

The Occurrence of *Baetis rhodani* (Ephemeroptera) in the River Lune

by

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ABSTRACT

After a long course over a stony substratum, the River Lune, England, runs over flat rock covered with moss. Larvae of four species of Ephemeroptera are abundant in this moss-covered area from spring to autumn. They overwinter in the egg stage. *Baetis rhodani*, abundant in much of the river at all times of year, is numerous in this stretch in winter but absent from most summer collections. This absence is tentatively attributed to exclusion by the summer species.

INTRODUCTION

The River Lune, one of the chief rivers draining north western England, runs southwards between two upland masses, the Lake District to the west and the Pennine Chain to the east. Most of the tributaries come from the Pennines. The main river flows through a long alluvial plain over a bed of pebbles, and finally, in a region known as the Crook o' Lune, cuts through a ridge of Millstone Grit to enter the sea at Lancaster. In the gorge through the Millstone Grit the river is floored with flat rock. Below a weir much of this rock is exposed and bare when the river level is low, and water is confined to a narrow channel, but above the weir the whole river-bed is always submerged and carpeted by moss (*Cinclidotus fontinaloides* (Hedw.) P. Beauv.). Here, in the middle of the summer of 1973, during the course of a search for a place to which students might be taken, *Centropilum pennulatum*, *C. luteolum*, *Procloeon bifidum* and *Baetis scambus* were encountered. As information about the life histories of these species was scanty or lacking, further collections were made (Macan 1978). A general survey of the whole river was also undertaken (Macan 1976).

METHODS

The collections were made with a hand-net of mesh fine enough to retain the smallest specimens, and, the objective being to secure a large sample, they lasted longer when specimens were scarce, or conditions were unfavourable. The numbers cannot, therefore, be compared. During a dry period the river was clear and collecting was easy. After rain the river was so turbid that neither the bottom nor the net could be seen, and after heavy rain the water rose to a level at which collections could be made only in the terrestrial vegetation.

CATCHES OF THE COMMON SPECIES

Collecting ceased in October 1973, started again in April 1974 and then continued without a break until October 1975. The findings call for little comment. Throughout the three summers, the four species named above, referred to in Table 1 as the summer species, were numerous, and during the winters, apart from a small number of *C. luteolum*, they were absent. All four species probably overwinter as eggs undergoing diapause development, except for *C. luteolum* which overwinters both in this way and in the larval stage (Bretschko 1965, Macan 1978). During the winter, *Baetis rhodani* was numerous and *B. muticus* was generally present. These two species disappeared in the spring when the summer species appeared and reappeared in the autumn when the summer species were becoming scarce. During the summer *B. rhodani* was rarely taken, though there were two large catches, one in 1973 and one in 1974, both in July.

Fig. 1 shows the lengths of the larvae of *B. rhodani*. The first arrival was a cohort of medium-sized larvae which continued to grow and which had disappeared by December, presumably having emerged. In November there was an influx of small larvae which grew slowly, and in February a second arrival of small larvae produced a fairly even distribution of individuals among the various size-classes. This persisted until *B. rhodani* disappeared from the Crook o' Lune, a disappearance that was evidently not due to emergence.

Table 2 shows the numbers of *B. rhodani* and *B. scambus* captured in summer some 10 km upstream in the middle of the river at Gressingham. The bottom here was of rounded pebbles and the flow so swift that only a coarse net could be used. Small larvae of *Baetis* pass through a coarse net. *Baetis scambus* is abundant in various parts of the R. Lune, but *Centropetium pennulatum*, *C. luteolum*, and *Procladius bifidus* are uncommon above the Crook and confined to places where flow is slow near the edge of the river (Macan 1976, table 2).

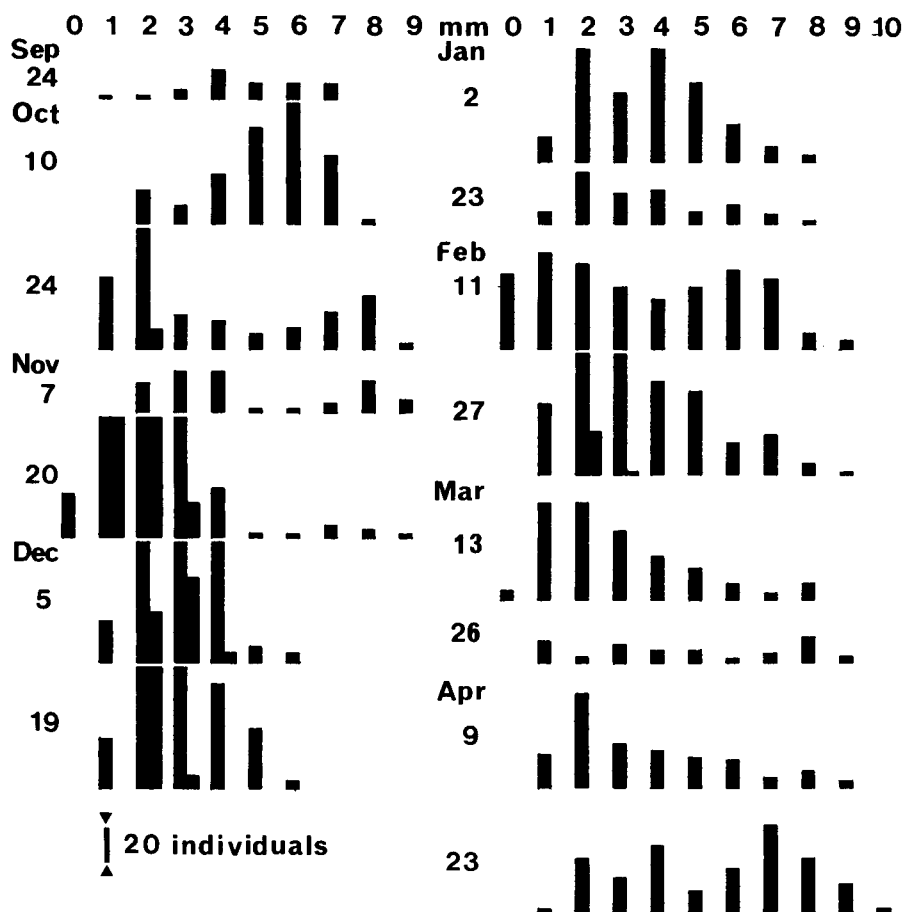


Fig. 1. Crook o' Lune: winter 1974/5. Number of specimens of *Baetis rhodani* in each millimetre size-group. When numbers exceed 40 the total is indicated in two columns.

0 = specimens less than 1 mm long.

1 = specimens between 1 and 2 mm long and so on.

DISCUSSION

Downstream drift of a species is at a maximum when activity is greatest (Elliott 1967). It is also associated with scarcity of food (Bohle 1978). *Gammarus pulex*, unable to maintain its position in a rapid flow at low temperature, is carried downstream in winter and regains the ground lost (Meijering 1972). Animals are carried downstream by floods.

The appearance of *B. rhodani* in the Crook o' Lune was not related to floods.

Table 1. Collections in the Crook o' Lune

	1973								1974							
	June 19	July 3	July 18	August 1 15 23			Sept 6	Oct 3	April 4 25		May 17 30		June 13 26			
summer spp.	150	214	194	178	395	329	109	84	8	154	72	187	58	204		
<i>B. rhodani</i>	0	0	25	0	0	0	0	1	45	4	0	0	4	0		
<i>B. muticus</i>	0	0	2	0	0	1	0	0	155	119	0	0	0	0		

	1974								1975							
	July 10 25		Aug 15	Sept 22	October 10 24		November 7	December 20	December 5 19		January 2 23		February 11 27			
summer spp.	220	212	336	117	41	18	13	2	4	5	12	7	0	0		
<i>B. rhodani</i>	124	0	2	29	126	132	54	261	187	196	146	56	193	203		
<i>B. muticus</i>	6	0	1	2	0	2	1	5	3	1	0	3	5	2		

	1975															
	March 13 26		April 8 23		May 7 21 27			4	June 12 18		25	3	July 10 23 31			
summer spp.	0	24	26	7	82	112	173	98	172	109	11	45	76	55	122	
<i>B. rhodani</i>	123	37	96	121	21	0	1	0	0	0	0	0	0	4	0	
<i>B. muticus</i>	6	6	38	9	7	0	0	0	0	0	0	0	0	2	0	

	1975							
	August 12 21 28			September 3 12 18			Oct 28 13	
summer spp.	248	225	164	121	114	40	115	38
<i>B. rhodani</i>	0	1	0	0	0	11	42	67
<i>B. muticus</i>	0	0	0	0	0	0	3	1

Table 2. River Lune at Gressingham; two-minute collections with a coarse net

	1978				1979				
	Jul	Sept	May	June	July	Aug	Oct		
	18	20	7	4 18	3 20	27	2		
<i>B. scambus</i>	85	66	10	10	153	164	173	10	6
<i>B. rhodani</i>	106	9	209	257	13	14	158	34	37
<i>B. muticus</i>	0	0	24	13	0	0	0	0	1

It appears in that region when temperature is falling and leaves when temperature is rising, but whether there is a connexion is not known. Except in some acid headwaters, *B. rhodani* is abundant throughout the R. Lune above the Crook at all times of year (Macan 1976) but whether food shortage at any time of year might lead to an unusual amount of drifting has not been investigated.

Any explanation of the observations recorded in Table 1 must take account not only of the arrival of *B. rhodani* but also of its departure. The invasions of July 1973 and 1974 disappeared as rapidly as they appeared. The occurrence of this species in the Crook o' Lune is not obviously related to any of the factors

just discussed, but the evidence does point to a relation with the presence of the summer species. The suggestion put forward is that the summer species exclude *B. rhodani* and *B. muticus* in some way.

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