Freshwater Biology *Explore this journal >*

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Volume 59, Issue 9
September 2014
Pages 1916–1925

Original Article

Relationships between stream macroinvertebrate communities and new flood-based indices of glacial influence

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First published:
2 June 2014 Full publication history

DOI:
10.1111/fwb.12395 View/save citation

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Funding Information

Summary

1. As glacier shrinkage is accelerating due to climate change, it is important to understand the effect of changes in glacier runoff on downstream aquatic communities. The overall goal of this study was to test the relevance of recently developed wavelet-based metrics of flow variations caused by glacial melting cycles to deepen our knowledge about the relationship between glacial influence and aquatic biodiversity.

2. In an equatorial glacierised catchment, we selected 15 stream sites covering a gradient of direct contribution from glacial runoff. At each site, we recorded water level time series for 10 months and sampled benthic macroinvertebrates. Wavelet analyses on the water level time series were used to calculate three indices: glacial flood intensity, frequency and temporal clustering. We then examined how these three indices were related to macroinvertebrate community composition using generalised additive models.

3. While macroinvertebrate density decreased significantly with glacial flood intensity, we found a significant hump-shaped relationship between local taxon richness and glacial flood

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intensity, a pattern that was not produced simply by overlapping broad taxon distributions from either end of the environmental gradient. These results suggest that glacial meltwater contribution creates local peaks in macroinvertebrate richness and enhances regional diversity in the catchment.

4. The significant relationships between faunal metrics and the new glacial influence indices suggest the latter are valuable for assessing the effects of altered meltwater contributions on aquatic communities of glacier-fed rivers. Relationships differed depending on the feature of the glacial disturbance considered (glacial flood intensity, frequency, temporal clustering). We anticipate that these distinctions may help disentangle the mechanisms driving aquatic biodiversity in glacierised catchments, especially in terms of identifying resistance and/or resilience as key processes in glacial macroinvertebrate communities.

Article Information

DOI

10.1111/fwb.12395

View/save citation

Format Available

Full text: HTML | PDF

Keywords

benthic macroinvertebrates; daily glacial floods; glacierised catchments; tropical mountains; wavelet analyses

Publication History

Issue online: 9 July 2014

Version of record online: 2 June 2014

Manuscript Accepted: 5 May 2014

Funded by

- Ecofondo. Grant Number: 034-ECO8-inv1
- WWF-Novozymes

Citing Literature

Number of times cited: 1

1 Sophie Cauvy-Fraunié, Patricio Andino, Rodrigo Espinosa, Dean Jacobsen, Olivier Dangles, Temporal scaling of high flow effects on benthic fauna: Insights from equatorial glacier-fed streams, *Limnology and Oceanography*, 2015, **60**, 5, 1836
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