



Integrating science and practical solutions for enhancing river connectivity

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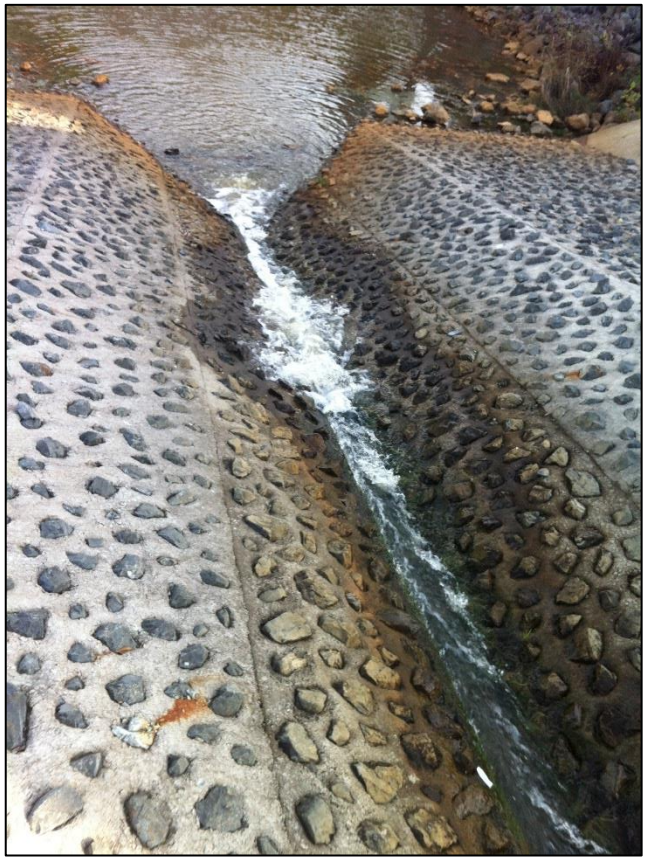
Introduction

- Understanding the fish
- Summary of fish passage research
- Translating science into practical solutions
- Thinking about monitoring
- Research needs

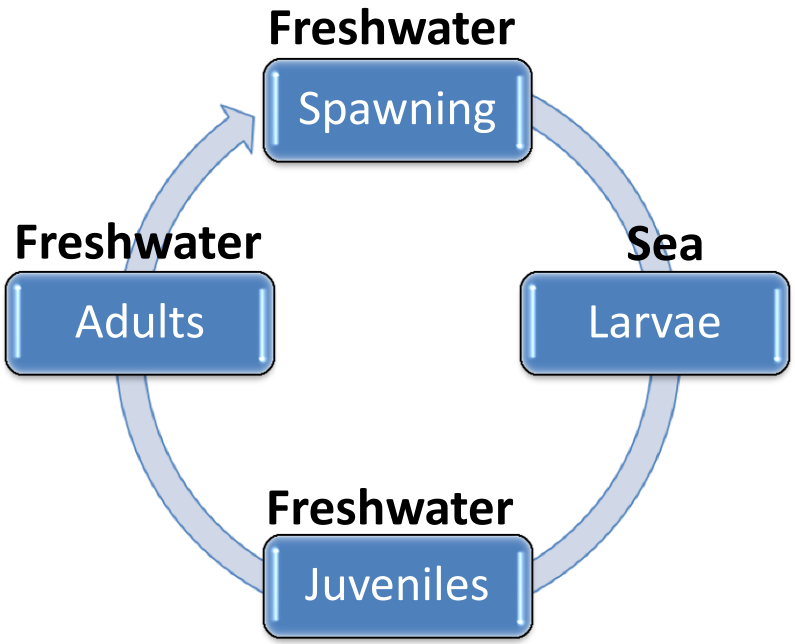


Understanding the fish

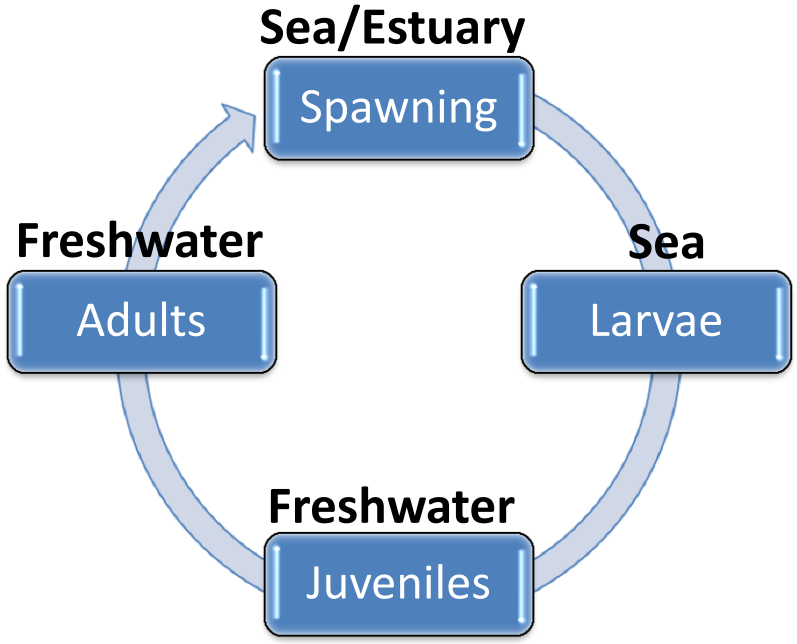
- To design instream structures to allow for fish passage, we need to understand the fish
- What do we need to know?
  - Life-cycle: When do migrations happen? Where are fish trying to get to? Where do they live?
  - Behaviour: Preference v avoidance of different conditions?
  - Capabilities: Swimmers v climbers? Strong v weak swimmers?

Understanding the fish

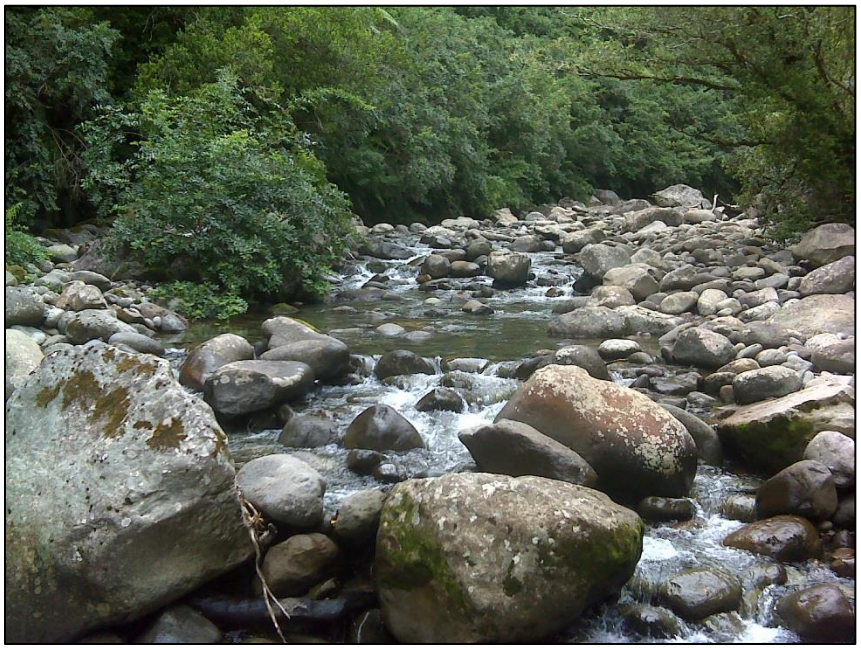
Kokopu & koaro



Eels/inanga



Understanding the fish



Understanding the fish

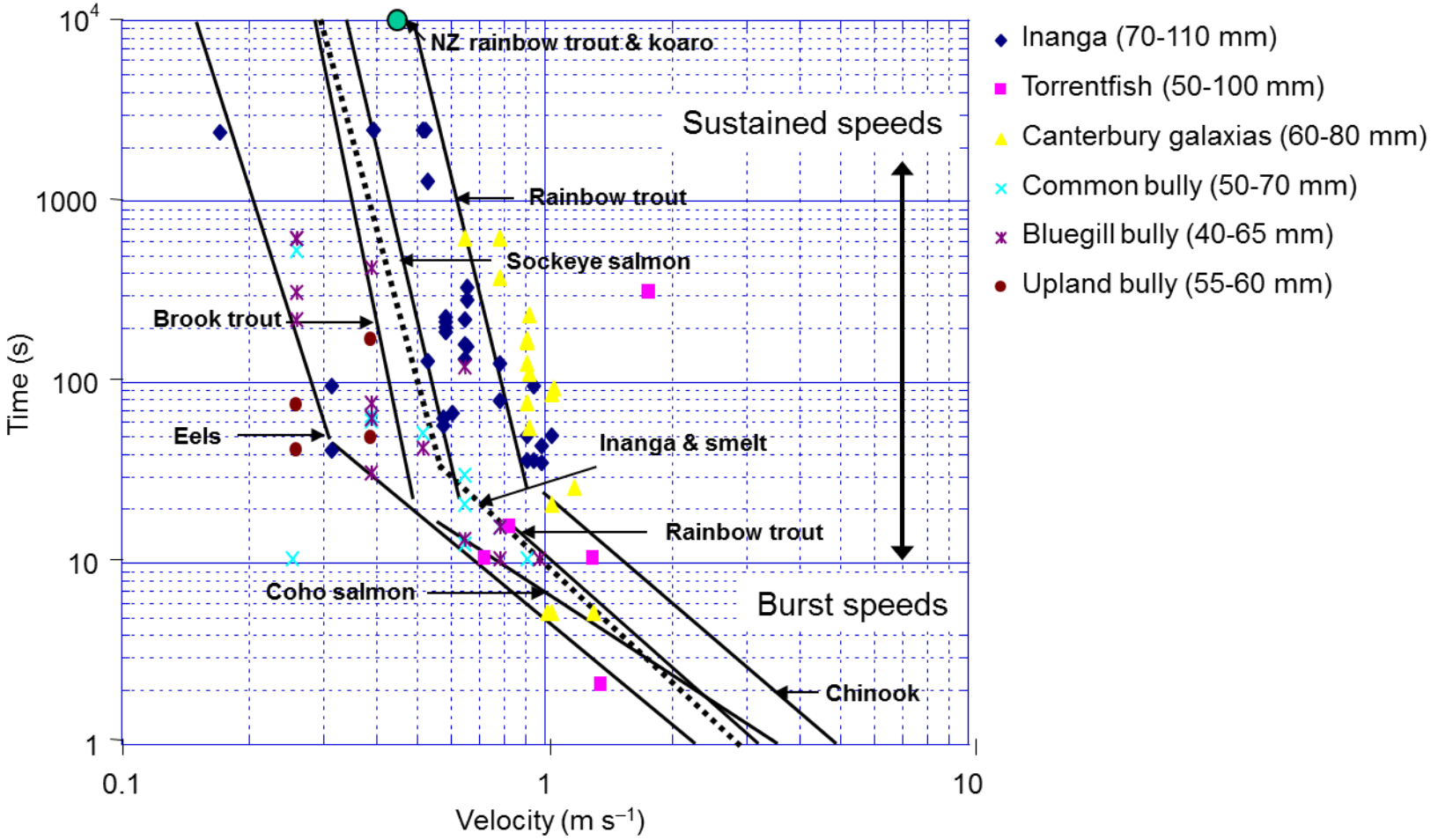
Climbers

Swimmers

Understanding the fish

- NZ native fish species are very different to Northern hemisphere species
  - Size at migration
  - Swimming abilities
- They require different solutions to those widely tried & tested (mainly for trout & salmon)

Swimming abilities

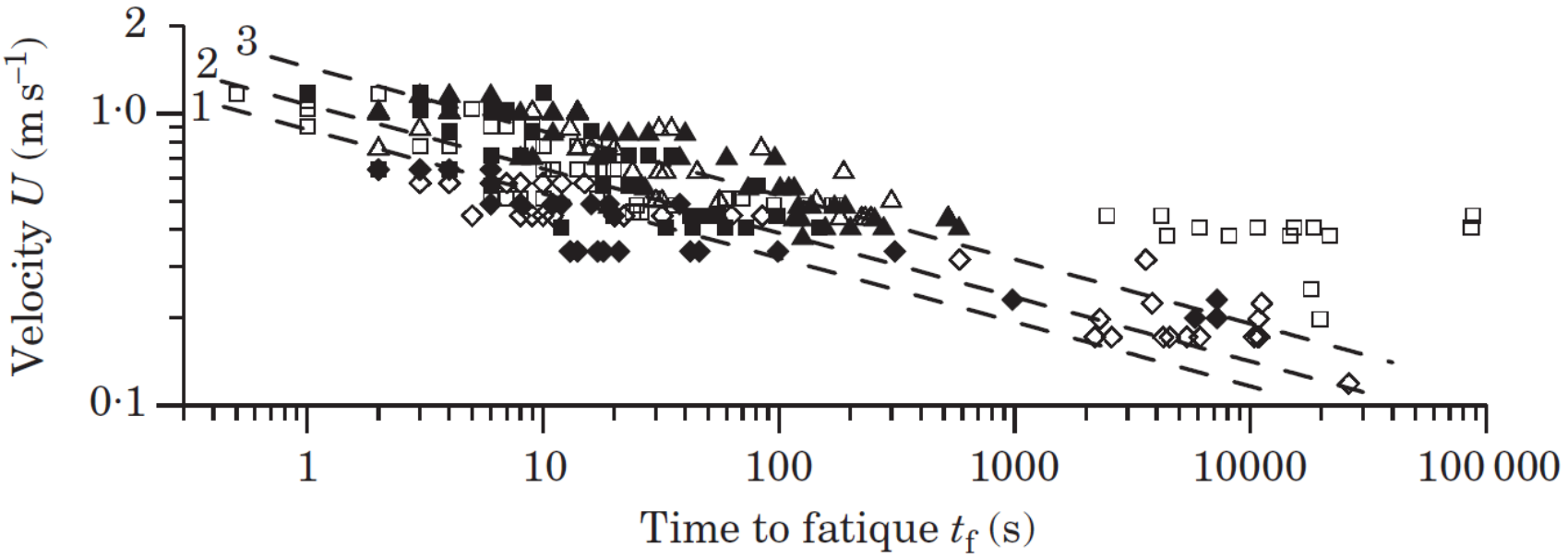


Turbulence

Very little information for native fish species

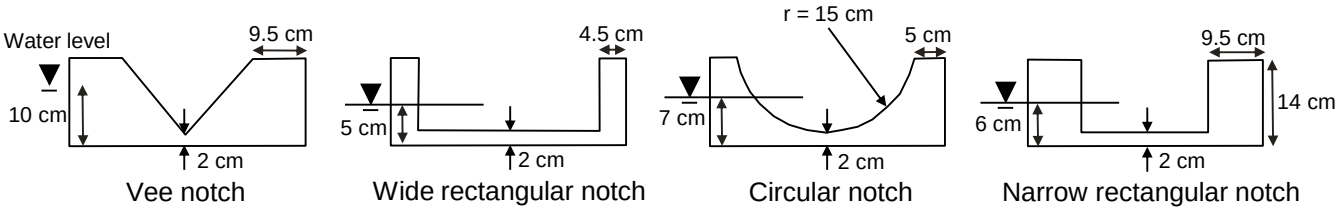
Effect of channel roughness on inanga swimming

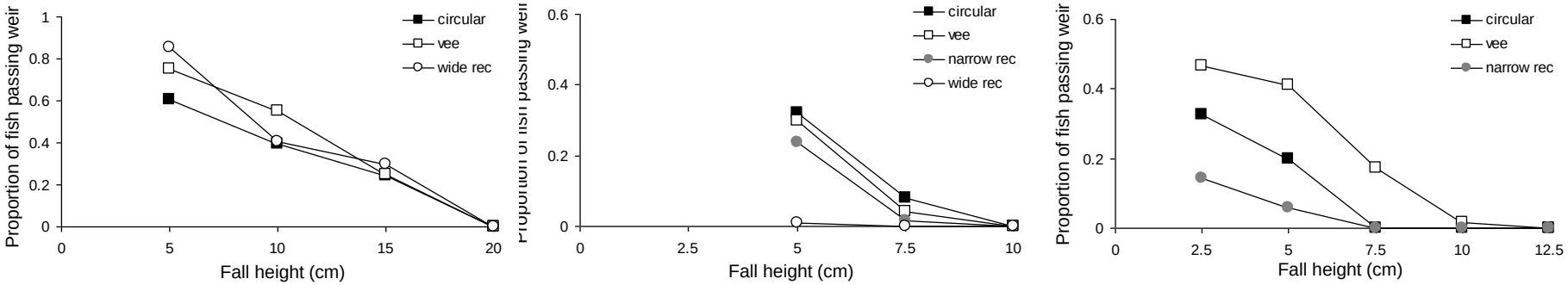
White markers = rough channel
Black markers = smooth channel

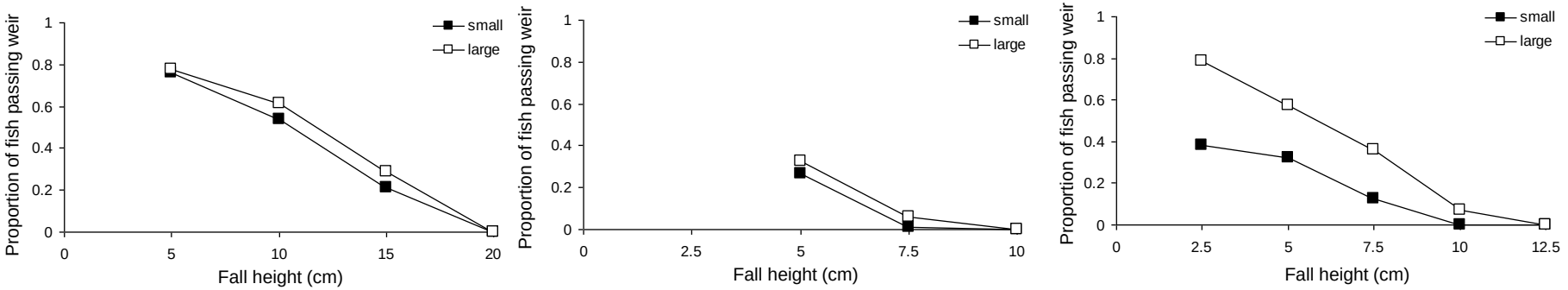


Nikora et al. (2003). Effects of fish size, time-to-fatigue and turbulence on swimming performance: a case study of *Galaxias maculatus*. J Fish Biol 63: 1365-1382.

Fall height & crest shape



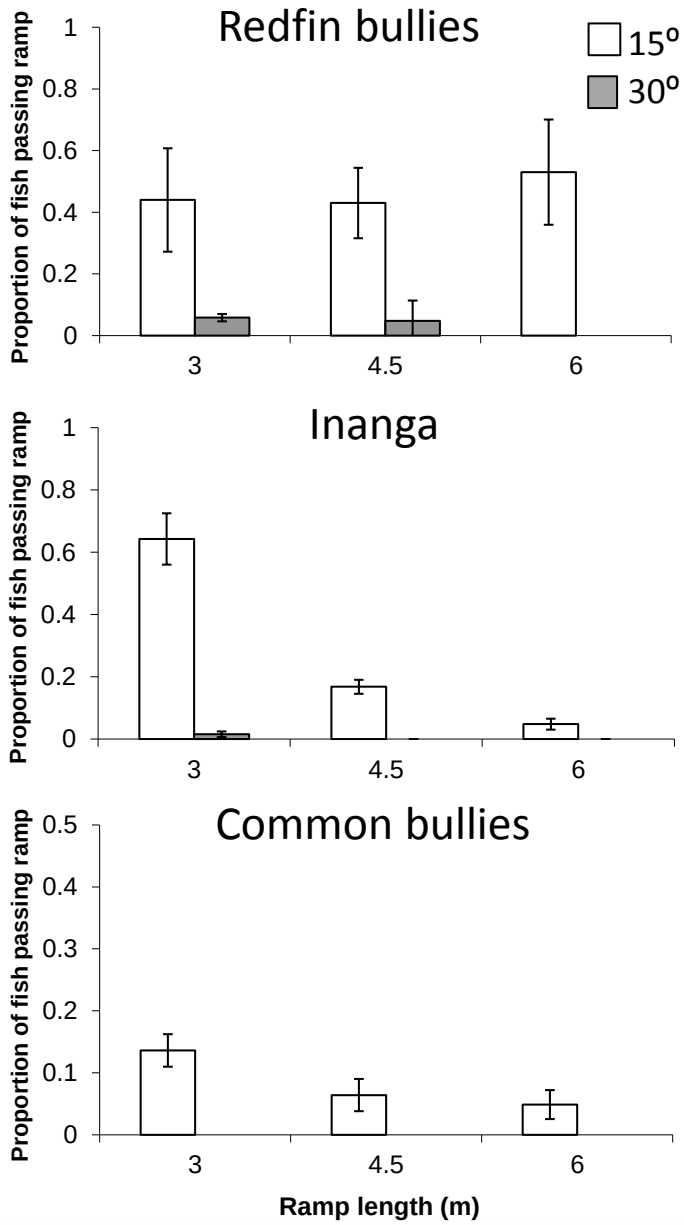




Adult inanga | Juvenile inanga | Common bully

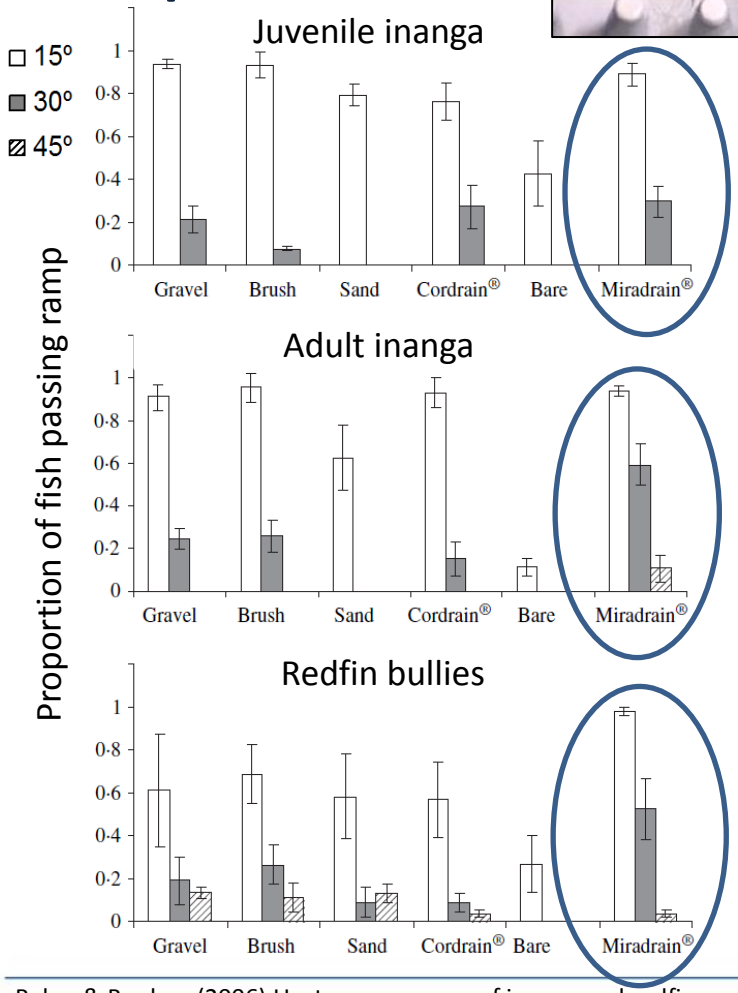
Baker (2003) Effect of fall height & notch shape on the passage of inanga & common bullies over an experimental weir. NZJMFR 37:2, 283-290

Ramp length & slope

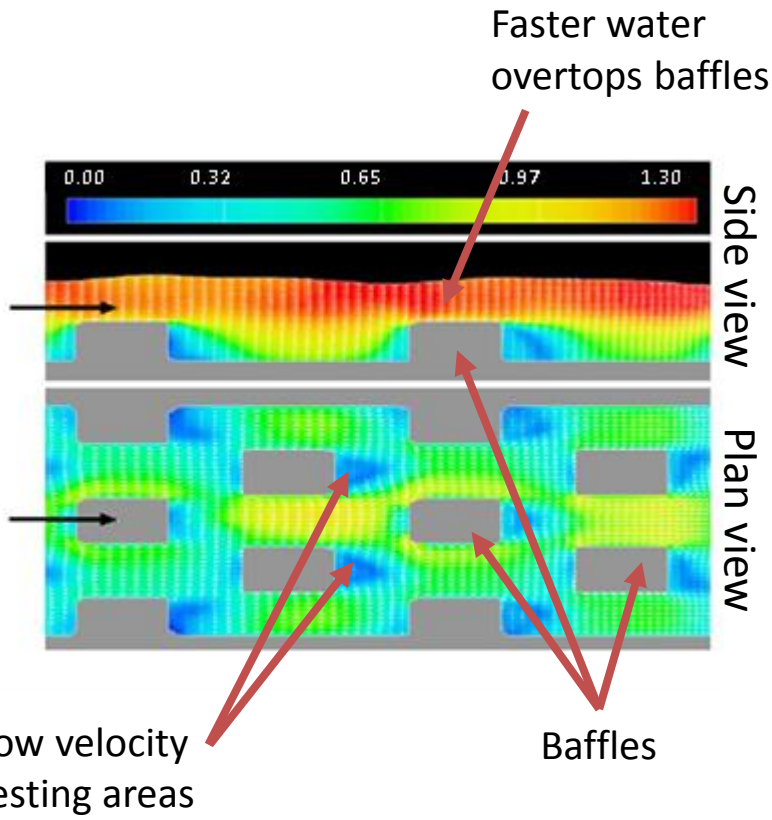


Substrate

Ramp substrates



Culvert baffles

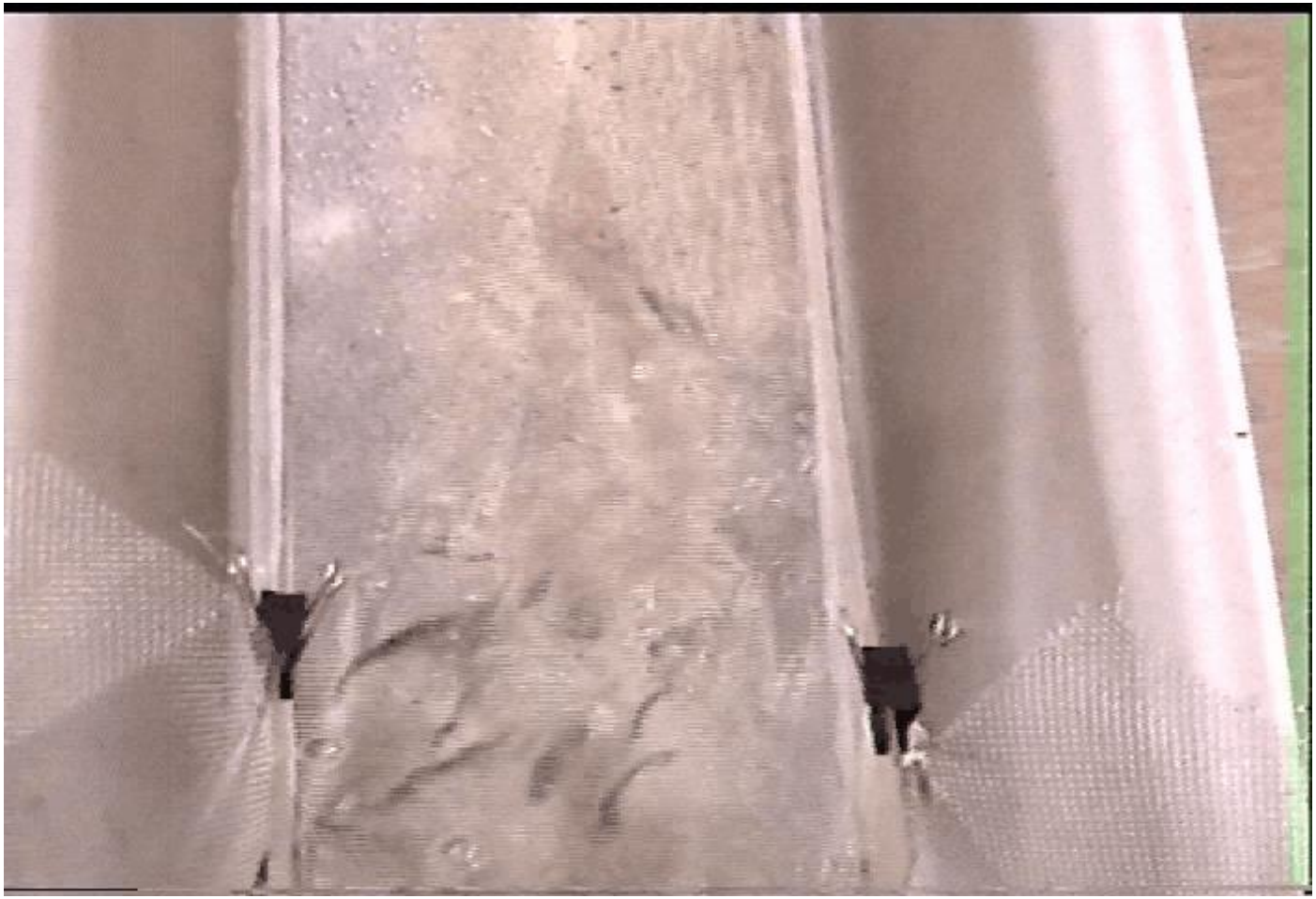


Baker & Boubee (2006) Upstream passage of inanga and redfin bullies over artificial ramps. JFBiol 69, p 668-681

Feurich et al (2011) Spoiler baffles in circular culverts. JEnvEng 137(9), p 854-857

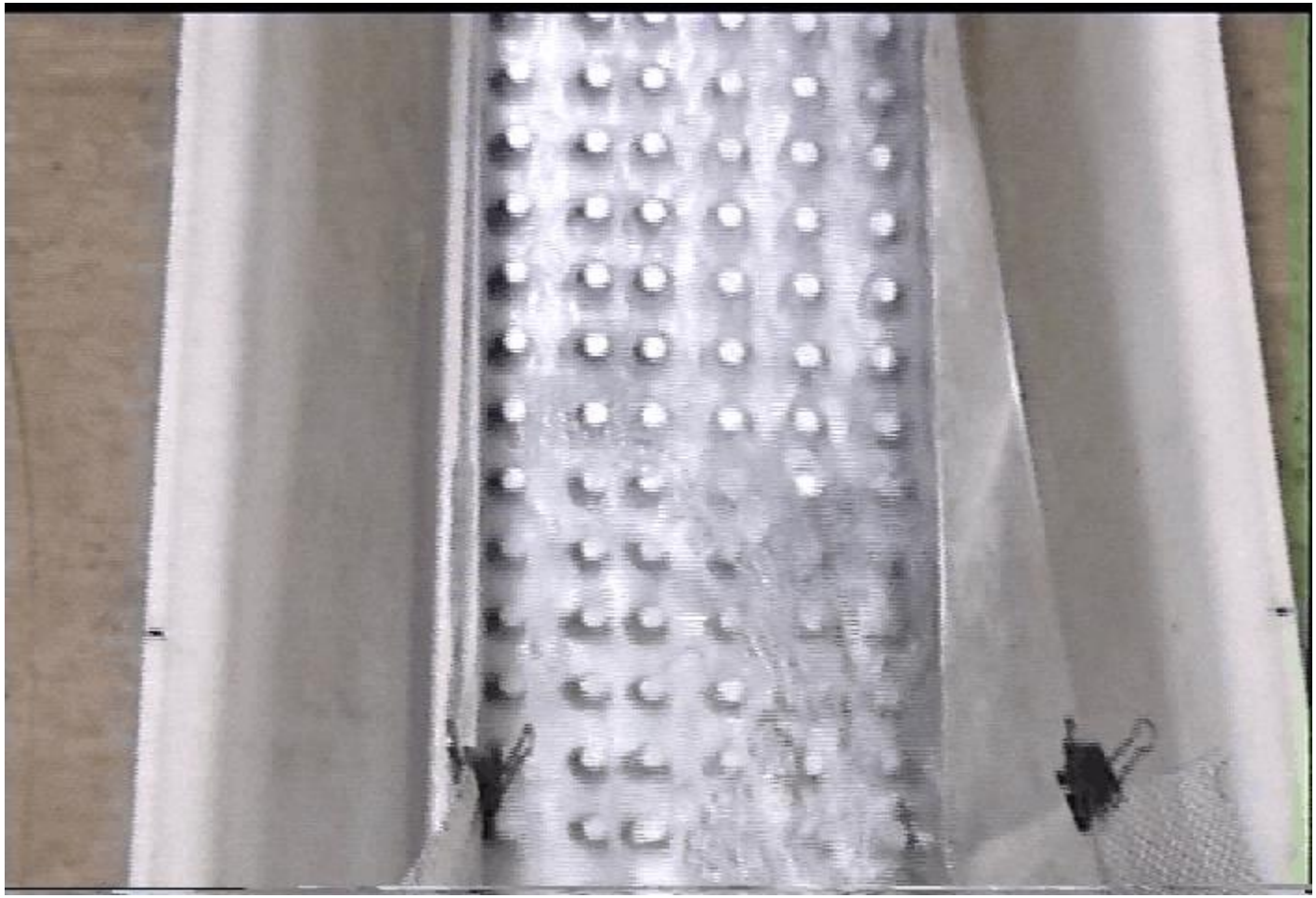
Substrate

Inanga attempting to pass a 15º ramp covered in sand



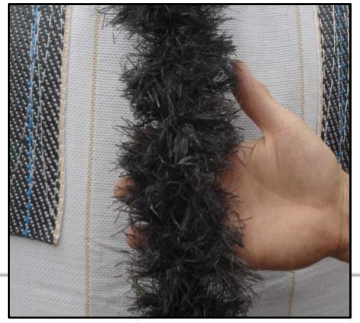
Substrate

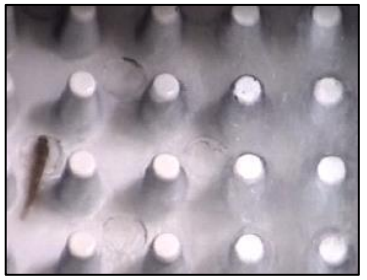
Inanga attempting to pass a 15º ramp covered in Miradrain ®

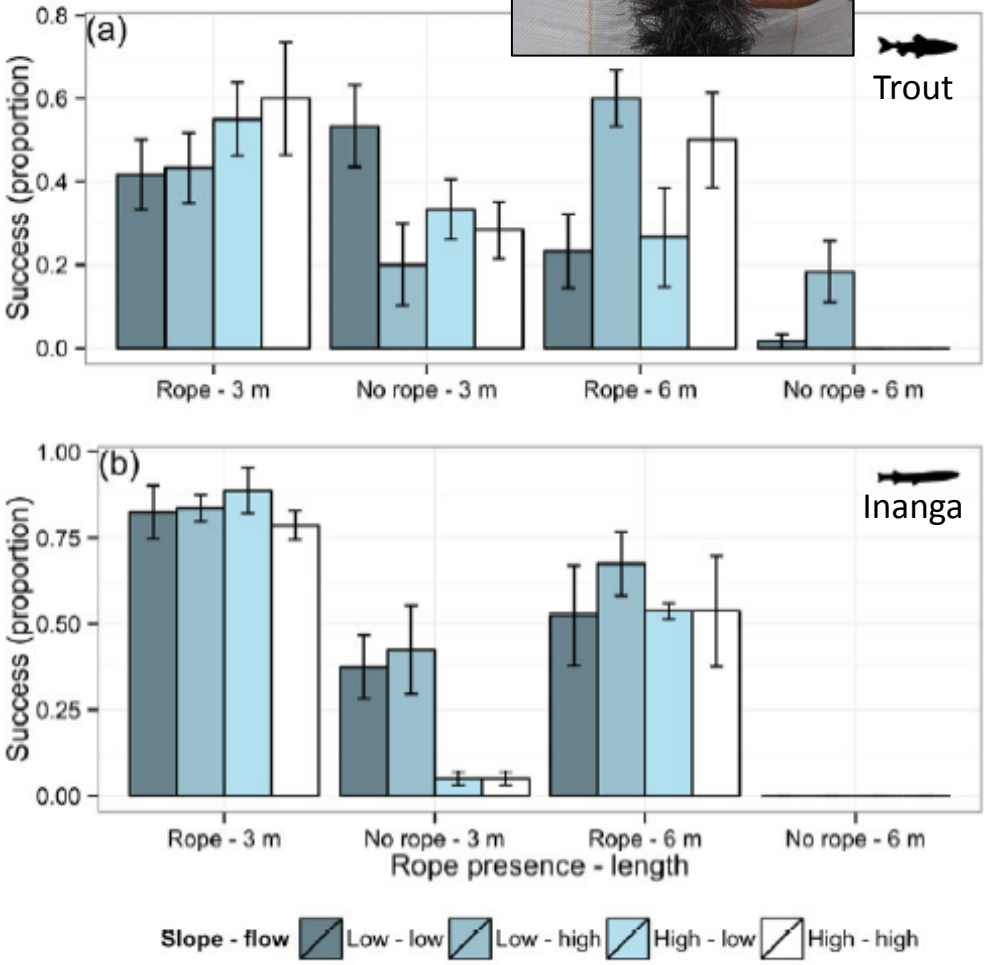


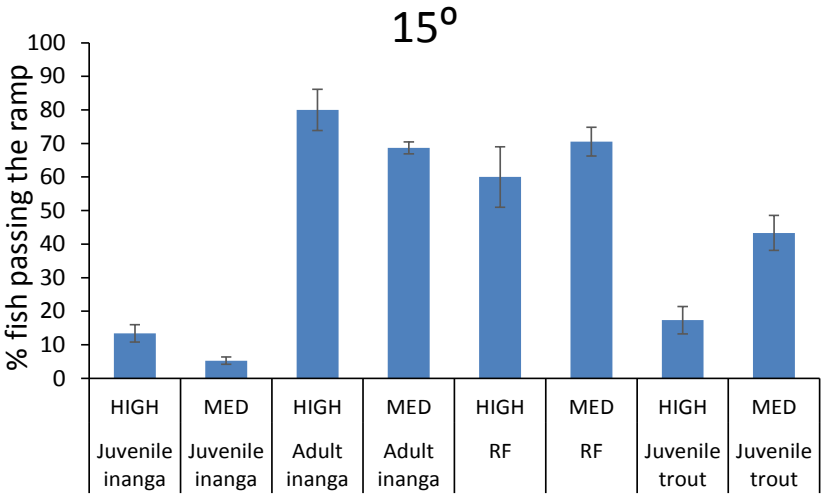
Substrate

Spat ropes





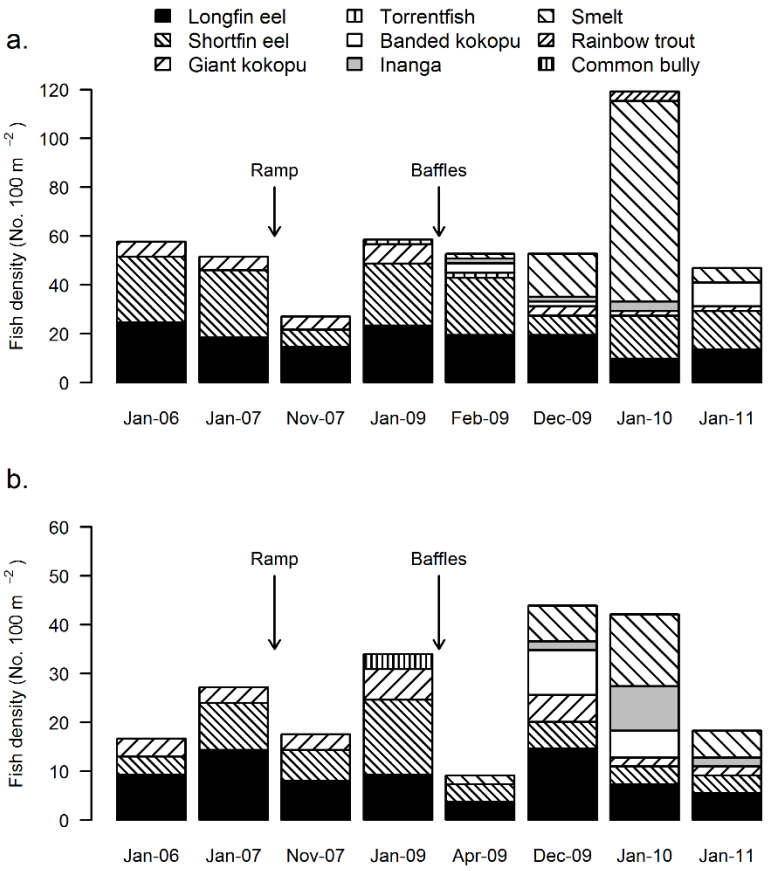




David et al (2013) Learning the ropes: Mussel spat ropes improve fish & shrimp passage through culverts. JAppEcol

Rock ramp & spoiler baffle installation

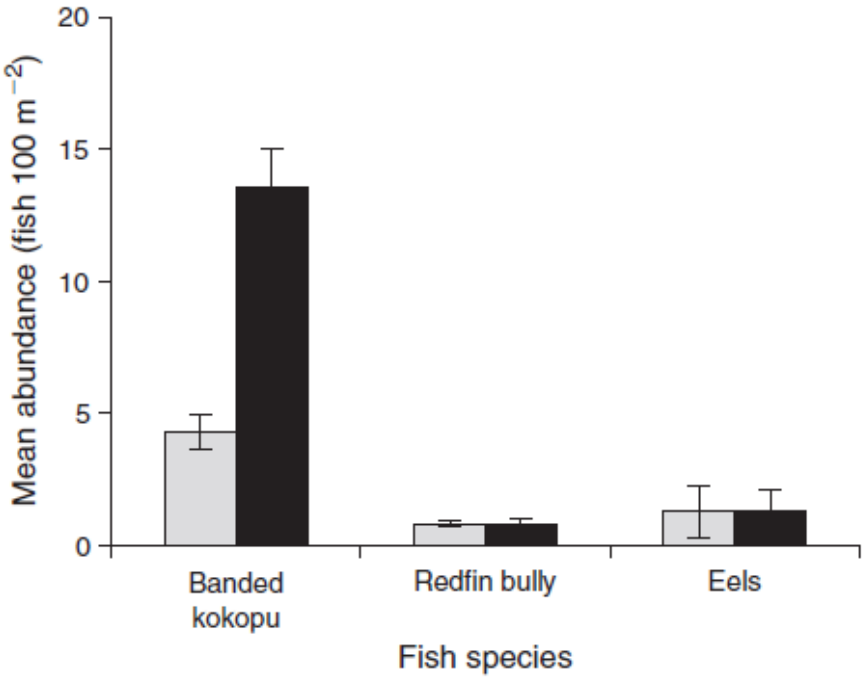
Bankwood Stream, Hamilton



Franklin & Bartels (2012) Restoring connectivity for migratory native fish in a New Zealand stream: effectiveness of retrofitting a pipe culvert. AqConsMFwRes 22, p 489-497

Spat rope installation

Waiwawa River on the Coromandel Peninsula

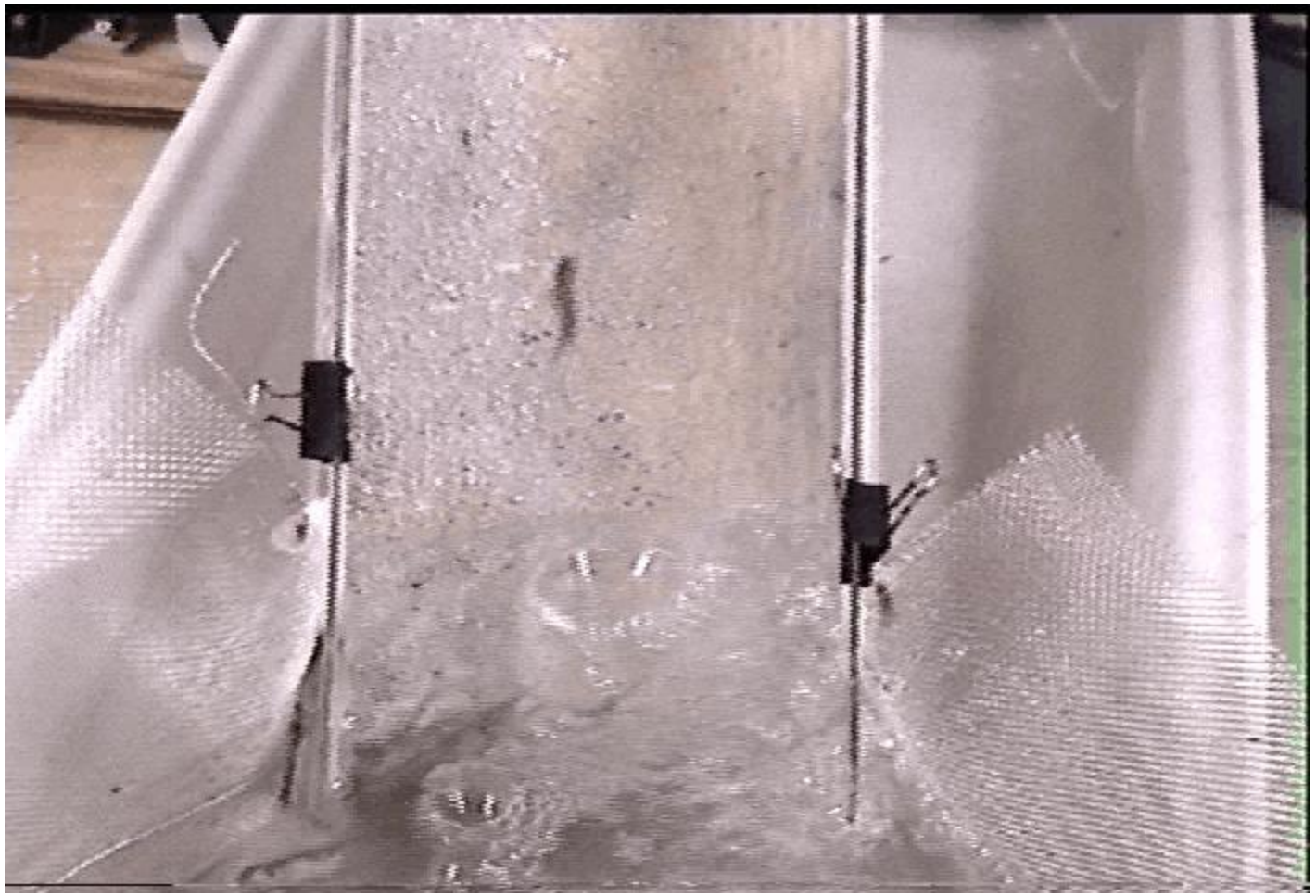



Credit: Bruno David

David & Hamer (2012) Remediation of a perched stream culvert with ropes improves fish passage. MFwRes 63, p 440-449

Catering for different fish species…

Banded kokopu ‘wriggle’ staying attached to the surface



Catering for different fish species…

Redfin bullies ‘hop’ and leave the surface on each forward movement

Catering for different fish species…

Lamprey use their sucker like mouth to climb. Note the effects of a sharp corner!

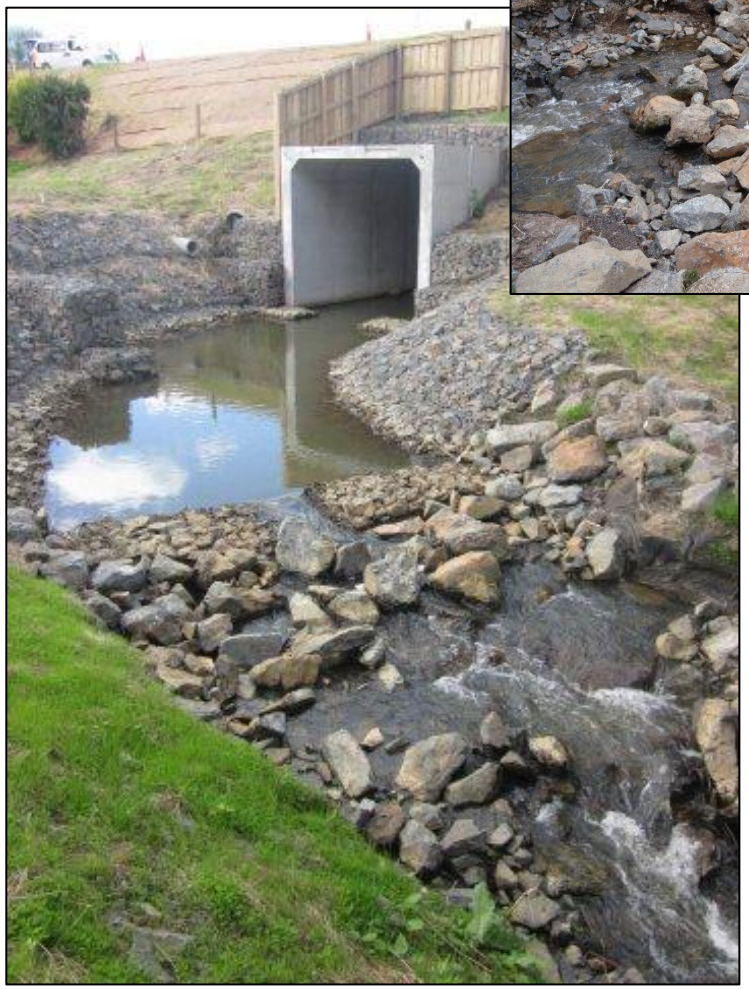
Ramp + ropes?

Mangawheau Stream, Auckland

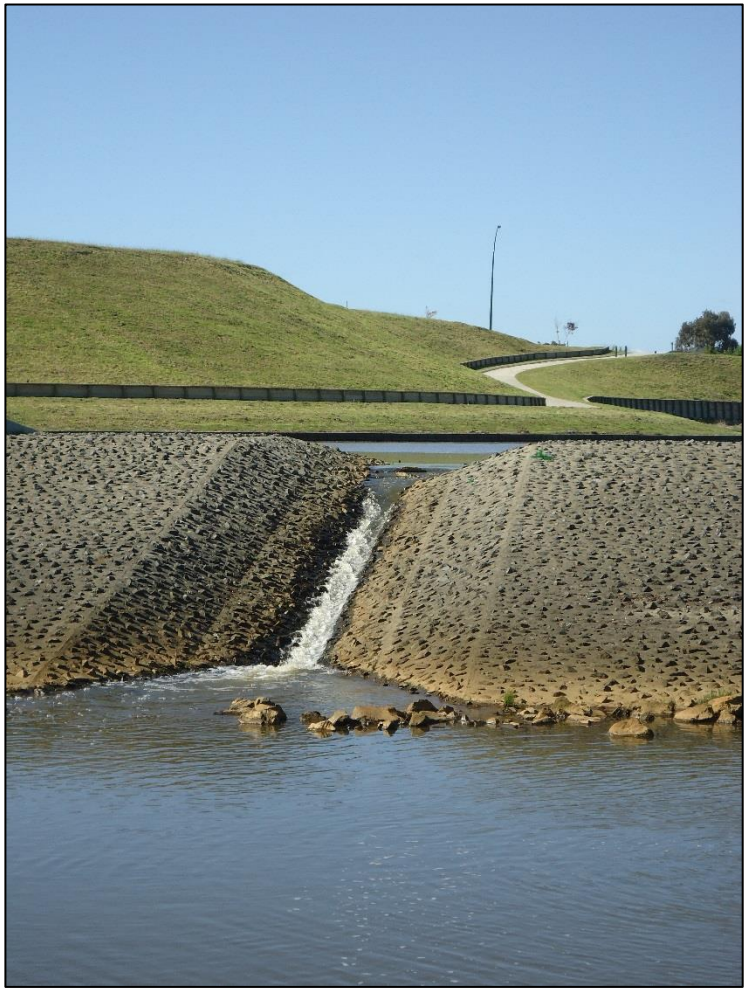
Tasman District

The good, the bad & the ugly

Te Awa O Katipaki Stream, Hamilton



The good, the bad & the ugly



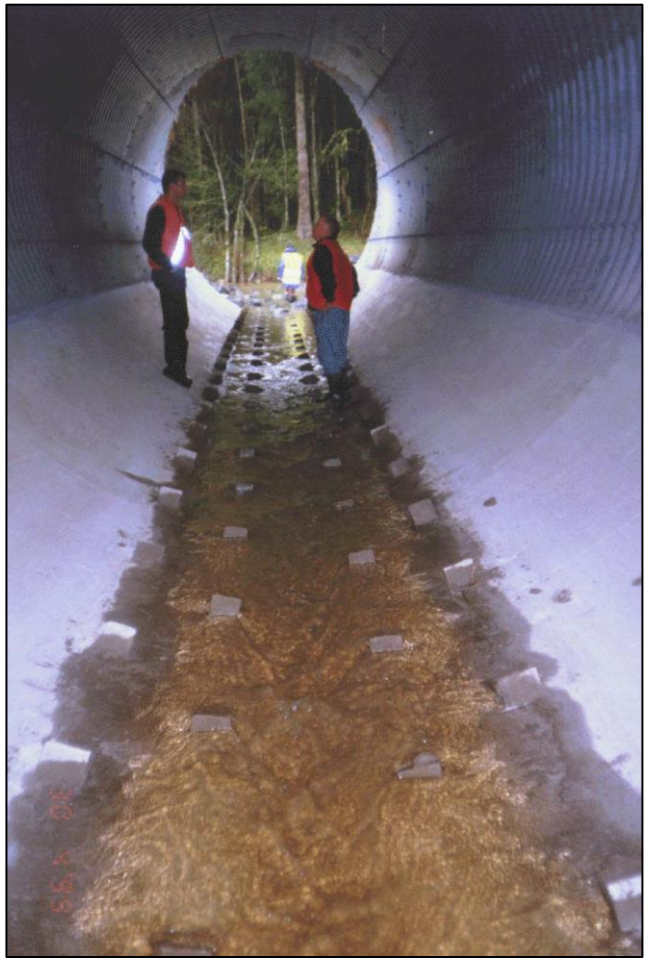
Te Awa O Katipaki Stream, Hamilton

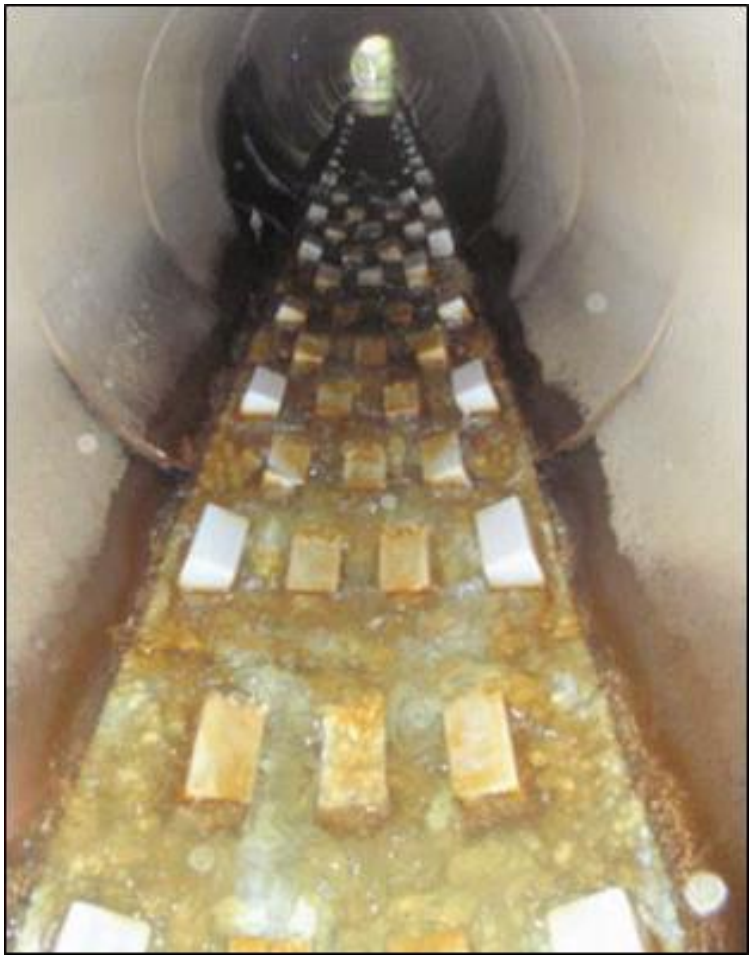
The good, the bad & the ugly

Tamahunga Stream, Auckland

The good, the bad & the ugly

Culvert baffling





The good, the bad & the ugly

Pohomihi Stream, Te Aroha

The good, the bad & the ugly

Pohomihi Stream, Te Aroha

Into the unknown…

- There are a range of innovative and cost-effective solutions being developed
- BUT…
  - need to ensure designs meet best practice guidelines
  - require monitoring/testing to ensure effectiveness before widespread application
  - must remember that one size does not fit all

Research needs

- Two themes:
  - Understanding the fish and what they look for.
  - Checking solutions are effective – monitoring!

Research needs

- Require better understanding of fish behaviour, physiology & habitat requirements
- What habitats do fish need to get to, when & where are they?
- Behavioural response to different hydraulic characteristics:
  - Attraction flows
  - Turbulence
- Selective fish passage: native v exotic species

Research needs

- Need to evaluate potential solutions to make sure they work
- Monitoring required
  - Upstream v downstream
  - Before v after
  - Quantitative
  - Results need to be made available

Conclusions

- Don’t install structures into waterways that are a barrier!
- Understand the fish
- Ensure structures & retrofits meet best practice guidelines
- Ecologists & engineers must work together