River Restoration Creates Artificial Habitats...or, why you should know the Reference Conditions when Restoring River Hydromorphology

Pedersen, Morten Lauge; Friberg, Nikolai; Kronvang, Brian

Publication date:
2009

Document Version
Publisher's PDF, also known as Version of record

RIVER RESTORATION CREATES ARTIFICIAL HABITATS...OR, WHY YOU SHOULD KNOW THE REFERENCE CONDITIONS WHEN RESTORING RIVER HYDROMORPHOLOGY

Morten Lauge Pedersen , Aalborg University, Department of Civil Engineering, Denmark
Nikolai Friberg & Brian Kronvang, National Environmental Research Institute, University of Aarhus, Denmark

INTRODUCTION

Stream restoration is widespread in Denmark and many projects have been completed during the last decade. A preliminary handbook for restoration of trout spawning sites in Denmark was published in 1987 adressing gravel composition, minimum areas and magnitude of the gravel layer and suggested an appropriate range of stream gradients where gravel reinstallations would be feasible. Recommendations of sinuosity and distance between riffles and pools have also been published. These recommendations are used along with old maps when streams and rivers are re-meandered by water managers.

Long-term monitoring of restoration projects and comparisons with streams in reference or minimum disturbed conditions, which can serve as restoration targets, are clearly needed to assess the actual success of stream restoration. However, no comparative studies between restored and reference streams have until now been undertaken in Denmark. The aim of the present study was to compare physical habitat structure and macroinvertebrate communities among minimum disturbed, channelised and restored streams in Denmark.

Photo : Gry Annika Jensen, Odsherred Municipality

METHODS

Twenty-one stream 100-m reaches covering app. 10-20 riffle and pool sequences depending on the stream width were selected for this study (stream width 2-5 m and a depth of app. 0.50–0.70 m). Seven streams had retained their natural meandering state, 8 were channelised and 6 were former channelised reaches that had been restored by re-meandering at least 3 years prior to the investigation. Physical habitats parameters (depth, substrate and current velocity) were surveyed in 120 plots placed in 12 evenly spaced transects along the 100 m reach. Six macroinvertebrate samples were collected covering both riffles, pools and edge habitats.

RESULTS

The restored streams clearly had higher proportions of cobble and pebble substrate compared to the natural streams and lower coverage of sand (Fig. 1). The abundance of Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa was significantly lower in channelised reaches, intermediate in natural reaches and highest in restored reaches (Fig 3).

We analysed abundances of individual taxa in the three stream types. Many taxa showed no systematic or significant difference among the three stream types. Overall macroinvertebrate abundance, taxonomic richness and diversity varied little among the streams. However, several taxa associated with cobble and pebble substrate were clearly favoured by the high coverage of these substrates in the restored reaches (Fig 3). *Ancylus fluviatilis* and the Ephemeroptera genera, *Baetis* and *Hydropsyche* were found in very high numbers on the re-meandered reaches compread to the natural and channelised reaches.

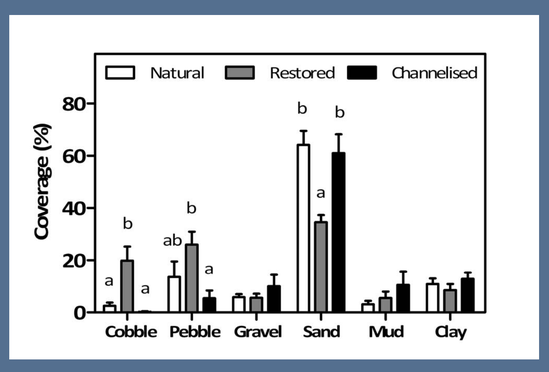

Figure 1. Substrate composition in naturally meandering, channelised and restored streams. Differences in coverage of individual substrates were tested using 1-way ANOVAs and pair wise differences were tested using Bonferroni-corrected post hoc tests. Lower case letters indicate significant differences.

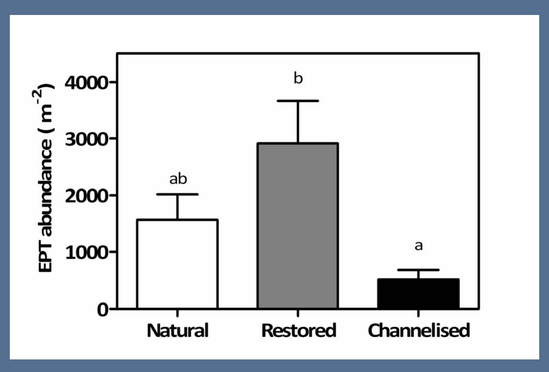

Figure 2. Abundance of EPT taxa in naturally meandering, restored and channelised streams. Differences in EPT abundance were tested using 1-way ANOVA and pair wise differences were tested using Bonferroni-corrected post hoc tests. Lower case letters indicate significant differences.

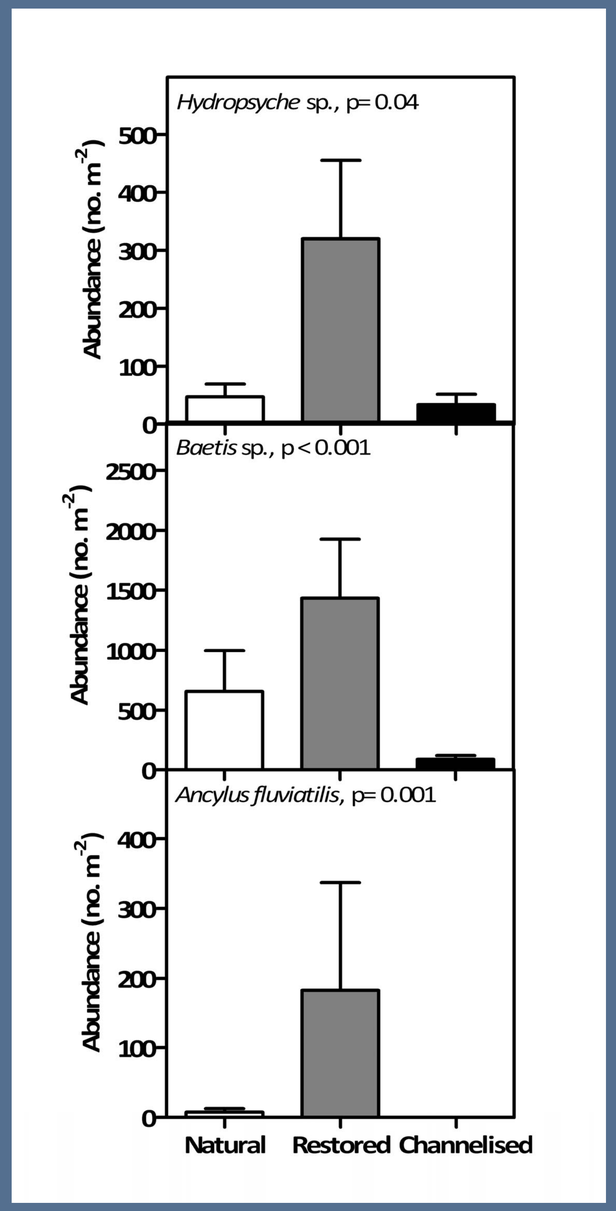

Figure 3. Abundance of three selected macroinvertebrate taxa associated with coarse substrates. Differences in EPT abundance were tested using 1-way ANOVA on log-transformed data.

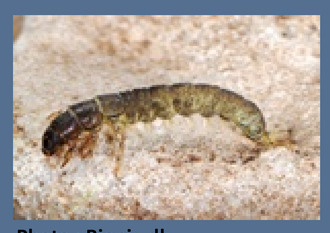

Photo : Biopix.dk

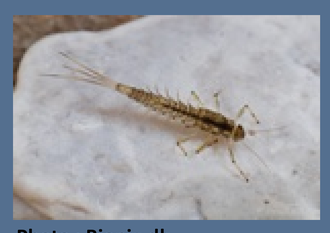

Photo : Biopix.dk

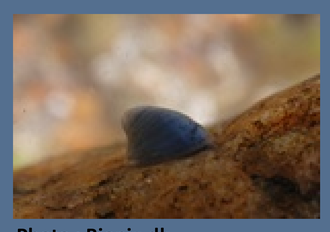

Photo : Biopix.dk

PERSPECTIVES

The study stream are located in different regions and the restoration has been carried out by different water managers. The results clearly indicate that each water manager being responsible for carrying out restoration has his/her own specific picture of how a re-meandered lowland Danish stream should look. Judging from our results the re-meandering includes dumping too much gravel in the restored streams thereby creating an artificially high percentage coarse-substrate-habitat. This favours macroinvertbrates associated with cobble and pebble, thereby creating a skewed community structure dominated by EPT taxa and other taxa demanding coarse substrate. Our results clearly indicate that there is a need for studying the structure of the natural and minimally disturbed lowland streams and using the data as a reference for the habitat structure to be obtained following river restoration.