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A Review of the Effects of Fine Sediment on River Biota

In this review we examined existing quantitative information from New Zealand and overseas studies to see if there is enough information available to make reliable prediction of impacts on river ecosystems from changes in levels of sedimentation.

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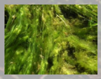
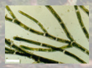
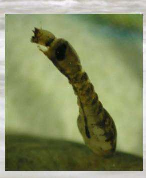
1 Accelerated sedimentation is known to have impacts on river ecosystem health.

- Suspended sediment limits the light getting to the riverbed and thus limits algal productivity
- Deposited sediment can smother algae
- Suspended sediment is highly abrasive

Invertebrates

- Sediment reduces the quality of invertebrate food and inhibits feeding
- Fine sediment fills up their hiding holes that are normally present amongst the larger gravel and stones
- Fine sediment deposited on the riverbed cuts off access down into the gravels – an important refuge for invertebrates from floods
- Suspended sediment is abrasive to invertebrates too
- Sediment can clog up their gills
- Invertebrate community composition will change in response to extra sediment – mayflies, stoneflies and caddisflies become less common, while dipterans and worms become more common




- Fish also face problems with abrasion and gill clogging
- The loss of hiding holes among larger cobbles and stones is also a concern
- Spawning success can be reduced by fine sediment accumulations
- Visual feeding fish have trouble seeing their prey in dirty water
- A change in the invertebrate community often means a reduction in food supplies for fish

2 Factors influencing habitat response

Existing sediment cover and biota

– the largest effects have been observed where sediment is added to sites that previously had little fine sediment. The biota present at such sites is unaccustomed to sediment and therefore strongly impacted.

Pollutants

- impacts of sediment will be more pronounced if there are pollutants/toxicants bound to the sediment.

Habitat types

– even in rivers with a low sediment load there is often fine sediment in the pools. However, the largest effects probably occur if sedimentation occurs in riffles.

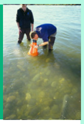
Sediment grain size

– sand will take longer to flush out than fine silt

3 Existing information from New Zealand and overseas research

Change in fine sediment	Change in total invertebrate abundance	Change in invertebrate diversity	Reference
12-17% increase in proportion of fines (by weight)	16-40% decrease in abundance		Ryder (1989)
Increase from 0 to 30% fine sediment (by weight)	50% reduction in invertebrate biomass	50% reduction in diversity	Angradi (1999)
Increase from 6% cover to 25% cover of fine sediment	20-55% reduction in invertebrate biomass	22% reduction in invertebrate diversity	Lemly (1982)
Increase from 5% cover to 50% cover of fine sediment	30-75% reduction in mayflies and 70-80% reduction in caddis	40-50% reduction in invertebrate diversity	Cottam & James (2003)
Increase from 7% cover to 53% cover of fine sediment	34% reduction in invertebrate density	No significant change in diversity	Matthaei et al. (2003)

4 Is it possible to predict how much change would be caused by a particular amount of fine sediment input on a river bed?



- existing studies give enough information to make **coarse predictions** of the response of biota to **increased sediment loading**.
- most existing studies have examined the impacts of a single, relatively large incremental **change in sediment inputs**. *Further studies* examining the impact of varying amounts of sediment additions incrementally over a range of concentrations **are required** in order to develop high resolution predictive models.
- the adoption of a standard method for characterizing the amount of fine sediment would allow *comparisons between data sets* and thus allow **more robust relationships between the fine sediment fraction and the biotic response** to be developed.