

How to assess and monitor ecological quality in freshwaters

Marja Ruoppa, Pertti Heinonen, Ansa Pilke, Seppo Rekolainen, Heikki Toivonen and Heidi Vuoristo (eds.)

The evaluation of long term monitoring of the River Laxá ecosystem, N. Iceland. The first 26 years

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Introduction

The purpose of monitoring is to observe changes that occur in ecosystems or populations of organisms. Their purposes vary according to the objectives of the studies. The main purpose of the EU Water Framework Directive is "achieving "good status" for all waters" after a continuous pressure from humans for centuries (EU 2000).

The animal populations in the Lake Mývatn-River Laxá ecosystems have been monitored for 26 - 30 years. The purpose of our monitoring studies is to (1) understand the nature and functioning of the river ecosystem, (2) to provide an alarm system when unwanted changes occur in the system and (3) to provide a tool for management.

Study area

The river Laxá runs from the lake Mývatn in NE-Iceland (65°35'N, 17°00'W) with a discharge of 33 m³s⁻¹ (Ólafsson 1979, Rist 1979) (Fig. 1). The study area extends from the lake outlet ca. 35 km downstream to the Brúafossar waterfalls (70 m high) in the Laxárgljúfur canyon, which prevents upstream migration of fish and sets a lower boundary for the study population (Gíslason 1994). The surface area of the river between Lake Mývatn and the Laxárgljúfur canyon is 355 ha.

Brown trout (*Salmo trutta*) is by far the most abundant fish species in this section of the river (Gíslason 1994). Below the Laxárgljúfur canyon, the river Laxá also sustains a large population of Atlantic salmon (*Salmo salar*). Two duck species are most abundant along the river, the Barrow's Goldeneye (*Bucephala islandica*) and the Harlequin duck (*Histrionicus histrionicus*) (Gardarsson 1979).

Between 1977 and 1985, about 50-94% of the benthic secondary production in the river was made up by the blackfly *Simulium vittatum* (Gíslason and Gardarsson 1988, Gíslason 1994) and most of the remaining secondary production was made by Orthocladinae (Chironomidae) (Gíslason in press).

Methods

Window traps catching mainly Chironomidae (midges) on the lake and Simuliidae (black-flies) and Chironomidae (midges) on the river were operated in May through September each year, beginning in 1977 (Jónsson et al. 1986). Two traps were at the lake and two traps at the river, at 2 and 5 km from the lake respectively, to monitor midges. Sport fisheries of the Laxá are closely regulated and the number of angling permits issued and catches are recorded (Gíslason et al. 2002, Steingrímsson and Gíslason 2002). The data on the waterfowl populations are for the years 1975 to 2002. Counting methods are described by Gardarsson (1979) and Gardarsson & Einarsson (1994, 2001).

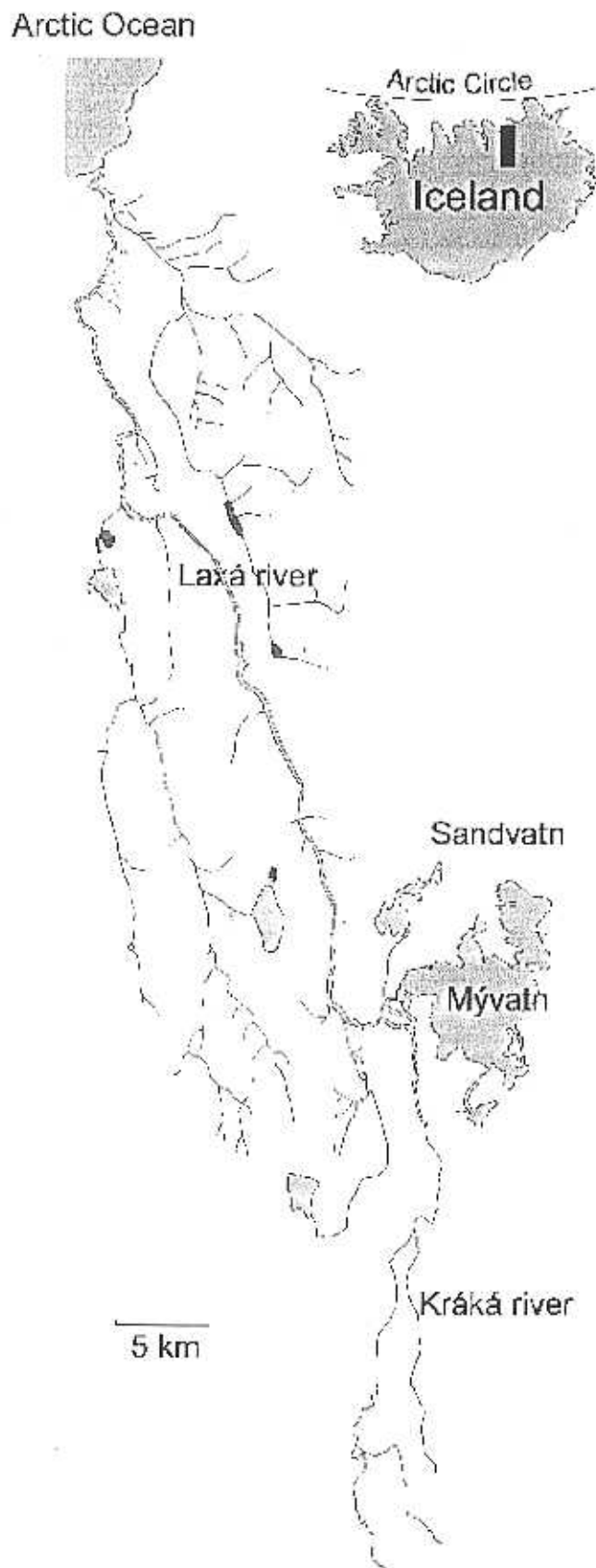


Figure 1. Map of the study area.

Results and discussion

The annual abundance of midges in the lake and the river traps tended to vary in an opposite fashion. In the upper Laxá, fluctuations of blackflies in the upper Laxá never exceeded one order of magnitude (Gíslason in print). Chironomid abundance in the Laxá traps was generally low and showed little year to year variation. In Lake Mývatn, chironomid abundance varied cyclically, with differences of up to three orders of magnitude from year to year, as the dominant species, *Tanytarsus gracilentus* went through its oscillations (Einarsson et al. 2002).

The total number of trout caught in the river was significantly related to the number of fishing permits issued (Fig. 2), but the catch per unit effort (CPUE) was highly significantly related to number of blackfly larvae in the generation commencing the year before (Fig 3). The numbers of Barrow's Goldeneyes on the river and on the lake were highly correlated to the number of blackflies in window traps along the river and number of chironomids around the lake. Highly significant relationship was found between the production of Harlequin ducklings and blackflies.

Monitoring animal populations on the Lake Mývatn and the River Laxá ecosystems has been essential in understanding their functioning and a useful management tool.

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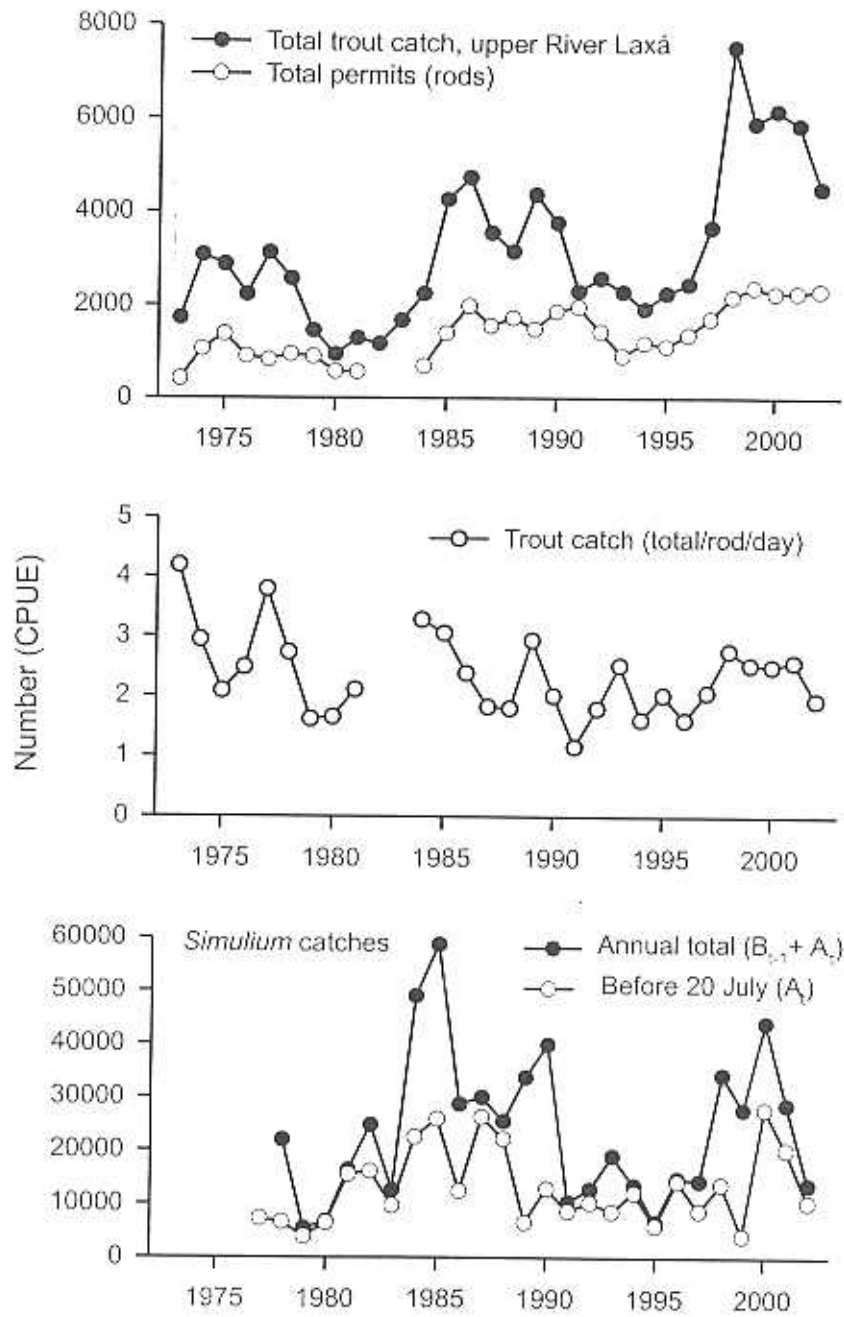


Figure 2. Annual issues of fishing permits and catch of brown trout (top), catch per unit effort (CPUE) of brown trout (middle) and window trap catches of blackflies in the River Laxá, shown as annual total and early summer (bottom). A is spring and early summer catches and B is late summer and autumn catches.

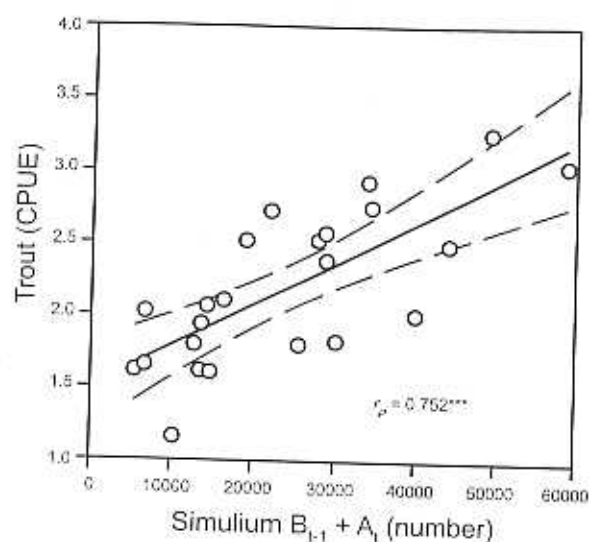


Figure 3. The relationship between brown trout catches (CPUE) and annual blackfly catches from 20 July ($t-1$) to 19 July (t).

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