



Novel gravel extraction method offers restoration potential

Experimental gravel and overburden skimming method of gravel extraction offers restoration potential over pit mining in braided river systems

What we know

- Braided river floodplains in their natural state are composed of a wide range of habitats and landscape elements, representing rare ecosystems that support high levels of biodiversity.
- Braided rivers are in decline and are some of the most threatened ecosystems worldwide.
- Gravel from braided rivers is a valuable resource, providing aggregates for use in construction.
- Gravel extraction can have adverse effects on a river's physical and ecological attributes, although methods of gravel extraction differ.

What we found

- Ponds, created via pit mining, had higher total nitrogen and phosphorus levels than the river reaches, and nutrient levels accumulated through time, i.e. the oldest ponds had the highest nutrient levels. Pit mining ponds contained fish species tolerant to high nutrient levels and stagnant flows, including shortfin and longfin eels, upland bullies, introduced perch and one Gollum galaxiid. Introduced perch made up 17% of the fish population in these ponds.
- Experimental gravel and overburden skimming sites had multiple river channels and high flow variation. The fish communities in these sites were more diverse and included southern flathead galaxias, torrentfish, lamprey, upland bullies, longfin eels and introduced brown trout. Introduced brown trout made up 6% of the fish population.
- Upland bullies had significantly higher parasite infection rates in pit mining ponds than in experimental skimming sites, and significantly faster growth rates, likely due to elevated nutrients and higher temperatures in the ponds.



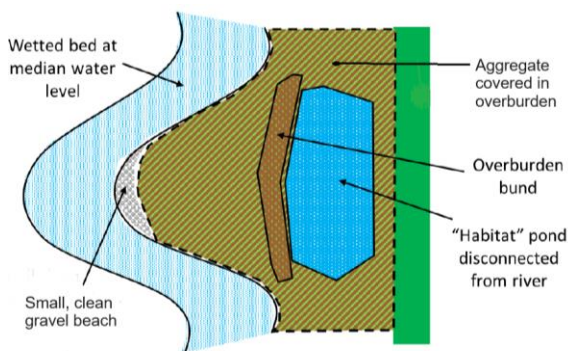
What we did

We compared fish community composition and upland bully population health in pit mining ponds compared to river reaches where experimental gravel and overburden skimming was taking place in Southland, New Zealand. The experimental skimming technique has already been shown to increase habitat and nesting success for braided river nesting birds by removing weedy overburden to expose bare gravels and restoring the river to having multiple channels with braided river islands.

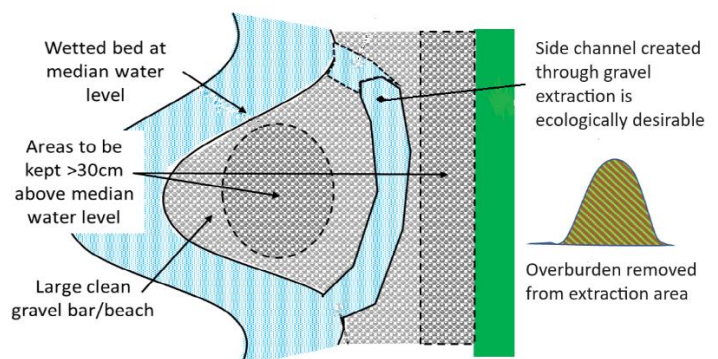
We assessed habitat variables including nutrient levels, water depth and wetted width, and used electrofishing surveys (river sites) and fyke netting surveys (pond sites) to survey the fish communities.

We investigated the diets, parasite infection rates and growth of upland bullies (*Gobiomorphus breviceps*) as measures of population health.

Pond created via pit mining



Restoration site post-gravel



Conclusions

Pit mining ponds do not resemble natural braided river habitats and are likely to accumulate nutrients and parasites.

Sites with experimental gravel and overburden skimming are more similar to naturally functioning braided rivers and have been shown to offer benefits to river-dependent native birds. While we cannot say this method is truly restorative in terms of the freshwater values analyzed, it has good restoration potential and justifies long-term monitoring and expansion to other sites to confirm the impacts on both freshwater species and environmental conditions.

Holistic ecosystem-level approaches to river restoration and management will yield the greatest ecological gains.



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Thank you to all the field and laboratory assistants.
Photos by Eva De Jong.

A scientific paper is being prepared from this research. Please contact Eva (evadejong@live.ie) in the interim for any questions.