.

C. taeniatifrons (Enderlein), 1925—Common. Nov. 8—Mar. 28. Entire river.

Prosimulium Roubaud, 1906

Three species were collected, and all apparently had a one-year life cycle, with emergence in the spring.

P. fuscum Syme and Davies, 1958—Rare. Mar. 28. Upper Pine R.

P. magnum Dyar and Shannon, 1927—Common. Nov. 9—May 10. Entire river.

P. mixtum Syme and Davies, 1958—Common. Nov. 9—May 10. Mostly Woods Cr. and upper Pine R.

Simulium Latreille, 1802

This was the most abundant genus, with some species having more than one generation each year. About one-fourth of the specimens collected from each site on every date were identified. The remainder were listed in Table 10 as *Simulium* spp.

S. corbis Twinn, 1936—Common. May 10. Mostly Woods Cr.

S. euryadminiculum Davies, 1949—Fairly common. Mar. 27—May 10. Mostly upper Popple R., upper Pine R.

S. jenningsi Malloch, 1914—Fairly common. July 23—Aug. 13. Mostly lower and middle Pine R.

S. pugetense (Dyar and Shannon), 1927—Very common. May 9-10. Entire river.

S. tuberosum (Lundstrom), 1911—Abundant. Year-around. Mostly Woods Cr., lower and middle Pine R.

S. venustum Say, 1823—Very common. Year-around. Entire river.

S. vittatum Zetterstedt, 1838—Rare. Nov. 11. Upper Pine R., upper Popple R.

CHIRONOMIDAE (Midges)

Chironomidae dominated the aquatic Diptera fauna in the Pine-Popple River. We collected 26 genera but could not identify species because of the paucity of information about the taxonomy of larvae.

Table 10. Numbers of Diptera Larvae Collected at 20 Sites on the Pine-Popple River.

Species	Site No.	Pine River										Popple River					Woods Creek	Total				
		1	2	3	4	5	6	10	14	15	17	18	19	20	7	9	11		12	13	16	8
TIPULIDAE																						
<i>Antocha</i> spp.			7	7	1	2	1	2	17	3		10		3	2			1	3		59	
<i>Dicranota</i> spp.						3	2	6	4	3								2		6	26	
<i>Helius</i> spp.												2									2	
<i>Hexatoma</i> spp.						3	1	3	5								1	1	1	4	19	
<i>Pseudolimmophila</i> spp.			2		1		1					1									5	
<i>Tipula</i> spp.		2			1	1	1	1		1						1				18	27	
BLEPHARICERIDAE																						
<i>Blepharicera</i> spp.									2						2						4	
DIXIDAE																						
<i>Dixella</i> spp.					1		2	1			5	15	4				5	5		4	42	
CULICIDAE																						
<i>Anopheles earlei</i>																		3			3	
<i>A. punctipennis</i>						2	5		2	11					6						26	
SIMULIIDAE																						
<i>Cnephia emergens</i>																					27	
<i>C. mutata</i>																					2	
<i>C. taeniatifrons</i>		4	1	20	7	23	5	41	6	38	21			9	1			2	9	6	193	
<i>Prosimulium fuscum</i>													3								3	
<i>P. magnum</i>			9	14		39	4	2	9						13			3		9	103	
<i>P. mixtum</i>						1		4		1			69					1	6	1	110	
<i>Simulium corbis</i>			7	2											9					124	142	
<i>S. euryadminiculum</i>			1						1		1		2						5		10	
<i>S. jenningsi</i>	1	2	1	4	1	5	15		1				2								31	
<i>S. pugetense</i>		7	29	12	20	22	14	7	8	2	1	1		64	7	2			4	1	209	
<i>S. tuberosum</i>		1	122	108	3	30	33	17	47	1				6	1	3	1		2	127	502	
<i>S. venustum</i>		1	13	8		3	4	1	3	20			5	135	1	1			8	3	206	
<i>S. vittatum</i>										1									1		2	
<i>S. spp.</i>		65	453	489	22	177	165	53	145	27	2	4	1102	153	25	10			12	865	3,769	
CHIRONOMIDAE																						
<i>Ablabesmyia</i> spp.	1				1												2				4	
<i>Brillia</i> spp.		2				3	7	3	4	2	1		2		3			1		7	35	
<i>Corynoneura</i> spp.			1		1	1	1		3		2	1		1	2					3	16	
<i>Cricotopus</i> spp.	4	4	1	26	7	7	2	1	35	8	10	167	28	2	1	16		5	6		330	
<i>Cryptochironomus</i> spp.		1			2	3						2							2		10	
<i>Diamesa</i> spp.	1			7			1				1	20									30	
<i>Dicrotendipes</i> spp.					1																1	
<i>Diplocladius</i> spp.					2																2	
<i>Endochironomus</i> spp.	1	1				2	1					2							1		8	
<i>Metriocnemus</i> spp.		1	4	4	11	17	5	4	15	24		6	17		5	28	5	1	3	17	167	
<i>Micropectra</i> spp.	77	53		5	43	48	39	31	20	42	15	143	281	26	6	169	17	19	388	35	1,457	
<i>Microtendipes</i> spp.	10	10	1	3	51	32	9	7	10	10	10	87	64	4	2	11	49	31	171	10	582	
<i>Nanocladius</i> spp.	1	16	3	19	41	55	81	77	72	12	11	16	24	22	19	18	15	11	66	121	700	
<i>Orthocladius</i> spp.	1		4			1		4							1						11	
<i>Paralauterborniella</i> spp.															2						2	
<i>Paratendipes</i> spp.																			1		1	
<i>Pentaneura</i> spp.	3	15	6	2	65	74	9	37	29	51	6	146	94	16	18	36	10	21	94	12	744	
<i>Phaenopsectra</i> spp.					1	1	2	1					21					1	1		28	
<i>Plecopteraacolutus</i> spp.			7	1	1	2	3		3	1	1			10	11		14	1	3	4	62	
<i>Polypedilum</i> spp.	1	12		21	124	148	71	69	72	13	1	30	25	20	8	17	5	4	75	58	774	
<i>Procladius</i> spp.						1												1		2	4	
<i>Psectrocladius</i> spp.	2		1		5	4	7		4	5	4	5	1			2	4	1	1	1	47	
<i>Smittia</i> spp.						1			1	1											3	
<i>Stictochironomus</i> spp.																	1				1	
<i>Tanytarsus</i> spp.		19	4	26	25	34	37	49	72	39	36	146	336	31	58	51	44	21	198	8	1,234	
<i>Trichocladius</i> spp.		1	1		5	8	3	1	1			3		3							26	
CERATOPOGONIDAE																						
<i>Atrichopogon</i> spp.																1					1	
<i>Palpomyia</i> spp.													2								2	
STRATIOMYIIDAE																						
<i>Stratiomys</i> spp.						1															1	
TABANIDAE																						
<i>Chrysops</i> spp.	1	2				1				1	1					1		1	2		10	
RHAGIONIDAE																						
<i>Atherix variegata</i>			1	18	22	18	84	28	74	59	6	11	43		32	39	4	23	15	12	45	534
EMPIDIDAE																						
		1	2		5	4	5	2	3		1		2		2		1		1		29	

Keys by Bryce (1960) and Roback (1957) were used to identify the various genera. Larvae were collected almost entirely by the samplers. Most genera were found throughout the year and were also quite well distributed throughout the river. The genus *Plecopteracoluthus* was phoretic on the larvae of *Nigronia serricornis* (Megaloptera) and stoneflies in the family Perlidae (Plecoptera) (Hilsenhoff, 1968). The genera are grouped below according to their abundance:

Abundant: *Micropsectra* Keiffer, 1909; *Tanytarsus* Wulp, 1874.

Very common: *Microtendipes* Kieffer, 1915; *Nanocladius* Kieffer, 1913; *Pentaneura* Philippi, 1865; *Polypedilum* Kieffer, 1913.

Common: *Cricotopus* Wulp, 1874; *Metriocnemus* Wulp, 1874.

Fairly common: *Brillia* Kieffer, 1913; *Diamesa* Waltl, 1837; *Phaenopsectra* Kieffer, 1921; *Plecopteracoluthus* Steffan, 1965; *Psectrocladius* Kieffer, 1906; *Trichocladius* Kieffer, 1906.

Uncommon: *Corynoneura* Winnertz, 1846; *Cryptochironomus* Kieffer, 1918; *Endochironomus* Kieffer, 1918; *Orthocladius* Wulp, 1874.

Rare: *Ablabesmyia* Johannsen, 1905; *Dicrotendipes* Kieffer, 1913; *Diplocladius* Kieffer, 1908; *Paralauterborniella* Lenz, 1941; *Paratendipes* Kieffer, 1911; *Procladius* Skuse, 1889; *Smittia* Holmgren, 1869; *Stictochironomus* Kieffer, 1919.

CERATOPOGONIDAE (Biting Midges)

One larva of *Atrichopogon* Kieffer, 1906, and 2 larvae of *Palpomyia* Meigen, 1818, were collected, but none could be named to species. Even the generic identification of *Palpomyia* is uncertain; these larvae could be *Bezzia* or *Probezzia*. Because the larvae of many Ceratopogonidae are extremely small, it is possible that they occur in much larger numbers than represented by the collections.

STRATIOMYIIDAE (Flower Flies)

Stratiomys Geoffroy, 1762

A single larva was collected from the Pine River August 27.

TABANIDAE (Deer Flies)

Chrysops Meigen, 1800

Larvae were collected from 8 sites on the Pine and Popple Rivers from August 25 to November 11.

RHAGIONIDAE (Snipe Flies)

Atherix Meigen, 1803

A single species was collected from faster waters throughout the entire river. Larvae of all sizes were found throughout the year.

A. variegata Walker, 1848—Very common. Year-around. Entire river.

EMPIDIDAE (Dance Flies)

Larvae were fairly common September 12 to May 10 in the Pine and Popple Rivers, but could not be named even to genus because keys were not available.

ACKNOWLEDGEMENTS

I wish to thank Dr. G. R. DeFoliart, University of Wisconsin, for his assistance in identifying Simuliidae larvae.

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ACKNOWLEDGMENTS

Published with the approval of the Director of the Research Division, College of Agricultural and Life Sciences. Research supported in part by the Wisconsin Department of Natural Resources.

Hilsenhoff is Associate Professor of Entomology at the University of Wisconsin, Madison; Longridge, Tennessen and Walton assisted in that Department; Narf is Biologist with the Department of Natural Resources.

Edited by Ruth L. Hine

