



Utility of mussel spat ropes for improving passage past culverts – summary to date and future development

# General outline

Discuss lab and field based experiments to date using ropes where main aims were to :

- Improve passage through perched culverts for climbing species
- Improve passage where internal barrel velocity creates a barrier - native fish and crustacea
- Pros/cons
- Future application

# Culverts and 'climbing' species

- Some NZ species have evolved the ability to jump and/or climb as migrating juveniles – steep topography, many waterfalls
- In some situations behaviour can be exploited to improve passage up into and through perched culverts



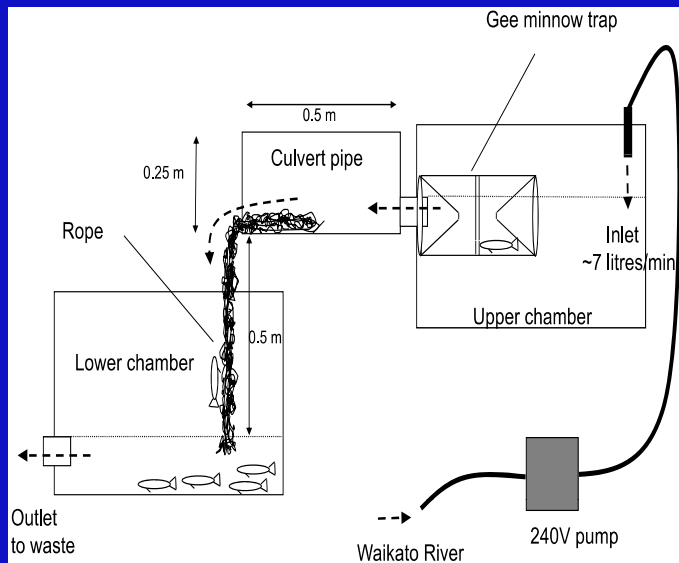
# Improving passage through perched culverts

## Laboratory trial 1 (2008)

Test species: Galfas (c. 45-55mm)

Perch height: 0.5m

Pipe length=0.5m



# Results summary Lab trial 1

- 0.5m perch height no problem for Gal fas with ropes
- Mean success >85% (n=4 reps, n= 30 fish/3 hr trial)
- Two rope types tested Super Xmas tree/Russet loop
- No sig diff between rope types
- Recommend super xmas (less debris)

• David, B.O.; Hamer, M.P.; Collier, K.J. Mussel spat ropes provide passage for banded kokopu (*Galaxias fasciatus*) in laboratory trials. *N. Z. J. Mar. Freshw. Res.* **2009**, *43*, 883–888.



# Field trial 1

Control v Treatment (BACT design)

Pre (n= 3) vs Post (n=3)

Perch Height= 2.4m

Pipe length =13m

Location: Coromandel coastal 2<sup>nd</sup> order bush streams

Species targetted:

Gobhut, Angaus, Angdie, Galfas



# Results summary Field trial 1

- Angaus/die – inconclusive (v low numbers in both C & T streams)
- Gobhut – unsuccessful relative to control site 2.4 m rope climb beyond capability for this species - investigate alternative option (propose flexi ramp)
- Galfas – significant increase relative to control – within this species' capability on this medium over this height at this locality –juves only

# Field trial 2 - underway

Can ropes improve eel recruitment to lake Harihari

Previous extensive netting survey suggested limited to zero eel recruitment in lake Harihari

Ropes installed to culvert in April 2009

Culvert diam: 500mm

Culvert length: 18m

Perch height: 1.9m

Repeat previous sampling effort by Chisnall & Ruru. 2008 when limited-no recruitment evident – Sampling to occur this year



Before

After



# Improving passage through non-perched culverts varying in length, flow and slope

- Laboratory trial 1 – Pilot test
- Test species: Gobhut (24-73mm)
- Pipe length=3m/6m
- Pipe gradient 10 deg
- Water Velocity 1l/s
- NB Some fish re-used/water temp effects

# Results summary Lab trial 1

Notwithstanding some methodological issues (temp/learning?):

No Gobhut passage in 3m or 6m when culvert set at 10 deg without ropes

But average 52% success when ropes provided

Dead pockets created by ropes and Gobhut able to sit stationary on culvert base along length

Tonkin J.D, Wright L.A.H, David B.O. Mussel Spat Ropes Assist Redfin Bully *Gobiomorphus huttoni* passage through Experimental Culverts with Velocity Barriers Water 2012, 4, 683-689; doi:10.3390/w4030683

# Improving passage through culverts varying in length, flow and slope

Laboratory experiment 1

Test species: Galmac, Saltru,  
(c. 45-115mm), Paratya shrimp

Pipe length=3m/6m

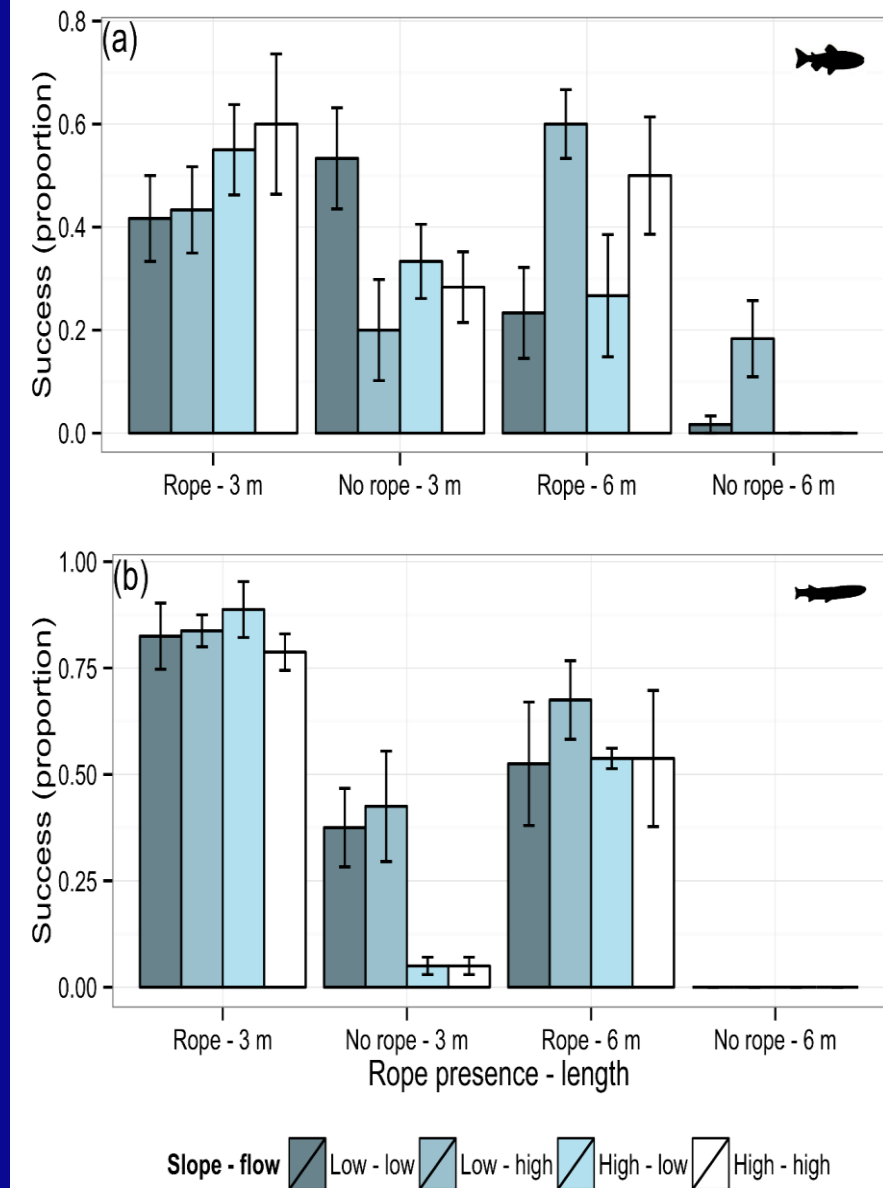
Pipe gradient 1.5/3 deg

Water velocity 0.24/0.75l/s



# Results summary Lab trial 2

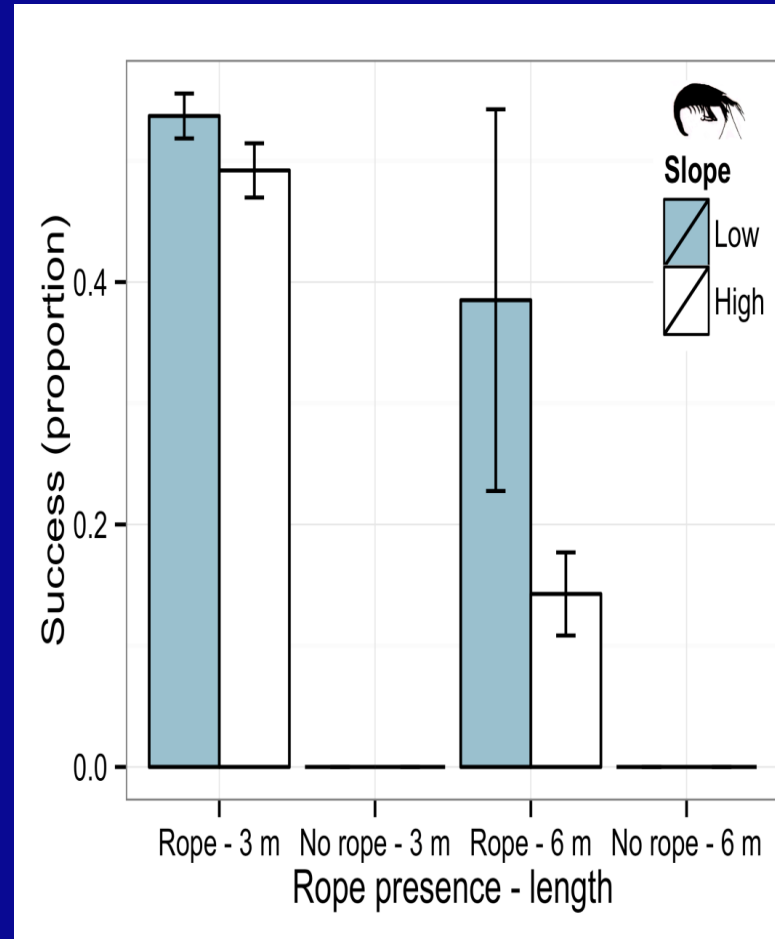
- Saltru – ropes improve passage success generally but esp in long (6m) high slope (3 deg) pipes
- Galmac – weaker than saltru so benefits of ropes evident even in 3m pipes when at higher slope (3deg)





# Results summary Lab trial 2

- Paratya shrimp –weaker again  
no passage in any combo  
tested unless ropes present



- David, B.O., Tonkin J.D., Taipeti, K., Hokianga, H. Learning the ropes: Mussel spat ropes improve fish and shrimp passage. (2013) Journal of Applied Ecology doi:10.1111/1365-1664.12178

Inanga 6m pipe group attack – no rope

Clip 31

Inanga 6m pipe – rope assist







Trout – 3m pipe exploiting 'pockets'



Paratya shrimp swim/climb perspex

Clip 14

# Future

- Test add-ons to ropes for larger culverts and possibly use rope as supporting structure for end of pipe solutions
- Assess long term durability and efficacy of ropes through time

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