

Effects of spates on the benthic macroinvertebrate community of a prealpine river (First results)

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Introduction

In the Kalte Sense, a prealpine river (Kanton Fribourg, CH), the effects of spates on the macroinvertebrate community was studied. The river reacts very sensitive to rainfall and after thundershower in the summertime

the water level often rises very fast. These spates often cause changes in the riverbed morphology.

It is accepted that discharge events are important abiotic factors for the benthic macroinvertebrate community and may decimate a great part of the population but only a few studies have been done. This study focuses on such high water situations, which occur several times in a year.

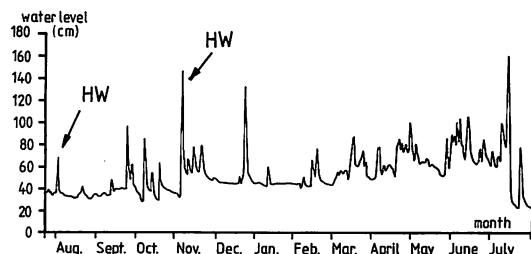


Fig. 1. Discharge regime.

Research area and method

The Kalte Sense is a steep mountain river (919 m above sea level) with a mean slope of 17‰. Its catchment area is 66 km² and the mean discharge is about 1.7 m³ · s⁻¹ (MARRER 1985). The width of the stream is between 6–10 m and the mean depth 0.3–0.5 m. Coarse gravel material (d(50%) = 50 mm) form the sediment surface.

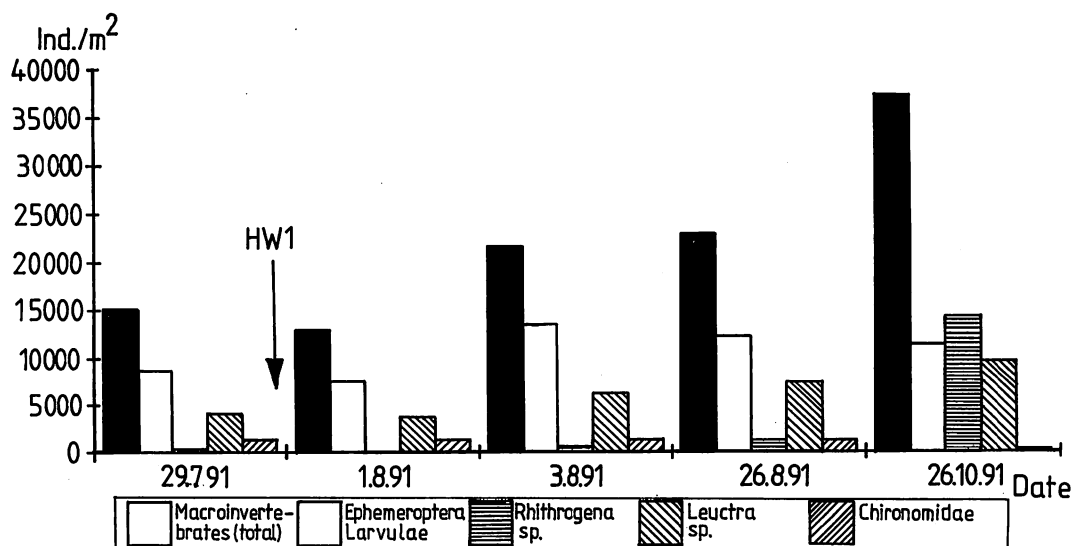


Fig. 2. Effect of HW1 to the benthic macroinvertebrates.

For sampling a modified Surber sampler (Box-sampler, mesh size 100 μm) and the Freezing-core method with electroposition (BRETSCHKO 1985) was used. The water level was registered by a Limnigraph (Fig. 1). A water level discharge relation is in preparation but not available at this time.

Results

Two high water situations (HW1, HW2), different in discharge and gravel transport were studied in detail.

Surber sampling

During HW1 the water level rose to 67 cm (31 cm above normal) but gravel transportation was small and also the effect on the benthic fauna. Three days after the spate the benthic fauna had fully recovered (Fig. 2). Discharge situations similar to HW1 are very common to the Kalte Sense, especially in spring, during snow melting. During a 375 days period 57 days with similar discharge conditions (60–70 cm) have been registered.

During HW2 the water level climbed up to 146 cm (110 cm above normal) and a great amount of gravel was transported. The event caused a 70 % decimation of the macroinvertebrate fauna. The fauna recovered, but 40 days after the spate there was still 35 % fewer animals than before (Fig. 3).

Events like HW2 occur much more seldom than HW1. During 375 days of observation 3 similar situations were detected.

Freeze-core-sampling

Freeze-core sampling was done before (1.11; N = 4) and shortly after (6.11; N = 3) the spate HW2. Comparing the two sample series, a clear reduction of the fauna was observed also in deeper layers of the bedsediments (Table 1).

The decimation of 3 important groups of the macroinvertebrate fauna, *Rhithrogena* sp., *Leuctra* sp. and Chironomidae was different and seems to be related to the distribution of the animals in undisturbed bedsediments (Fig. 4). *Rhithrogena* sp. suffered the most (88 % reduction), whereas Chironomidae, mainly distributed in sediment layers between 20 to 50 cm, showed the lowest reduction (45 %). The *Leuctra* sp. population, which colonizes the upper and lower parts of the bedsediments was reduced by 73 %. The distribution patterns before and after HW2 are shown in Fig. 4.

Discussion

The preliminary results of this study show that the spates may be important abiotic factors for the macroinvertebrate community of a mountain

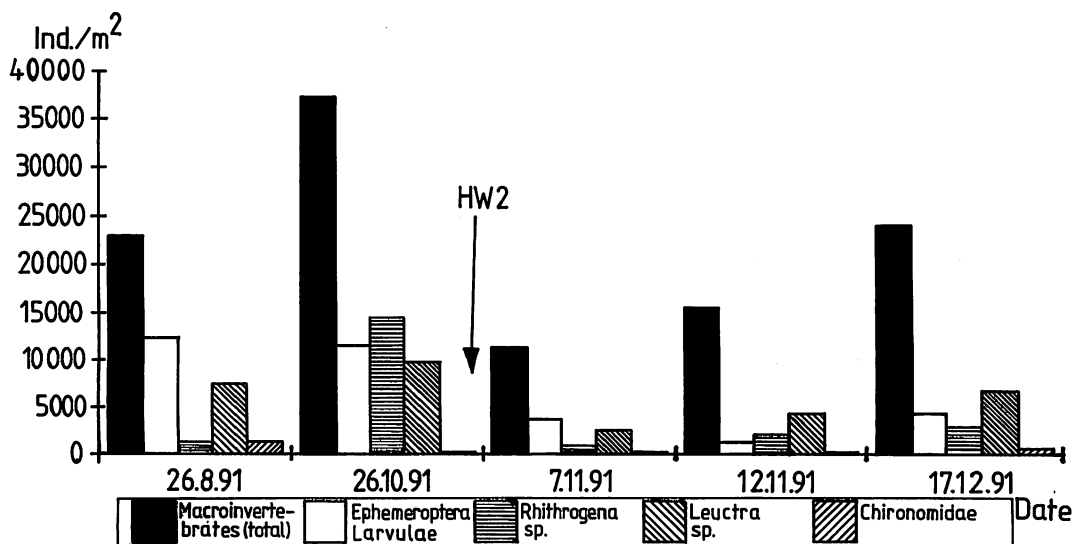


Fig. 3. Effect of HW2 to the benthic macroinvertebrates.

Table 1. Effect of HW2 on the fauna of different sediment layers.

Macroinvertebrate groups	Reduction in different sediment layers (%)					Total loss of individuals in the core (%)
	0–10 cm	10–20 cm	20–30 cm	30–50 cm	50–70 cm	
Macroinvertebrate (total)	71	51	78	67	15	64
Ephemeroptera <i>Rhithrogena</i> sp.	84	92	85	90	95	88
Plecoptera <i>Leuctra</i> sp.	82	63	78	62	31	73
Diptera Chironomidae	43	+11	87	64	13	45

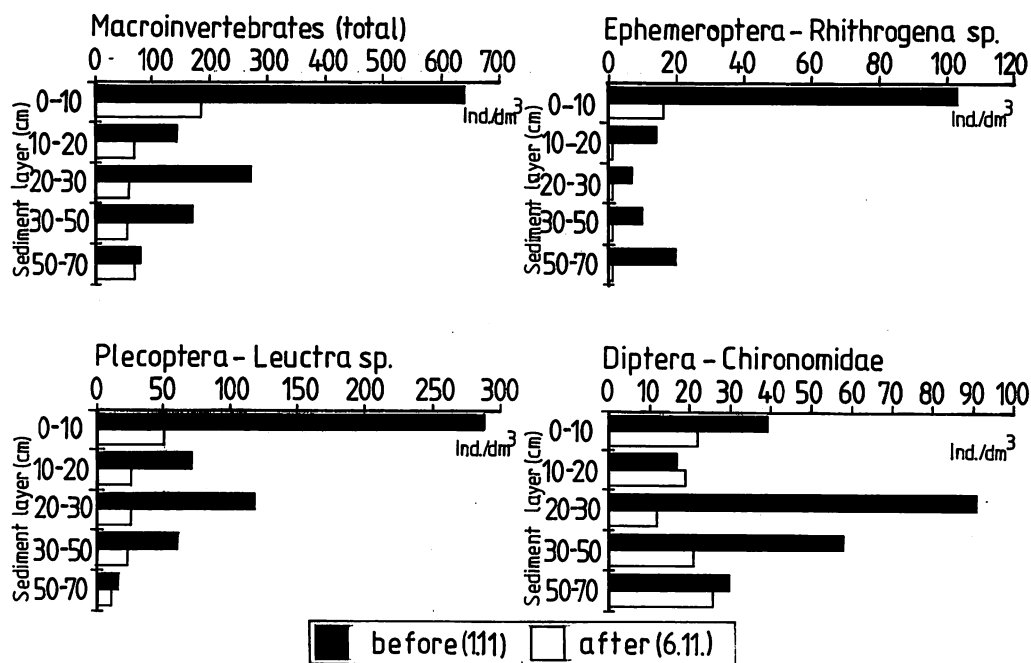


Fig. 4. The vertical distribution of benthic macroinvertebrates before November 1 and after November 6, the spate HW2.

stream. Especially if gravel transportations occur, they can cause a significant reduction of the population.

The Freeze-core samples show, that there is a decimation of the fauna also in deeper sediment layers, but the reduction of macroinvertebrates declines with depth.

SCHWÖRBEL (1964) described the hyporheic habitat as a refuge for macroinvertebrates during spates. With the methods used here it is not possible to tell, if there was an active migration of animals into the hyporheic habitat, but the freeze-core results suggest that the distribution of certain benthic macroinvertebrates (Chironomidae, Leuctri-

dae) in the bedsediments may act as a passive protection from spates.

Landschaft (BUWAL), Bundesamt für Straßenbau und SANDOZ AG Rheinfonds. Coordination: I. TOMKA and A. ZURWERRA.

Acknowledgements

The present study is a part of the project “Einfluß von technischen Eingriffen an natürlichen Fließgewässern auf die Fauna und Flora”, supported by Schweizerischem Nationalfond, Bundesamt für Umwelt, Wald und

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This is a reprint of

Verhandlungen – Proceedings – Travaux

of the International Association for Theoretical and Applied Limnology, Congress in Barcelona 1992

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