

# The Great Lakes Entomologist

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Volume 17  
Number 4 - Winter 1984 *Number 4 - Winter*  
1984

Article 5

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December 1984

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### Recommended Citation

Newman, Dennis L. and Funk, Richard C. 1984. "Drift of Riffle Beetles (Coleoptera: Elmidae) in a Small Illinois Stream," *The Great Lakes Entomologist*, vol 17 (4)

DOI: <https://doi.org/10.22543/0090-0222.1522>

Available at: <https://scholar.valpo.edu/tgle/vol17/iss4/5>

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## DRIFT OF RIFFLE BEETLES (COLEOPTERA: ELMIDAE) IN A SMALL ILLINOIS STREAM

Dennis L. Newman<sup>1</sup> and Richard C. Funk<sup>2</sup>

### ABSTRACT

The daily and seasonal periodicities of drift of riffle beetles were examined in Polecat Creek, Illinois, during the spring and summer of 1978. Drift samples were collected from a single site over four 24-h periods. *Dubiraphia vittata* adults comprised 72% of the total numerical sample and exhibited greatest mean daily drift density in September. *Macronychus glabratus* adults were also common in drift collections, with highest densities recorded during May and August. The drift of *D. vittata* and *M. glabratus* exhibited distinct patterns of diel periodicity with peaks occurring in the early hours of darkness. Substantial differences in drift densities between adult and larval stages were evident for *D. vittata* and *M. glabratus*, in both cases the adults were more prone to drift.

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The drift of lotic invertebrates refers to the downstream displacement of benthic organisms in stream currents. Benthic organisms of lotic habitats are variously adapted to resist displacement by stream flow (Hynes 1970); however, some organisms do lose their attachment and are swept downstream. Three types of invertebrate drift have been identified: "behavioral" drift, "constant" drift, and "catastrophic" drift. It is behavioral drift, with its pronounced nocturnal peaks, which has been so well studied by stream ecologists.

Comprehensive reviews of the drift literature have been completed by Hynes (1970) and Waters (1969, 1972). In addition, Adamus and Gaufin (1976) presented a synopsis of Nearctic taxa found in the drift. Taxa that are generally considered to be quantitatively most important in the drift are Ephemeroptera, Trichoptera, and Plecoptera. Elmids, which are generally a common component of the lotic fauna, are rarely reported as being significant contributors to the drift. The purpose of this study was to investigate the diel and seasonal variations in drift of the elmid community in a small warmwater stream.

### THE STUDY AREA

Polecat Creek originates from field tiles in Edgar County and flows westward approximately 22 km to the Embarras River in Coles County, Illinois. The creek has an overall drop of 40 m: the upper 14.5 km has a gradient of 1.06 m/km and the lower 7.6 km drops at a rate of 3.2 m/km. The watershed for the entire stream system drains 7434 ha of land. Polecat Creek has been described as a stream with relatively clean water and an abundant and diverse invertebrate and fish fauna (Durham and Whitley 1971, Horner 1971).

Drift collections were taken at one site located 4.6 km upstream from the mouth of the stream. The sampling site was bordered on the north by an oak-hickory forest and on the south by rolling farmland. The dominant aquatic vegetation was the alga *Cladophora*, which grew on rocks during early summer. The mean stream width at the sampling site was 5.8 m, the mean depth was 23 cm, and the mean current velocity during sampling was 0.42 m/sec.

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## MATERIALS AND METHODS

Drift collections were taken from a single riffle over a 24-h period on 28-29 April, 19-20 May, 10-11 August, 1-2 September 1978. The sampling location was in midstream near the downstream end of a riffle. The net was supported by iron rods driven into the substrate and was positioned close to the stream bed; however, the immediate area about the net was not disturbed. The upper edge of the net was always above the surface of the water column. The April and May collections were made using a drift net with a mesh size of 0.646 mm; however, that net was lost in a flood and the August and September collections were made using a mesh size of 0.471 mm. Current velocity measurements were taken at the mouth and on either side of the drift net using a Gurley Pygmy current meter. Cross-sectional area was measured immediately downstream of the net using a meter stick. Drift samples were collected at 2-h intervals and preserved in 70% isopropyl alcohol. The drift of aquatic invertebrates was standardized according to volume of water passing through the net, defined as drift density, and expressed as numbers per 100 m<sup>3</sup>.

## RESULTS AND DISCUSSION

Elmids in Polecat Creek exhibited maximum drift densities in the August and September collections (Table 1). The seasonal increase was primarily due to large numbers of adult elmids. The highest mean daily drift density occurred in September when *Dubiraphia vittata* (Melsheimer) reached a density of 22.2 individuals/100m<sup>3</sup>. *Macronychus glabratus* (Say) adults were most abundant in May with a mean daily drift density of 2.8/100m<sup>3</sup>. Abundance of *Stenelmis crenata* (Say) adults and *Stenelmis* larvae exhibited peaks in August. *S. vittipennis* (Zimmerman) adults and *Dubiraphia* larvae exhibited no seasonal trends in abundance. *Ancyronyx variegata* (Germar) adults were uncommon in all drift samples; their peak drift density (0.09/100m<sup>3</sup>) occurred in August. Of the 1150 elmids collected from Polecat Creek, *D. vittata* and *M. glabratus* adults comprised 72 and 13%, respectively, of the total sample. Elmid larvae comprised a small percentage (8%) of the total drift samples.

In Polecat Creek, two elmids, *D. vittata* and *M. glabratus*, exhibited distinct patterns of diel periodicity (Fig. 1). *D. vittata* exhibited unimodal drift patterns with peaks occurring in the early hours of darkness. Peak nocturnal densities ranged from 7.4 to 130.8/100m<sup>3</sup>; in contrast, diurnal drift densities ranged from 0 to 3.1/100m<sup>3</sup>. The drift of *M. glabratus* was bimodal in both May and August. The nocturnal peaks in drift of *M. glabratus* extended over a 6-h period; whereas the drift pattern of *D. vittata* exhibited a sharp rise approximately 1-h after sunset, followed by a gradual decline through the night. The latter drift pattern is generally considered to be the classic pattern of diel periodicity (Waters 1972).

In Polecat Creek, distinct differences in drift densities between adult and larval stages were evident for *D. vittata* and *M. glabratus* (Table 1). For both species, the adults were more prone to drift. However, differences in drift rates between adults and larvae of the genus *Stenelmis* were minimal and were probably only random differences. Brusven (1970) reported differences in drift rates between larval and adult stages for the elmids *Narpus concolor* (LeConte) and *Optioservus seriatus* (LeConte) from two streams in Idaho. As was the case in Polecat Creek, the adults in Brusven's study showed a greater propensity to drift. He attributed differences in drift to differing activities and use of the microenvironment, especially as it related to vertical distribution. More specifically, we believe that these differences in drift between adults and larvae result from subtle differences in food habits and the food gathering process. Waters (1972) stated that food gathering may be the principal activity resulting in drift. Davis (1981) examined food habits of three species of *Stenelmis* adults and *Stenelmis* larvae from Polecat Creek and found no differences between adult and larval food selection. Interestingly, those adults and larvae also showed no differences in drift rates.

Although invertebrate drift is now a well studied phenomenon, a review of the drift literature indicated that certain taxa from this study have not previously been reported as

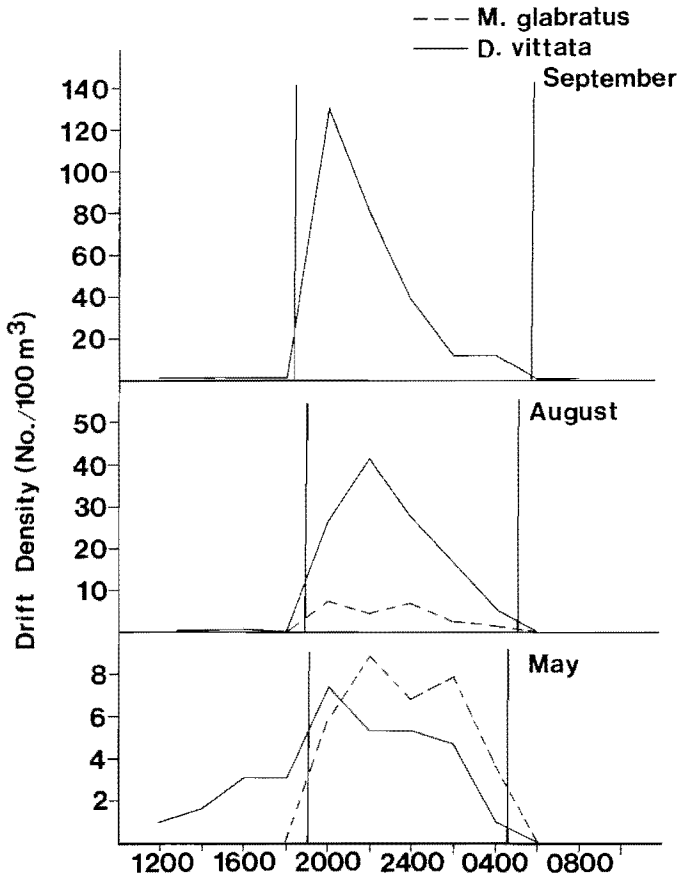


Fig. 1. Diel drift patterns for the elmids *Dubiraphia vittata* and *Macronychus glabratus*, collected in Polecat Creek, Illinois. Vertical lines represent sunrise and sunset.

components of the drift. Adamus and Gaufin (1976) compiled a synopsis of those taxa known to drift and those taxa which exhibit a pattern of diel periodicity. According to that review, *D. vittata* and *S. crenata* had not previously been reported as components of the drift, nor had *D. vittata* and *M. glabratus* been reported as drifting in a pattern of diel periodicity.

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Table 1. Composition, numbers, and mean drift density (no./100 m<sup>3</sup>) of elmids from drift samples in Polecat Creek, Illinois.

Taxa	April		May		August		September	
	No.	No./100 m <sup>3</sup>	No.	No./100 m <sup>3</sup>	No.	No./100 m <sup>3</sup>	No.	No./100 m <sup>3</sup>
<i>Ancyronyx variegata</i> <sup>a</sup>	1	0.03	2	0.09	2	0.09	1	0.04
<i>Dubiraphia</i> sp. <sup>b</sup>	—	—	5	0.20	2	0.07	—	—
<i>D. vittata</i> <sup>a</sup>	28	0.78	62	2.71	234	9.84	509	22.16
<i>Macronychus</i> sp. <sup>b</sup>	4	0.11	8	0.35	12	0.46	—	—
<i>M. glabratus</i> <sup>a</sup>	29	0.80	64	2.80	46	1.92	13	0.59
<i>Stenelmis</i> sp. <sup>b</sup>	4	0.11	7	0.31	42	1.70	7	0.28
<i>S. crenata</i> <sup>a</sup>	6	0.17	6	0.26	20	0.84	5	0.20
<i>S. vittipennis</i> <sup>a</sup>	8	0.22	6	0.26	7	0.31	10	0.41
Total	80	2.22	160	6.93	365	15.23	545	23.68

<sup>a</sup>Adults.<sup>b</sup>Larvae.

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