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A Trophic Analysis of Three Species of Elmidae from Polecat and Riley Creeks, Coles County, Ill.

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A Trophic Analysis of Three Species of Elmidae

from Polecat and Riley Creeks, Coles County, Ill.

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Abstract

The food habits of *Stenelmis sexlineata*, *Stenelmis vittipennis*, *Stenelmis crenata*, and larval *Stenelmis* were studied in Polecat and Riley Creeks, Coles County, Illinois. Rock Scrapings were taken and compared with the gut analyses of the larval and adult beetles. These beetles were found to be scraper/collectors and detritivore/herbivores, generally scraping surfaces of rocks. Detritus, green algae, and diatoms were found to be the major categories present in both the rock scrapings and the gut analyses. The cellular contents of diatoms (chloroplasts and other cytoplasmic inclusions) were digested by the beetles. No conclusions regarding feeding preferences are made, although it was noted that green algae make up a disproportionately large percentage of the diet. This may indicate some selective feeding or that microhabitats in which the green algae are abundant are preferred.

No evidence of resource partitioning was found on the basis of food type. However, resource partitioning may be accomplished by other means, many of which are enumerated by Seagle (1979).

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Introduction

The Elmidae comprise an important component of many lotic habitats; these beetles have also been suggested to be indicators of water quality. Ecological studies of these beetles and other aquatic populations will help explain the structure of aquatic ecosystems. Cummins (1973) states that, "Trophic relationships of aquatic invertebrates have been the subject of investigations by aquatic ecologists for some time. The importance of such studies stems from the need for a basic understanding of the complex interactions of aquatic organisms. The formulation of proper management or rehabilitation of aquatic ecosystems is dependent on the understanding of these aquatic systems." Extensive discussion of the importance of trophic studies is found in Cummins (1973).

The primary purpose of the present study was to describe the foods ingested by larval and adult Stenelmis spp. Three species of adult beetles (S. sexlineata, S. vittipennis, and S. crenata) were identified and studied; larvae were identified only to genus. Part of this study was designed to determine whether these beetles are generalists, which feed on whatever is available, or if they are selective or restrictive in their feeding habits. Cummins (1973) defines selective and restrictive feeding as follows:

> Selective feeding involves the rejection of some of the available food items; restrictive feeding involves a mechanical, physical, or chemical incapability of ingesting (or digesting) certain food items available in the environment. In many cases it is difficult, if not impossible, to distinguish between selective feeding and physical (or chemical) restrictions that

prevent the intake of all apparently available food materials, or between selective feeding and microhabitat selection.

The term selective feeding (or food preference) will be used here without distinguishing "true" selective or preferential feeding behavior from restrictive feeding as defined above.

A second portion of this study was an attempt to assess the ability of these beetles to utilize the food value present in the diatoms, which they ingest. Diatoms with and without chloroplasts were counted in rock scrapings and in gut contents. A comparison of these two values would determine whether these beetles digest the contents of the diatoms. Kurtak (1979) suggests that diatoms may be digested either entirely or partially by blackfly larvae. The degree of digestion depended upon the time the diatom remained in the digestive tract; the longer the duration in the gut the more complete the digestion. Kurtak noted that the normal time spent in the gut in nature may not be sufficiently long enough to allow complete digestion to occur.

The final question considered in this study was resource partitioning. Gause's theory of competitive exclusion concludes that no two sympatric species can successfully compete for a single limiting resource without some important difference in requirements. Therefore, a situation in which there are three or even two species of Elmidae in the same riffle would indicate some type of resource partitioning.

Three major categories (spatial, temporal, and trophic) were said by Seagle (1979) to be important in resource partitioning in aquatic ecosystems. Seagle further states that "similar sympatric congeners may differ in food habits but usually also differ in some spatial or temporal aspect as well." He suggested a multidimensional model for Optioservus trivittatus, S. crenata, and S. mera taking into account all three major strategies for resource partitioning. Seagle suggests, however, that spatial differences are most important in the coexsistence of the species he encountered; trophic and temporal differences play an important but secondary role. He also suggests that particle size is of possible importance in trophic partitioning.

Previous studies on the feeding habits of the family Elmidae and the genus Stenelmis range from generalizations based on gross observations to more specific studies based on detailed observations. An early account by Blatchley (1910) states that these beetles feed on decomposing matter in the water, "thus forming one of nature's purifying systems." This statement was based on general observations of the habitat and behavior of beetles in the family Elmidae. However, early observations were not limited to the family level. West (1929) reported that Macronychus glabratus feeds on decomposing, waterlogged wood and the nutrients it contains. Sanderson (1938) suggests that Stenelmis spp. feed mainly on algae: "I have observed the adults of S. quadrimaculata feeding upon algae in marl incrustations.

Specimens taken from a stream and brought into the laboratory with dead leaves and stones were found to graze over both surfaces. If rocks were not present, they proceeded to feed upon the debris on one another." Other workers state that both larvae and adults feed upon algae, moss, marl incrustations, detritus, and some roots of larger plants (Leech and Chandler,1956; Edmondson,1959; Dillon and Dillon, 1961; Brown,1972; Pennak,1978).

Most of the works mentioned above are general, and usually deal with feeding habits at the family level. Studies which deal with elmids at the generic or specific level are fewer and are primarily concerned with trophic relationships within the community. Koslucher and Minshall (1973), for example, studied the food habits of some benthic invertebrates of a cool-desert stream in Idaho and stated that, "Of the herbivores studied all seemed to feed, in the main, on detritus and algae; in general the invertebrates studied were opportunists and fed in proportion to the foods present." This observation agrees with Cummins' (1973) view that, in the main, herbivorous invertebrates are food generalists. One of the species studied in some detail by Koslucher and Minshall (1973) was the elmid Optioservus divergens. Thirty-six larvae were found to eat detritus (83.6%) and diatoms (16.4%). Chapman and Demory (1963) report that adult and larval O. quadrimaculatus depend heavily upon algae, and, of these, chiefly upon diatoms. Six adults were found to have 65% algae and 36% detritus in their digestive tracts.

The larvae examined during two sampling periods contained 90% algae and 10% detritus (10 larvae examined) and 100% algae (one larva examined).

The food habits of Stenelmis beameri were studied as part of an extensive investigation of trophic relationships in a woodland stream ecosystem (Coffman 1967); several subsequent works cite some of the findings from this study (Cummins, Coffman, and Wuycheck,1971; Merritt and Cummins, 1978). Cummins (1973) summarized these results in his paper dealing with the trophic relationships of aquatic insects. Both adults and larvae were analyzed and the results were expressed as a percent composition of the gut contents in three food categories (algae, detritus, and animal), as follows: algae, 71.3%; detritus, 7.2%, animal, 21.5%. Adult S. beameri guts were found to have 59.4% algae and 40.6% detritus. Cummins (1973) also formulated a general classification of feeding mechanisms and food categories for aquatic insects as follows: (1) shredders--vascular plant material; (2) collectors--detritus particles; (3) scrapers--attached algae; (4) predators--live prey. With this classification scheme, the Elmidae and S. beameri specifically are classified as collectors and scrapers (Cummins,1973; Merritt and Cummins,1978).

Another species of Stenelmis was studied by Lesage and Harper (1976). S. crenata larvae were found to eat 90% detritus and 10% diatoms (primarily Navicula and Synedra). Similar foods were found for S. beameri by Coffman (1967) but a marked difference in the percentages for these food categories was found.

Other elmid species studied by Lesage and Harper (1976) were as follows: Optioservus ampliatus, 50% detritus and 50% diatoms; Promoresia tardella, 30% detritus and 70% diatoms; Ouilimnius latrusculus, 90% detritus and 10% diatoms; Macronychus glabratus, primarily water-soaked wood.

None of the published studies details the specific types or quantity of food items ingested by elmids. The present study is an attempt to report the specific types of food ingested by these beetles in a more complete manner. Seagle (1979) examined three species of riffle beetles. S. crenata adults ate 77.1% detritus, 22.5% green algae, and 0.4% diatoms. Larval S. crenata ate 74.9% detritus, 19.9% green algae, and 5.2% diatoms. Adult Optioservus trivittatus consumed 74.6% detritus, 23.8% green algae, and 1.5% diatoms; larvae ate 68.3% detritus, 28.9% green algae, and 2.7% diatoms. S. mera adults consumed 79.2% detritus, 8.7% green algae, and 11.6% diatoms, while larval S. mera ate 93.1% detritus, 4.7% green algae, and 1.5% diatoms. Seagle also states that "an insignificant portion of their diets was composed of blue-green algae and animal parts," but no details regarding the percentages these categories comprise are given. Seagle states that resource partitioning at the trophic level may be based on particle size rather than on the types of food eaten.

Seagle's (1979) paper is by far the most ecologicallyoriented elmid work to date. However neither Seagle's paper nor any other work known to the writer has attempted to compare the foods present in the environment with the foods ingested by these beetles.

Study Area

Beetles were obtained from riffles in Polecat and Riley Creeks in Coles County, Illinois.

Durham and Whitley (1971) stated that, "Polecat Creek has its origin in Edgar County and flows westward through Coles County ultimately emptying into the Embarras River. Several reaches of the creek have been extensively dredged; one such area near Ashmore has been slowed and widened due to gravel pit operations. For the most part, except possible septic drainage from Ashmore, this stream is considered clean, with a wide variety of aquatic organisms." An average width of 4.9m and an average gradient of 1.54m/km were reported for this creek by Horner (1971). The riffle chosen for collecting is located approximately 75 meters downstream from a bridge located in the NW¼ of Sec. 10, T 12N, R 10E, Coles County, Illinois. The substrate in this riffle consists mainly of sand, gravel, slate, and some larger rocks.

Riley Creek is a small third-order stream which empties into Kickapoo Creek. An average width of 5.08m and a gradient which averages 1.07m/km characterize this stream (Horner 1971). The primary riffle sampled is located in the NW¼ of Sec. 16, T 12N, R 9E and approximately 155m upstream from the bridge crossing the creek at this point. The substrate in the riffles here is composed mainly of sand and coarse gravel; some large rocks are also found. Beetles and available food samples were taken mainly from the riffle described above; on several occasions, however, sampling was done at riffles downstream from the primary riffle.

Materials and Methods

Field Methods

Larval and adult specimens of *Stenelmis* spp. were taken from riffles in Polecat and Riley Creeks, Coles County, Illinois. Sampling was done over a period of six months from 27 June 1980 through 23 December 1980. At least two samples were taken each month, one from each creek; a total of fourteen samples were taken.

Collections of beetles were made by using a Surber-swift water sampler and by hand-picking specimens from rocks. Specimens were placed in Acid-Lugol's solution: 1 part iodine, 2 parts potassium iodide, 20 parts water, and 2 parts glacial acetic acid. Regurgitation was not observed in the short period of time, usually less than 3 hours, required to travel from the field to the laboratory. During the summer collection period, the specimens were kept on ice until dissected in the laboratory.

In order to estimate available food, the surfaces of rocks from each of the riffles were scraped into distilled water and preserved with Acid-Lugol's solution. An approximate attempt was made to scrape a constant total surface area for each sample. Samples were stored in the dark at 4-8^{o} C for later analysis.

Laboratory Methods

Rock scrapings were analyzed by means of the membrane-filter technique modified from McNabb (1960). A sub-sample of variable size was diluted to 25ml to prevent clogging of the filter. The 25ml sample was then agitated and filtered through a gridded 47mm (diameter) Millipore filter disk, type HAWG, with a pore size of 0.45 micrometers. The filters were allowed to dry overnight. A rectangular portion of the filter was then cut to fit onto a 3x1 inch slide to which low viscosity immersion oil had previously been added. A small additional amount of immersion oil was then added to the top of the filter rectangle before placing the coverslip over it.

Adults and larvae were identified to species or genus, respectively, by the use of Brown's identification manual of the Dryopoidea (1972).

The intact digestive tracts of both adults and larvae were removed by first cutting the extreme posterior portion of the abdomen. Then grasping the head with a pair of self-closing microdissecting forceps, and the pronotum with another pair of forceps, the digestive tract was pulled from the body cavity intact. If the digestive tract was broken, the specimen was discarded.

The gut contents for each taxonomic group were pooled. The sample was vigorously agitated before filtering and the entire sample was filtered in the same manner as the rock scrapings. This technique is modified from that of McNabb (1960) and has been used by several researchers for quantitative analyses of gut contents of aquatic insects

(Mecom and Cummins,1964; Coffman, Cummins, and Wuycheck, 1971; Koslucher and Minshall,1973; Hall and Pritchard,1975). Brown (1961) reviews several methods of gut content analyses.

Each slide (rock scrapings or gut contents) was examined under oil immersion (1000x), and algae, detritus, etc. were counted on a "per strip" basis. A strip is defined here as the horizontal microscopic field of view between two grid markings on the filter disk at 1000x. Strips were counted until either 30 strips or 300 organisms were counted on each slide.

All diatoms were identified to genus. All other organisms were identified to the lowest possible taxonomic category. Diatoms and other algae were identified with the aid of the following: Smith (1950); Prescott (1962); Tiffany and Britton (1951); Patrick and Reimer (1966, 1975); Weber (1971); Collins and Kalinsky (1977).

Temperature data for the entire sampling period are represented in Figure 1 and Figure 2.

Results

Tables 1-5 present the raw data collected during this study. Each of these tables is divided into seven major categories, as follows: Bacillariophycophyta (diatoms), Chlorophycophyta (green algae), Phytoflagellates, Chrysophycophyta (golden-brown algae), Cyanochloranta (blue-green algae), Miscellaneous (hydra thecae, pollen, and testicate protozoans), and detritus.

Several subgroups under the above headings should be defined here to clarify their meaning. Within the Chlorophycophyta are two categories representing unidentified unicellular green algae, coccoids and grouped coccoids. Coccoids are unicellular green algae which are isolated from similar cells. The term grouped coccoids refers to more than one green algal cell in a somewhat loose aggregation. Under the heading Chrysophycophyta is the subheading sarcinoid Chrysophyceae. This grouping refers to golden-brown algal cells in a packet-like arrangement.

In order to give some indication of relative abundance in each sample the number of strips per slide, number of food items per slide, and number of individual organisms per slide (larvae or adult beetles) are presented in Tables 1-5. This information is repeated in the continuation of each of these tables for ease of comparison.

Reference to Tables 1-5 and 6-10 shows that several groups of food items comprised a consistently high proportion in both the rock scrapings and the gut analyses. Six diatom genera were found to comprise the highest relative percentage of diatoms on the rocks and within the guts of the beetles, *Amorpha*, *Cocconeis*, *Cyclotella*, *Gomphonema*, *Navicula*, and *Nitzschia*. Of these genera, *Navicula* and *Nitzschia* were, in most cases, the most common diatoms encountered on the rocks and in the gut analyses.

Within the Chlorophycophyta, three groups consistantly comprised an important percentage of the gut contents and rock scrapings. Unicellular coccoids and grouped coccoids made up the largest percentage of the green algae both on the rocks and in the gut analyses; however, the unicellular coccoids and grouped coccoids were found in greater numbers within the guts than on the rocks. Members of the Ulotrichales (filamentous green algae) were found to comprise a smaller percentage of the green algae on rocks and in gut contents, but, as before, a greater percentage of the filamentous green algae occurred in the gut contents than on the rocks.

The Chrysophycophyta were represented on the rocks primarily by sarcinoid Chrysophyceae. Within the gut contents of both larvae and adult beetles, sarcinoid Chrysophyceae and *Dinobryon*-like organisms were represented.

The Cyanochloronta fluctuated widely during the sampling period. *Anabaena*-like algae accounted for a very small percentage of the organisms present on the rocks. However, the overall percentage of *Anabaena*-like organisms in the gut analyses was high in some cases, a situation which may be due to fragmentation of the trichomes during mastication, during the filtration technique, or both.

Tables 11 and 12 present the mean percentages of each of the major food groups found on the rocks and in the beetle guts. Table 12 gives this information for both creeks; Table 11 separates the results for each creek. Detritus and diatoms make up a consistently high percentage on the rocks and within the guts. The percentage of green algae is consistently high in the guts, but lower in the rock scrapings. These three categories, detritus, Bacillariophycophyta, and Chlorophycophyta, comprise the major food categories of the rock scrapings and the gut contents.

A one-way analysis of variance (ANOVA) was performed on each major category for each creek, both separately and combined (data from Tables 6-10). These tests were done in order to ascertain whether any significant differences existed in the data to indicate feeding preferences or resource partitioning. All percentage data were first transformed to their arcsine equivalent. This transformation was done so that statistical comparisons could be made. The resulting F values are found in Table 13. Consistently significant differences at the $p \leq 0.05$ level were seen for the diatoms and green algae. Other significant differences were found for individual streams.

A Student-Newman Keuls (SNK) test was run for each significant F value in Table 13. Sokal and Rohlf (1969) define this procedure as follows: "Student-Newman Keuls is an example of a stepwise method using the range as the statistic to measure differences among means." The SNK will then compare the means (ranked in ascending order) and determine where the significant differences occur for significant F values shown by the ANOVA tests (Table 14).

Differences shown by Table 14 are primarily between the rock scrapings and the gut contents of the beetles; in only one case is any difference seen between the food habits of the beetles. Larvae were found to have taken greater amounts of diatoms than S. vittipennis in Polecat creek. As shown by Table 14 many of the differences seen for each creek alone were differences between one or two means and did not carry over when both creeks were combined.

In most instances larval and adult beetles were found to have fewer diatoms in the gut analyses than were found on the rocks. Only the gut contents of larvae in Polecat creek were found not to be different from the rock scrapings. In most cases the percentages of green algae were found to be different when comparing the rock scrapings to the gut contents of the beetles. The beetles were found to have consumed a greater amount of green algae than was found on the rocks. In Polecat creek the amount of green algae in gut contents of adult S. vittipennis and larvae were found not to differ from the amount of green algae on the rocks. In Riley creek the amount of green algae in the gut contents of S. vittipennis were found not to differ from the amount of green algae observed from the rock scrapings. When data from both streams were combined *S. vittipennis* and *Stenelmis* larvae were found to contain significantly greater amounts of green algae than were found in rock scrapings.

Comparison of the percentages of intact diatoms with those in which the chloroplasts were lacking showed rock scrapings and gut contents with mean percentages of diatoms without chloroplasts of 9.8% and 47.6% respectively. These values are significantly different at the $p \leq 0.01$ level.

Discussion

From the data collected here, *S. sexlineata*, *S. vittipennis* *S. crenata*, and larval *Stenelmis* spp. can be classified as scrapers and collectors according to the classification of trophic niches as proposed by Cummins (1973). Further, the feeding habits observed during this study indicate that these beetles are detritovore/herbivores, which generally graze the surfaces of rocks. These conclusions support other investigators' assumptions and conclusions.

Preferential or selective feeding was not unequivocally demonstrated. The amounts of green algae in the gut contents were significantly greater than the amounts found on the rocks. This difference could indicate several things. One possiblity is that these beetles show an actual preference for green algae. A second possibility is that these beetles are showing a preference for feeding areas or microhabitat selection. The selection of microhabitat where green algae are abundant would show an apparent preference for green algae even if the beetles were generally scraping rock surfaces. The selection of microhabitat may, however, be influenced by the types of food present and, therefore, green algae may be selected for in this manner. It is likely that the mechanism at work here is a combination of factors (trophic as well as others, such as substrate preference) which results in a larger percentage of green algae in the gut than that found in the rock scrapings.

The consistently low percentage of diatoms in the guts as compared to that found from the rock scrapings would at first indicate an avoidance of diatoms by these beetles. However, consideration of the manner in which the diatom counts were made in this study renders such a conclusion invalid. From the comparisons of rock scrapings and gut analyses the percentage of diatoms without chlorophyll from the rock scrapings was less than the percentage of diatoms without chlorophyll (and other cytoplasmic inclusions) in the gut analyses. Therefore, it appears that the beetles have the ability to digest the material found within the diatom frustules. If the diatoms assumed to have been digested are taken into account for the gut analyses, the rock scrapings and the gut contents appear to be subequal.

Several significant differences were found within each creek separately but were not found to be consistent between creeks nor when data for both creeks were combined (Table 13). Acutal feeding preference or feeding area preference (microhabitat selection) may be at work here. Also as the differences which are not consistent for both streams are found in Polecat creek and all three species of Elmidae in this study were present in the same riffle the possibility of increased competition may result in the differences seen.

The wide variation in previously reported gut contents makes comparisons with these studies difficult. In addition, the lack of estimates of available food in these earlier studies makes comparisons difficult. However, some comparisons can be made. Cummins (1973) reports adult S. beameri to contain 59.4% algae and 40.6% detritus; these values are similar to those found in this study (Table 12). The values which Cummins found for larval _S. beameri_ were quite different from those found for larval _Stenelmis_ spp. in this investigation. Two previous studies report significantly different foods for _S. crenata_. Lesage and Harper (1976) report _S. crenata_ larvae to have taken 90% detritus and 10% diatoms. Seagle (1979) reports _S. crenata_ larvae to contain 74.9% detritus, 19.9% green algae, and 5.2% diatoms. Adult _S. crenata_ were reported to contain 77.1% detritus, 22.5% green algae, and 0.4% diatoms. In this study, _S. crenata_ were found to have taken 57.5% detritus, 21.7% green algae, 11.6% diatoms, and 9.2% in other categories combined. Detritus was found to play a less important part in the food habits of _S. crenata_ in this study than was found in the above study and diatoms were found in greater abundance than in Seagle's work.

Seagle (1979) concludes that resource partitioning for the three species of Elmidae he observed is multi-dimensional (spatial, temporal, and trophic). He also concludes that spatial strategies are probably the most important means by which these beetles partition resources; he considered trophic and temporal partitioning less important. No indication of resource partitioning for food types was found in this study. Seagle suggests that food particle size may play an important role in resource partitioning for elmid beetles. A distinct body size difference for each of the three species of beetles studied by Seagle has been shown by Brown (1972); therefore, Seagle concludes that this size difference may translate to a particle size selection for food items. No distinct size groupings as seen by Seagle were reported by Brown (1972) for the species considered in this study. Particle size can not be ruled out, however, and is most probably a means, in at least some instances, by which resource partitioning may be accomplished by these beetles.

Future investigations into feeding habits and resource partitioning in the family Elmidae should take into account several factors; (1) Microhabitat preference (2) gross substrate preference (3) position of the adult and larval beetles on rocks and other substrates (4) comparison of particle size of potentially available food and that ingested.

In conclusion this study showed Stenelmis sexlineata, Stenelmis vittipennis, Stenelmis crenata, and Stenelmis larvae to be scrapers/collectors and detritivores/herbivores, and in the main were generalists. Green algae, however, were found in greater concentrations in the gut than on the rocks which could indicate either preferential feeding or spatial microhabitat preference. Diatoms were digested by the beetles. No certain evidence was discovered for resource partitioning by feeding preferences.

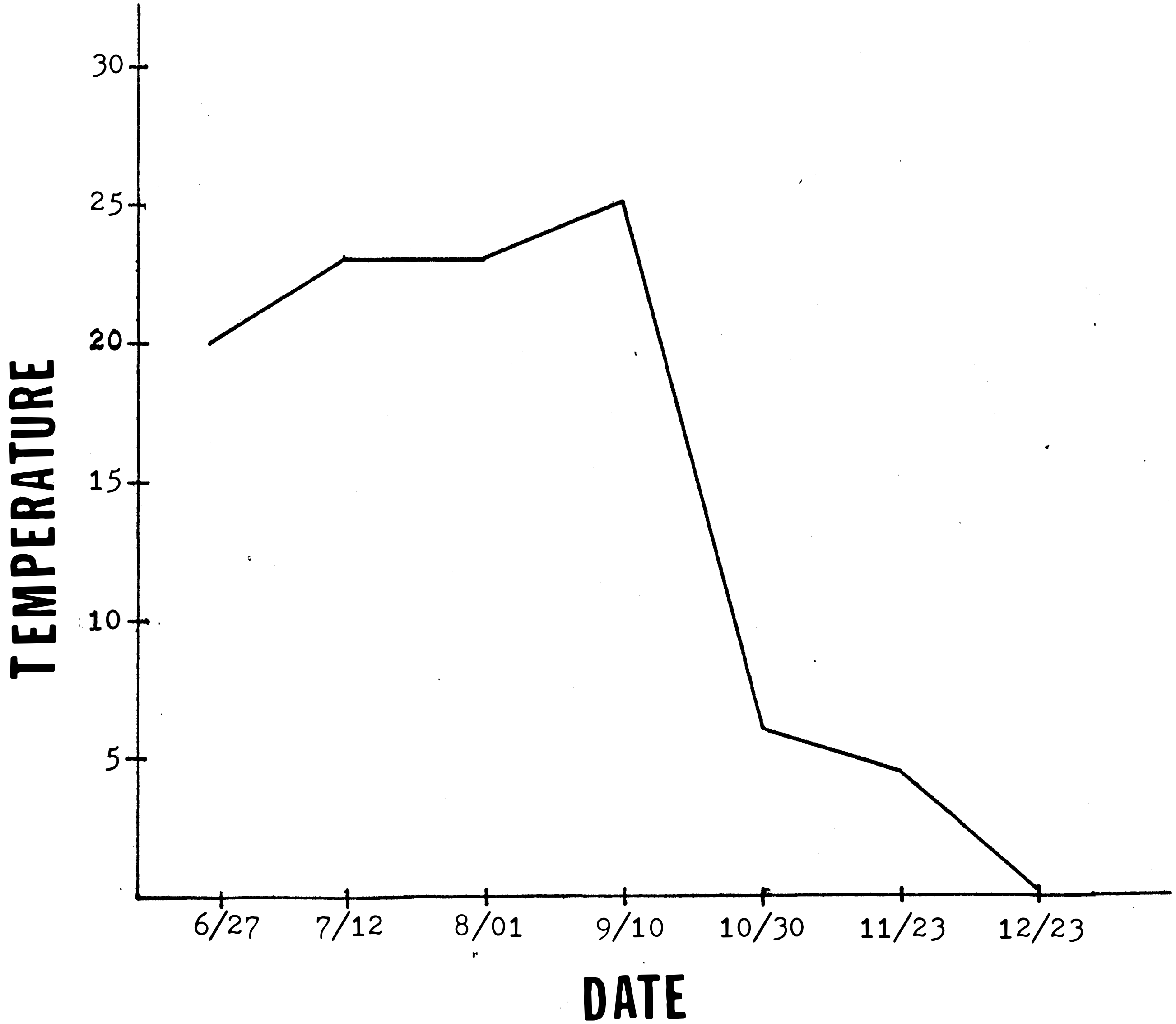

Figure 1. Water temperature (°C), Riley Creek.

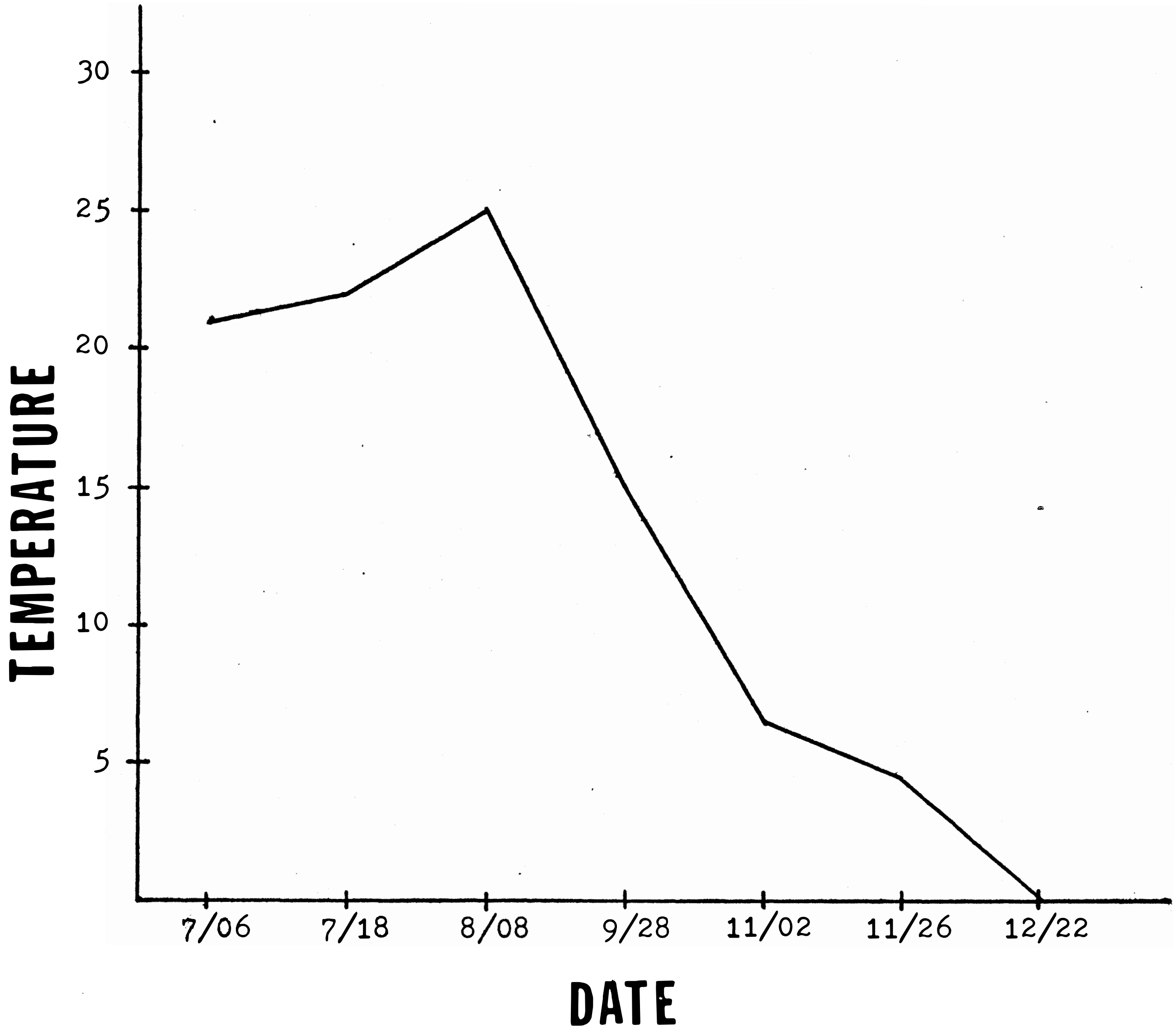

Figure 2. Water temperature (°C), Polecat Creek.

Table 1. Composition of rock scrapings given according to the appropriate taxonomic category for each date.

Date of Sample	Stream*	# Strips/Slide	# Food Items/Slide	BACILLARIOPHYCOPHYTA	Achanthes	Amorpha	Cocconeis	Cyclotella	Cymatopleura	Cymbella	Diatoma	Diploneis	Epithemia	Fragilaria	Gomphonema	Gyrosigma	Hantzschia	Melosira	Navicula	Neidium	Nitzschia	Pinnularia	Rhoicosphenia	Stauroneis	Stephanodiscus	Surirella	Synedra
6/27	2	4	773		6	22	17	12	-	16	-	1	-	-	13	-	-	1	87	-	42	1	43	-	-	4	6
7/06	1	1	930		11	53	10	9	-	3	-	-	-	1	26	-	2	3	85	-	130	1	18	-	-	8	2
7/12	2	1	748		6	28	14	8	-	3	-	-	-	1	12	-	-	-	105	-	117	1	19	-	-	-	1
7/18	1	2	921		4	35	6	9	1	7	-	6	-	-	15	-	-	-	100	-	62	1	15	-	-	9	3
8/01	2	7	714		4	12	19	6	-	3	-	-	-	7	11	-	-	-	101	-	131	2	4	-	-	2	7
8/08	1	2	118		1	85	5	21	2	-	-	-	-	-	9	-	-	1	83	-	64	1	12	-	-	-	4
9/10	2	1	754		-	6	9	1	2	1	-	1	-	-	8	-	-	-	88	-	125	-	1	-	-	3	6
9/28	1	2	1200		4	23	8	15	-	1	-	1	-	4	9	2	-	1	82	-	125	-	7	-	-	1	6
10/30	2	4	770		2	3	9	19	1	3	-	4	-	6	16	-	-	-	90	-	88	6	3	-	1	4	8
11/02	1	1	1134		6	64	18	18	-	9	-	1	-	3	8	-	-	-	65	-	91	3	10	-	1	1	4
11/23	2	1	733		5	8	20	75	1	4	-	-	-	5	10	1	-	2	100	-	86	2	4	-	3	8	8
11/26	1	1	602		-	7	4	45	-	-	1	1	-	10	10	-	-	6	62	-	127	1	-	-	1	15	2
12/22	1	1	648		-	5	3	34	4	-	-	-	-	1	26	-	-	-	46	-	160	-	5	-	-	11	5
12/23	2	2	1118		15	3	12	30	3	2	-	-	-	15	18	-	-	-	162	-	180	1	8	1	4	12	9

*1=Polecat Creek; 2=Riley Creek

Table 1(cont.). Composition of rock scrapings given according to the appropriate taxonomic category for each date.

Date of Sample	Stream*	# Strips/Slide	# Food Items/Slide	CHLOROPHYCOPHYTA Ulotrichales	Closterium	Coccoids	Coelastrum	Cosmarium	Franceia	Grouped coccoids	Pandorina	Scenedesmus	Stephanosphera	PHYTOFLAGELLATES Cryptomonad	Euglenoids	CHRYSOPHYCOPHYTA Dinobryon-like	Sarcinoid Chrysophyceae	CYANOCHLORONTA Anabaena-like	MISCELLANEOUS Hydra theca	Pollen	Testicate protozoans	DETRITUS
6/27	2	4	773	18	-	39	-	-	-	2	-	-	-	-	3	-	2	-	-	3	-	435
7/06	1	1	930	-	-	19	-	-	-	-	-	-	-	-	2	-	-	-	-	2	-	545
7/12	2	1	748	6	-	20	-	-	-	6	-	-	-	-	-	-	-	3	-	3	-	395
7/18	1	2	921	2	-	25	-	-	-	4	-	-	-	-	3	1	3	-	-	3	-	610
8/01	2	7	714	15	-	23	-	-	-	-	-	-	-	-	3	-	-	-	-	4	-	360
8/08	1	2	1181	10	-	24	-	-	-	-	1	-	-	-	1	-	4	-	-	1	-	850
9/10	2	1	754	9	-	15	-	-	-	4	-	-	-	-	1	1	56	2	-	1	-	415
9/28	1	2	1200	10	-	17	-	-	-	-	-	-	-	-	1	-	4	-	-	5	-	874
10/30	2	4	770	14	-	25	-	-	-	9	-	-	-	-	10	-	1	-	-	3	-	804
11/02	1	1	1134	2	-	17	-	-	-	2	-	-	-	-	1	-	2	2	-	4	-	802
11/23	2	1	733	11	-	7	-	-	-	2	-	-	-	-	1	-	-	-	-	-	-	370
11/26	1	1	602	2	-	19	-	-	-	-	-	-	-	-	1	-	-	-	-	3	-	285
12/22	1	1	648	1	-	6	-	-	-	-	-	-	-	-	-	-	1	-	-	5	-	335
12/23	2	2	1118	7	-	12	-	-	-	3	-	-	-	-	-	-	-	-	-	1	-	620

*1=Polecat Creek; 2*Riley Creek

Table 2. Gut contents of larval <u>Stenelmis</u> spp. given according to the appropriate taxonomic category for each date.

Date of Sample	Stream*	# Strips/Slide	# Larvae/Slide	# Food Items/Slide	BACILLARIOPHYCOPHYTA Achanthes	Amorpha	Cocconeis	Cyclotella	Cymatopleura	Cymbella	Diatoma	Diploneis	Epithemia	Fragilaria	Gomphonema	Gyrosigma	Hantzschia	Melosira	Navicula	Neidium	Nitzschia	Pinnularia	Rhoicosphenia	Stauroneis	Stephanodiscus	Surirella	Synedra
6/27	2	30	20	166	1	1	4	122	-	-	-	-	-	-	24	1	-	2	45	-	16	3	4	-	35	4	10
7/06	1	25	14	690	2	7	8	86	5	10	-	-	-	7	21	-	-	-	79	1	38	5	2	-	7	1	1
7/12	2	22	20	563	4	7	41	6	-	13	-	5	-	7	12	-	1	1	33	1	54	2	16	-	-	8	-
7/18	1	25	20	639	8	16	6	37	-	14	3	2	-	4	17	-	-	-	51	-	30	5	5	2	2	7	4
8/01	2	17	20	568	1	5	19	25	-	5	2	4	-	6	10	1	-	-	42	-	76	2	9	-	-	2	1
8/08	1	30	20	482	4	3	4	35	2	3	-	-	-	-	1	-	-	-	13	-	17	2	-	-	1	4	-
9/10	2	23	20	658	3	11	16	30	8	6	-	2	-	-	16	-	-	-	68	-	87	-	-	-	1	6	-
9/28	1	12	20	1208	-	14	2	38	-	5	1	3	-	2	19	2	1	-	69	-	103	-	-	-	-	7	-
10/30	2	30	19	161	-	1	-	25	-	-	-	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-	-
11/02	1	30	19	617	-	6	2	32	-	1	-	1	-	-	6	-	2	-	24	-	65	-	1	-	-	1	-
11/23	2	30	19	95	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	2	-
11/26	1	30	19	116	-	1	-	3	-	-	-	-	-	-	1	-	-	1	1	-	1	1	-	-	-	-	-
12/22	1	30	16	79	-	-	-	8	-	-	-	-	-	-	2	-	-	-	-	-	2	-	-	-	-	-	-
12/23	2	30	18	117	-	-	-	19	-	-	-	-	-	-	1	-	-	-	2	-	5	-	-	-	-	-	-

*1=Polecat Creek; 2=Riley Creek

Table 2(cont.). Gut contents of larval <u>Stenelmis</u> spp. given according to the appropriate taxonomic category for each date.

Date of Sample	Stream*	# Strips/Slide	# Larvae/Slide	# Food Items/Slide	CHLOROPHYCOPHYTA	Ulotrichales	Closterium	Coccoids	Coelastrum	Cosmarium	Franceia	Grouped Coccoids	Pandorina	Scenedesmus	Stephanosphera	PHYTOFLAGELLATES	Cryptomonad	Euglenoids	CHRYSOPHYCOPHYTA	Dinobryon-like	Sarcinoid Chrysophyceae	CYANOCHLORONTA	Anabaena-like	MISCELLANEOUS	Hydra theca	Pollen	Testicate protozoans	DETRITUS
6/27	2	30	20	166		33	-	16	-	-	-	-	-	-	-		-	-		-	-		-		1	41	-	63
7/06	1	25	14	690		-	-	42	-	-	-	5	-	-	-		-	14		-	4		-		-	7	3	335
7/12	2	22	20	563		51	-	21	-	-	-	27	-	-	-		-	6		-	9		-		-	2	1	235
7/18	1	25	20	639		4	-	45	-	-	-	21	1	2	-		-	4		-	2		14		-	13	-	320
8/01	2	17	20	568		54	-	22	-	-	-	14	-	-	-		-	7		-	2		1		1	2	-	255
8/08	1	30	20	482		1	-	24	-	-	-	1	-	-	-		-	3		10	1		2		-	42	-	310
9/10	2	23	20	658		4	-	36	-	-	-	5	-	-	-		-	10		4	3		-		-	-	2	340
9/28	1	12	20	1208		8	-	31	-	-	-	-	-	-	-		-	5		2	3		-		-	13	3	874
10/30	2	30	19	161		-	-	27	-	-	-	17	-	-	-		-	4		-	3		2		-	3	-	75
11/02	1	30	19	617		-	-	63	-	-	-	7	-	-	-		-	4		23	-		47		-	43	4	285
11/23	2	30	20	95		-	-	31	-	-	-	16	-	-	-		-	-		-	8		1		-	-	-	35
11/26	1	30	20	116		-	-	57	-	-	-	7	-	-	-		-	-		-	2		8		-	2	1	30
12/22	1	30	16	79		-	-	10	-	-	-	2	-	-	-		-	-		-	1		4		-	-	-	50
12/23	2	30	18	117		-	-	25	-	-	-	7	-	-	-		-	3		-	-		5		-	-	-	50

*1=Polecat Creek; 2=Riley Creek

Table 3. Gut contents of adult <u>Stenelmis sexlineata</u> given according to the appropriate taxonomic category for each date.

Date of Sample	Stream*	# Strips/Slide	# Beetles/Slide	# Food Items/Slide	BACILLARIOPHYCOPHYTA	Achanthes	Amorpha	Cocconeis	Cyclotella	Cymatopleura	Cymbella	Diatoma	Diploneis	Epithemia	Fragilaria	Gomphonema	Gyrosigma	Hantzschia	Melosira	Navicula	Neidium	Nitzschia	Pinnularia	Rhoicosphenia	Stauroneis	Stephanodiscus	Surirella	Synedra
6/27	2	30	11	656		2	3	2	20	-	3	-	-	-	1	7	-	-	-	49	-	5	4	2	-	-	-	1
7/06	1	30	16	298		-	3	5	2	-	6	-	-	-	2	7	-	-	1	14	1	17	2	2	-	-	-	-
7/12	2	30	20	580		23	2	35	15	-	15	-	5	-	3	6	-	-	-	35	-	56	5	10	-	1	8	-
7/18	1	30	7	235		2	3	3	8	-	2	-	2	-	-	1	-	1	-	4	-	-	5	-	-	-	-	-
8/01	2	30	20	636		1	2	19	7	-	8	1	5	-	-	26	4	-	-	57	-	41	3	1	-	1	1	3
8/08	1	30	15	309		2	4	9	9	-	1	-	-	-	-	2	-	-	-	1	-	15	1	-	-	-	1	-
9/10	2	30	20	242		-	3	4	8	-	-	-	-	-	-	2	-	-	-	15	-	15	-	1	-	-	-	-
9/28	1	30	9	146		-	1	1	7	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-
10/30	2	30	19	107		-	-	1	18	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
11/02	1	30	6	65		1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11/23	2	30	20	95		-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-	-	-	-	-
11/26	1	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/22	1	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/23	2	30	4	134		-	-	-	16	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-

*1=Polecat Creek; 2=Riley Creek

Table 3(cont.). Gut contents of adult <u>Stenelmis</u> <u>sexlineata</u> given according to the appropriate taxonomic category for each date.

Date of Sample	Stream*	# Strips/Slide	# Beetles/Slide	# Food Items/Slide	CHLOROPHYCOPHYTA	Ulotrichales	Closterium	Coccoids	Coelastrum	Cosmarium	Franceia	Grouped coccoids	Pandorina	Scenedesmus	Stephanosphera	PHYTOFLAGELLATES	Cryptomonad	Euglenoids	CHRYSOPHYCOPHYTA	Dinobryon-like	Sarcinoid Chrysophyceae	CYANOCHLORONTA	Anabaena-like	MISCELLANEOUS	Hydra theca	Pollen	Testicate protozoans	DETRITUS
6/27	2	30	11	656		-	13	75	-	-	-	147	-	2	-		-	3		-	49		-		-	35	3	230
7/06	1	30	16	298		-	-	50	-	-	-	43	2	-	-		-	4		-	12		-		-	20	-	105
7/12	2	30	20	580		-	-	32	-	-	-	22	-	-	-		-	5		-	10		-		-	1	1	290
7/18	1	30	7	235		-	-	23	-	-	-	18	-	-	-		-	3		-	2		11		1	5	1	235
8/01	2	30	20	636		2	-	21	-	-	-	12	-	-	-		-	5		-	-		-		-	71	-	345
8/08	1	30	15	309		-	-	19	-	-	-	11	-	1	-		-	-		6	4		3		-	17	-	203
9/10	2	30	20	242		-	-	14	-	-	-	9	-	-	-		-	-		5	2		-		-	2	2	160
9/28	1	30	9	146		-	-	14	-	-	-	4	-	1	-		-	1		3	2		12		-	4	1	90
10/30	2	30	19	107		-	-	21	-	-	-	13	-	-	-		-	2		-	2		1		-	-	2	45
11/02	1	30	6	65		-	-	10	-	-	-	3	-	-	-		-	-		4	-		17		-	11	-	17
11/23	2	30	20	95		-	-	13	-	-	-	13	-	-	-		-	1		2	4		8		-	-	-	50
11/26	1	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-		-	-		-		-	-	-	-
12/22	1	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-		-	-		-		-	-	-	-
12/23	2	30	4	134		-	-	40	-	-	-	3	-	-	-		-	-		1	-		2		-	1	-	70

*1=Polecat Creek; 2=Riley Creek

Table 4. Gut contents of adult Stenelmis vittipennis given according to the appropriate taxonomic category for each date.

Date of Sample	Stream*	# Strips/Slide	# Beetles/Slide	# Food Items/Slide	BACILLARIOPHYCOPHYTA	Achanthes	Amorpha	Cocconeis	Cyclotella	Cymatopleura	Cymbella	Diatoma	Diploneis	Epithemia	Fragilaria	Gomphonema	Gyrosigma	Hantzschia	Melosira	Navicula	Neidium	Nitzschia	Pinnularia	Rhoicosphenia	Stauroneis	Stephanodiscus	Surirella	Synedra
6/27	2	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/06	1	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/12	2	30	10	463		-	3	11	14	-	9	-	2	-	5	15	1	-	-	32	-	81	-	5	-	-	2	-
7/18	1	30	13	351		4	3	5	8	-	2	-	2	-	-	2	-	-	-	6	-	7	-	-	-	2	-	-
8/01	2	30	16	524		3	-	61	5	-	2	-	1	-	-	9	-	4	-	35	-	32	-	-	-	-	1	1
8/08	1	30	7	233		-	4	1	3	-	-	-	-	-	-	-	-	-	-	2	-	8	-	-	-	-	-	-
9/10	2	30	12	158		1	1	4	6	-	-	-	-	-	-	3	-	-	-	6	-	8	-	-	-	-	-	-
9/28	1	30	4	257		1	2	3	6	-	1	-	-	-	-	-	-	-	-	2	-	4	-	-	-	-	-	-
10/30	2	30	6	96		-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11/02	1	30	3	162		-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11/23	2	30	4	29		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
11/26	1	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/22	1	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/23	2	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*1=Polecat Creek; 2=Riley Creek

Table 4(cont.). Gut contents of adult Stenelmis vittipennis given according to the appropriate taxonomic category for each date.

Date of Sample	Stream*	# Strips/Slide	# Beetles/Slide	# Food Items/Slide	CHLOROPHYCOPHYTA	Ulotrichales	Closterium	Coccoids	Coelastrum	Cosmarium	Franceia	Grouped coccoids	Pandorina	Scenedesmus	Stephanosphera	PHYTOFLAGELLATES	Cryptomonad	Euglenoids	CHRYSOPHYCOPHYTA	Dinobryon-like	Sarcinoid Chrysophyceae	CYANOCHLORONTA	Anabaena-like	MISCELLANEOUS	Hydra theca	Pollen	Testicate protozoans	DETRITUS
6/27	2	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-		-	-		-		-	-	-	-
7/06	1	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-		-	-		-		-	-	-	-
7/12	2	30	10	463		5	-	19	-	-	1	14	-	-	-		-	5		-	7		-		-	2	-	230
7/18	1	30	13	351		9	-	33	-	-	-	18	-	-	-		6	-		-	1		23		-	20	-	200
8/01	2	30	16	524		1	-	29	-	-	-	5	1	-	-		-	1		-	3		3		-	7	-	320
8/08	1	30	7	233		-	-	11	-	-	-	12	-	-	-		-	-		6	-		-		1	10	-	175
9/10	2	30	12	158		-	-	10	-	-	-	7	-	-	-		-	2		3	-		-		-	7	-	100
9/28	1	30	4	257		-	-	8	-	-	-	5	-	-	-		-	1		19	2		10		-	5	8	180
10/30	2	30	6	96		-	-	13	-	-	-	4	-	-	-		-	-		6	-		3		1	7	2	50
11/02	1	30	3	162		-	-	18	-	-	-	14	-	-	-		-	-		10	-		35		1	2	-	81
11/23	2	30	4	29		-	-	6	-	-	-	3	-	-	-		-	-		1	-		8		-	-	-	10
11/26	1	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-		-	-		-		-	-	-	-
12/22	1	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-		-	-		-		-	-	-	-
12/23	2	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-		-	-		-		-	-	-	-

*1=Polecat Creek; 2=Riley Creek

Table 5. Gut contents of adult <u>Stenelmis</u> <u>crenata</u> given according to the appropriate taxonomic category for each date.

Date of Sample	Stream*	# Strips/Slide	# Beetles/Slide	# Food Items/Slide	BACILLARIOPHYCOPHYTA	Achanthes	Amorpha	Cocconeis	Cyclotella	Cymatopleura	Cymbella	Diatoma	Diploneis	Epithemia	Fragilaria	Gomphonema	Gyrosigma	Hantzschia	Melosira	Navicula	Neidium	Nitzschia	Pinnularia	Rhoicosphenia	Stauroneis	Stephanodiscus	Surirella	Synedra
7/06	1	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/18	1	30	20	428		3	3	5	13	-	6	-	4	-	2	3	-	-	-	6	-	19	-	1	-	-	-	-
8/08	1	30	20	444		3	5	20	7	-	4	1	-	-	-	2	-	-	-	9	-	12	-	1	-	2	-	-
9/28	1	30	12	315		1	-	-	7	-	-	-	-	-	-	-	-	-	-	5	-	6	-	-	-	-	-	-
11/02	1	30	3	30		-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
11/26	1	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/22	1	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*1=Polecat Creek; 2=Riley Creek

Table 5(cont.). Gut contents of adult Stenelmis crenata given according to the appropriate taxonomic category for each date.

Date of Sample	Stream*	# Strips/Slide	# Beetles/Slide	# Food Items/Slide	CHLOROPHYCOPHYTA Ulotrichales	Closterium	Coccoids	Coelastrum	Cosmarium	Franceia	Grouped coccoids	Pandorina	Scenedesmus	Stephanosphera	PHYTOFLAGELLATES Cryptomonad	Euglenoids	CHRYSOPHYCOPHYTA Dinobryon-like	Sarcinoid Chrysophyceae	CYANOCHLORONTA Anabaena-like	MISCELLANEOUS Hydra theca	Pollen	Testicate protozoans	DETRITUS
7/06	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/18	1	30	20	428	-	-	29	-	-	-	11	-	-	-	-	4	-	1	27	1	5	-	285
8/08	1	30	20	444	-	-	15	-	-	-	12	-	-	-	-	3	5	2	3	2	40	-	295
9/28	1	30	12	315	-	-	31	-	-	-	14	1	-	-	-	8	5	8	1	-	28	-	200
11/02	1	30	3	30	-	-	6	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	10
11/26	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/22	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*1=Polecat Creek; 2=Riley Creek

Table 6. Relative percentage of food items found in the rock scrapings for each sample date. (Percentage is based on the number of times the food item appears in each sample).

Date of Collection

Food Category	6/27	7/06	7/12	7/18	8/01	8/08	9/10	9/28	10/30	11/02	11/23	11/26	12/22	12/23
Detritus	56.2	58.6	52.8	66.2	50.4	72.0	55.0	72.8	57.8	70.6	50.5	47.3	51.6	55.4
Bacillario-phycophyta	35.1	39.0	42.1	29.7	43.3	24.4	33.3	24.1	34.2	26.6	46.7	48.5	46.3	42.5
Chlorophycophyta	7.6	2.0	4.3	3.4	5.3	3.1	3.7	2.3	6.2	1.9	2.7	3.5	1.1	2.0
Chrysophycophyta	0.3	0.0	0.0	0.4	0.0	0.3	7.6	0.3	0.1	0.2	0.0	0.0	0.2	0.0
Cyanochloronta	0.0	0.0	0.4	0.0	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Phytoflagellates	0.4	0.2	0.0	0.0	0.4	0.1	0.0	0.1	1.3	0.1	0.1	0.2	0.0	0.0
Miscellaneous	0.4	0.2	0.4	0.3	0.6	0.1	0.1	0.4	0.4	0.4	0.0	0.5	0.8	0.1

Table 7. Relative percentage of gut contents for larval <u>Stenelmis</u> spp. for each sample date. (Percentage based on number of times the food item appears in the stomach).

Date of Collection

Food Category	6/27	7/06	7/12	7/18	8/01	8/08	9/10	9/28	10/30	11/02	11/23	11/26	12/22	12/23
Detritus	38.0	48.6	41.7	50.1	44.9	64.3	51.7	72.4	46.6	46.3	36.8	25.8	63.3	42.6
Bacillario-phycophyta	7.2	40.6	37.5	33.4	37.0	18.3	38.6	22.3	18.6	22.9	4.2	7.8	15.1	23.1
Chlorophycophyta	29.5	6.8	17.6	11.4	15.8	5.4	6.8	3.2	27.3	11.3	49.5	55.2	15.2	27.4
Chrysophycophyta	0.0	0.6	1.6	0.3	0.4	2.3	1.1	0.4	1.9	3.7	8.4	1.7	1.3	0.0
Cyanochloronta	0.0	0.0	0.0	2.2	0.2	0.4	0.0	0.0	1.2	7.6	1.1	6.9	5.1	4.3
Phytoflagellates	0.0	2.0	1.1	0.6	1.2	0.6	1.5	0.4	2.5	0.6	0.0	0.0	0.0	2.6
Miscellaneous	25.3	1.4	0.5	2.0	0.5	8.7	0.3	1.3	1.9	7.6	0.0	2.6	0.0	0.0

Table 8. Relative percentage of gut contents for adult *Stenelmis sexlineata* for each sample date. (Percentage based on number of times the food item appears in the stomach).

Date of Collection

Food Category	6/27	7/06	7/12	7/18	8/01	8/08	9/10	9/28	10/30	11/02	11/23	11/26	12/22	12/23
Detritus	35.0	35.3	50.0	59.5	54.2	65.7	66.1	61.7	42.1	26.1	52.6	-	-	52.3
Bacillario-phycophyta	15.1	20.8	37.8	13.2	28.3	14.6	19.8	9.6	19.6	4.6	4.2	-	-	12.7
Chlorophycophyta	36.1	31.9	9.3	17.4	5.5	10.0	9.5	13.0	31.8	20.0	27.4	-	-	32.1
Chrysophycophyta	7.5	4.0	1.7	0.9	0.0	3.2	2.9	3.4	1.9	6.2	6.3	-	-	0.7
Cyanochloronta	0.0	0.0	0.0	4.7	0.0	1.0	0.0	8.2	0.9	26.2	8.4	-	-	1.5
Phytoflagellates	0.5	1.3	0.9	1.3	0.8	0.0	0.0	0.7	1.9	0.0	1.1	-	-	0.0
Miscellaneous	5.8	6.7	0.3	3.0	11.2	5.5	1.7	3.4	1.8	16.9	0.0	-	-	0.7

Table 9. Relative percentage of gut contents for adult <u>Stenelmis vittipennis</u> for each sample date. (Percentage based on number of times the food item appears in the stomach).

Date of Collection

Food Category	6/27	7/06	7/12	7/18	8/01	8/08	9/10	9/28	10/30	11/02	11/23	11/26	12/22	12/23
Detritus	-	-	49.7	57.0	61.0	75.1	63.2	70.0	52.1	50.0	34.4	-	-	-
Bacillario-phycophyta	-	-	38.9	11.7	29.4	7.7	18.4	7.4	10.4	0.6	3.5	-	-	-
Chlorophycophyta	-	-	8.4	17.1	6.9	9.9	10.8	5.0	17.7	19.7	31.1	-	-	-
Chrysophycophyta	-	-	1.5	0.3	0.6	2.6	1.9	8.2	6.3	6.2	3.4	-	-	-
Cyanochloronta	-	-	0.0	6.5	0.6	0.0	0.0	3.9	3.1	21.6	27.6	-	-	-
Phytoflagellates	-	-	1.1	1.7	0.2	0.0	1.3	0.4	0.0	0.0	0.0	-	-	-
Miscellaneous	-	-	0.4	5.7	1.3	4.7	4.4	5.1	10.4	1.9	0.0	-	-	-

Table 10. Relative percentage of gut contents for adult <u>Stenelmis crenata</u> for each sample date. (Percentage based on number of times the food item appears in the stomach).

Date of Collection

Food Category	6/27	7/06	7/12	7/18	8/01	8/08	9/10	9/28	10/30	11/02	11/26	12/22	12/23
Detritus	-	-	-	66.6	-	66.4	-	63.5	-	33.3	-	-	-
Bacillario-phycophyta	-	-	-	15.2	-	15.1	-	6.1	-	10.0	-	-	-
Chlorophycophyta	-	-	-	9.4	-	6.1	-	14.6	-	56.7	-	-	-
Chrysophycophyta	-	-	-	0.2	-	1.6	-	4.1	-	-	-	-	-
Cyanochloronta	-	-	-	6.3	-	0.7	-	0.3	-	-	-	-	-
Phytoflagellates	-	-	-	0.9	-	0.7	-	2.5	-	-	-	-	-
Miscellaneous	-	-	-	1.4	-	9.4	-	8.9	-	-	-	-	-

Table 11. Mean percentage of food items found in all categories for all sample dates combined in each individual creek. (Percentage is based on the number of times the item appears in each sample.)

Polecat Creek	Rock Scrapings	Larvae	S. sexlineata	S. vittipennis	S. crenata
Detritus	62.7	52.9	49.6	63.0	57.5
Bacillariophycophyta	34.1	22.9	12.6	6.9	11.6
Chlorophycophyta	2.5	15.5	18.5	12.9	21.7
Chrysophycophyta	0.2	1.5	3.5	4.3	1.5
Cyanochloronta	0.0	3.2	8.0	8.0	1.8
Phytoflagellates	0.1	0.6	0.7	0.5	1.0
Miscellaneous	0.4	3.4	7.1	4.4	4.9

Riley Creek	Rock Scrapings	Larvae	S. sexlineata	S. vittipennis	S. crenata
Detritus	54.1	43.2	50.4	52.1	-
Bacillariophycophyta	39.6	23.7	19.6	20.1	-
Chlorophycophyta	4.5	24.8	21.7	15.0	-
Chrysophycophyta	1.1	1.9	3.0	2.7	-
Cyanochloronta	0.1	1.0	1.5	6.3	-
Phytoflagellates	0.3	1.3	0.7	0.5	-
Miscellaneous	0.3	4.1	3.1	3.3	-

Table 12. The mean percentage of food items found in all categories for all sample dates combined. (Percentage is based on the number of times the item appears for each sample.)

	Rock Scrapings	Larvae	*S. sexlineata*	*S. vittipennis*	*S. crenata*
Detritus	58.4	48.1	50.1	56.9	57.5
Bacillariophycophyta	36.8	23.3	16.7	14.2	11.6
Chlorophycophyta	3.5	20.2	20.3	14.2	21.7
Chrysophycophyta	0.7	1.7	3.2	3.4	1.5
Cyanochloronta	0.1	2.1	4.2	7.0	1.8
Phytoflagellates	0.2	0.9	0.7	0.5	1.0
Miscellaneous	0.3	3.7	4.8	3.8	4.9

Table 13. F values from the one-way ANOVA tests. Data represented are arcsine values and *=a significant F value($p \leq 0.05$).

	Polecat Creek		Riley Creek		Both Creeks	
	$F_{cal.}$	$F_{table(4,22)}$	$F_{cal.}$	$F_{table(3,22)}$	$F_{cal.}$	$F_{table(4,47)}$
Detritus	0.94	2.82	3.47	3.05	1.84	2.61
Bacillariophycophyta	9.40*	2.82	3.65*	3.05	8.86*	2.61
Chlorophycophyta	3.10*	2.82	6.40*	3.05	7.11*	2.61
Chrysophycophyta	5.55*	2.82	1.69	3.05	2.46	2.61
Cyanochloronta	2.73	2.82	1.37	3.05	2.75	2.61
Phytoflagellates	4.11	2.82	1.26	3.05	1.75	2.61
Miscellaneous	3.88*	2.82	0.84	3.05	1.85	2.61

Table 14. Results of the SNK range tests for significant F values. Lines overlapping the numerical values indicate no significant differences between those means (means in this table represent arcsine equivalents). The means are coded as follows: R=Rock Scrapings, L=larval *Stenelmis*, S_1=*Stenelmis sexlineata*, S_2=*Stenelmis vittipennis*, and S_3=*Stenelmis crenata*.

POLECAT CREEK

Bacillariophycophyta		Chlorophycophyta		Chrysophycophyta		Miscellaneous	
S_2	14.08	R	8.90	R	2.14	R	3.42
S_3	19.64	S_2	20.51	S_3	5.37	L	9.13
S_1	20.26	L	21.31	L	6.43	S_3	10.47
L	28.01	S_1	25.03	S_1	10.52	S_2	11.82
R	35.54	S_3	25.61	S_2	10.87	S_1	14.68

RILEY CREEK

Bacillariophycophyta		Chlorophycophyta	
S_2	24.94	R	12.05
S_1	25.48	S_2	22.00
L	27.90	S_1	26.65
R	38.96	L	29.14

BOTH CREEKS

Bacillariophycophyta		Chlorophycophyta	
S_2	18.34	R	10.48
S_3	19.64	S_2	21.34
S_1	23.30	L	25.22
L	27.95	S_3	25.61
R	37.25	S_1	25.98

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