

Keeping gravel extraction out of the water may not be the best solution for instream ecology

Garder l'extraction du gravier hors de l'eau n'est peut-être pas la meilleure solution pour l'écologie réservée

Amanda M. Death¹, Russell G. Death¹, Fiona Death¹, Ian C. Fuller² & Sheryl Paine³

¹Ecology Group, Institute of Natural Resources, Massey University, Palmerston North, New Zealand (r.g.death@massey.ac.nz)

²Physical Geography Group, Institute of Natural Resources, Massey University, Palmerston North, New Zealand (i.c.fuller@massey.ac.nz)

³Opus Consulting

RÉSUMÉ

L'extraction de gravier se pratique dans de nombreuses rivières en Nouvelle-Zélande avec entre 100.000 et 300.000 m³ par an extrait de certaines rivières. Les Conseils régionaux de contrôle de l'extraction de gravier contrôlent la quantité, le calendrier et les méthodes qui peuvent être utilisées pour le prélèvement. Habituellement, les extractions sont faites en période de faibles débits sur les plages sèches (barres) aux côtés des secteurs en eau. Nos observations dans la rivière Pohangina, cours d'eau qui a un lit actif qui divague latéralement dans le bassin versant Manawatu (North Island, Nouvelle-Zélande), suggèrent que de grandes quantités de sédiments fins sont déposés sur les plages, qui sont remobilisés dans les bras de la rivière en eau dès les premières précipitations. Nous avons examiné l'impact de ces sédiments déposés sur les communautés d'invertébrés de la rivière Pohangina. Les communautés numériquement dominées par des éphémères et des phryganes en amont sont essentiellement des chironomidés à l'aval. Il y a une diminution des indices biologiques tels que le MCI et l'EPT. Ceci suggère que l'extraction de gravier sur les plages sèches peut avoir des effets préjudiciables assez graves sur l'intégrité écologique

ABSTRACT

Gravel extraction occurs from many rivers throughout New Zealand with between 100,000 and 300,000 m³ per year extracted from some rivers. Resource management agencies control gravel abstraction by controlling the amount, timing and methods that can be used for the abstraction. Usually the abstractions occur during low flows and from the dry beaches (bars) alongside the wetted channel. Our observations in the Pohangina River, a laterally active wandering gravel-bed river in the Manawatu catchment (North Island, New Zealand), suggest that this leaves large quantities of fine sediment on these beaches that are mobilized into the wetted channel with the first significant rainfall event. We examined the impact of this deposited sediment on invertebrate communities of the Pohangina River. Communities changed from being numerically dominated by mayflies and caddisflies upstream to chironomid dominated communities downstream. There was a corresponding decrease in biological indices such as percent EPT. This suggests gravel extraction from dry beaches can have quite severe detrimental impacts on instream ecological integrity.

KEYWORDS

Ecological integrity, gravel extraction, invertebrates, river management, sediment.

1 INTRODUCTION

Gravel extraction occurs in a large number of New Zealand rivers and streams to provide resources for roading operations and to reduce flooding. Between 100,000 and 300,000 m³ of gravel is extracted from some rivers annually. Most environmental management agencies (Regional Councils) in New Zealand restrict extraction to the dry margins of the river banks to reduce potential adverse ecological effects. We have observed that this extraction process leaves large deposits of fine sediment on the river banks that is deposited into the wetted channel from the first high flow event. This has the potential to have a deleterious effect on the biota. To assess this we examined the instream benthic invertebrate communities before and after a gravel extraction operation at one site on the Pohangina River, North Island, New Zealand. a wandering gravel-bed river.

2 METHOD

Macroinvertebrates were collected upstream and downstream of a gravel extraction site on the Pohangina River. The samples were collected on 3 occasions; November 2010, (after gravel extraction and a small spate), December 2010, (before a flood and gravel extraction) and February 2011, (after a spate and gravel extraction). Five 0.1m² Surber samples (250 µm mesh) were collected from each location and stored in 70% ethanol. The invertebrates were removed from the samples, identified to the lowest possible taxonomic level and counted, in the laboratory. At each of the locations, on the same three occasions, five quorer samples were also collected to assess deposited sediment levels in the wetted channel.

3 RESULTS & DISCUSSION

Before gravel extraction, there was no significant difference in sediment levels at each location. After gravel extraction and a small spate, the amount of deposited sediment downstream of the gravel extraction increased, as the increased flows moved the sediment from the riverbank into the wetted channel (Fig.1).

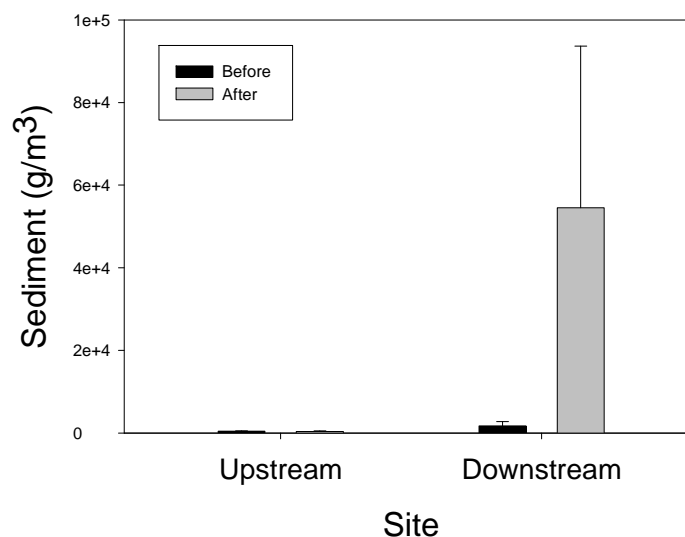


Figure 1: Mean (± 1 SE) deposited sediment at upstream and downstream sites, before (black) and after (grey) gravel extraction and a small spate.

The Macroinvertebrate Community Index (MCI, a measure of biological quality) and its quantitative equivalent, the QMCI, showed little effect of the sediment deposition from the gravel extraction. However, the Ephemeroptera, Plecoptera and Trichoptera (EPT) all declined in the wetted channel downstream of the gravel extraction as a result of the deposited sediment (Fig. 2).

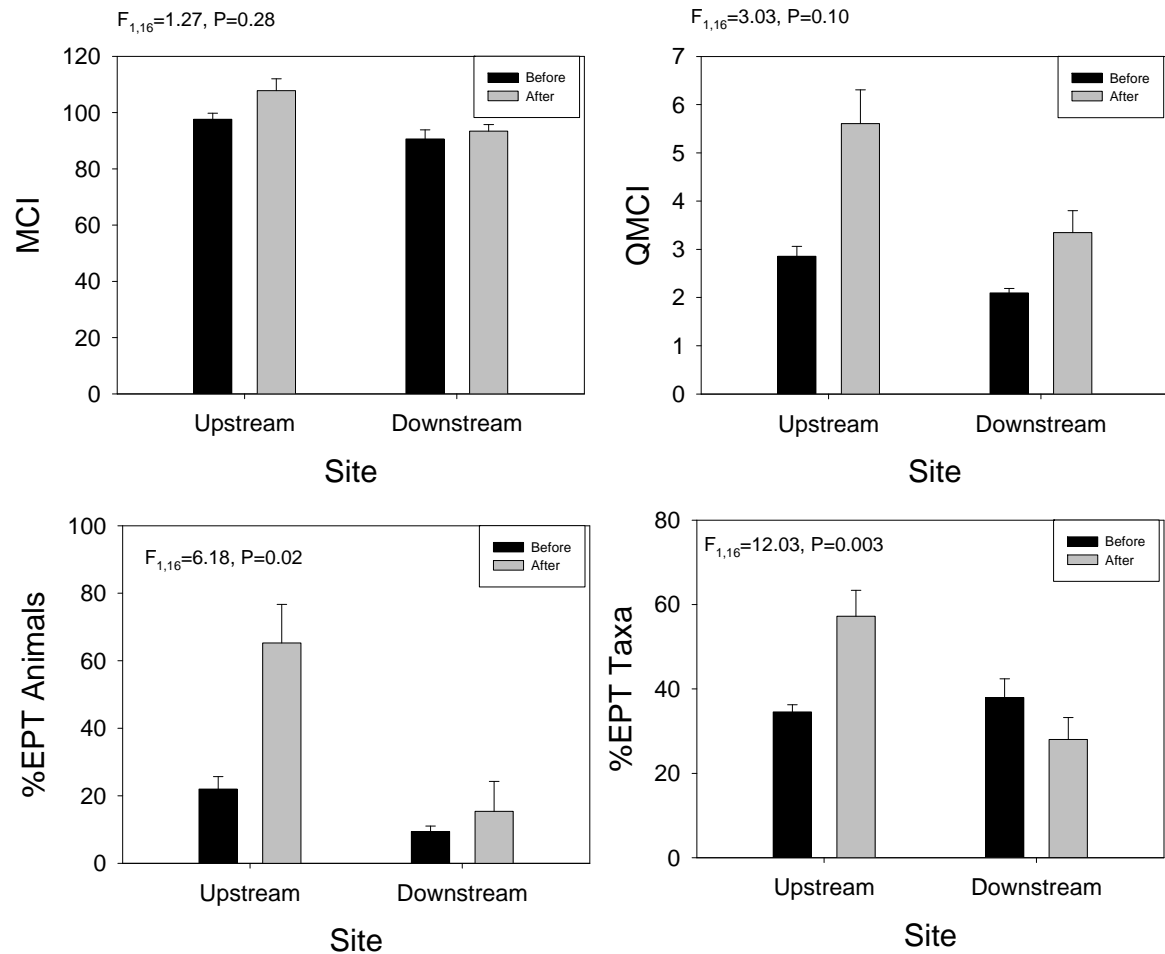


Figure 2 : Mean (\pm 1 SE) MCI (top left), QMCI (top right), % EPT animals and taxa (bottom) at upstream and downstream sites, before (black) and after (grey) gravel extraction and a small spate.

4 CONCLUSIONS

At the Pohangina River study site we found that gravel extraction in the dry leaves fine sediment on the river bank. This sediment ends up in the wetted channel after the first small spate. The sediment that enters the wetted channel had a detrimental effect on the biota in an already biologically "degraded" river, resulting in more chironomids and less mayflies. Whether this is better or worse than actually abstracting the gravel from the wetted channel awaits further investigation.