Is the 'moat effect' real?

A review of what we know – and don't know – about how flow affects predation on braided river birds

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Main predators of braided river birds

Video, DNA, field observations, diet studies:

- Ferrets
- Stoats
- Cats
- Hedgehogs
- Rats

- Black-backed gulls
- Harriers

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The moat/safe island hypothesis:

That birds nesting on islands have higher egg, chick, adult survival than those on 'mainland' or 'bank' sites...

...because water is a barrier or deterrent to <u>mammalian</u> predators

Origins:
- Pierce, 1987 - flows of 3 m³/s protected stilts, terns, Tekapo R.
- Hay, 1984, Hughey 1985 – wrybills, Rakaia R.
- Rebergen *et al.* 1998 – Banded dotterels, Tekapo and Ohau Rivers

What do we mean by 'island'?
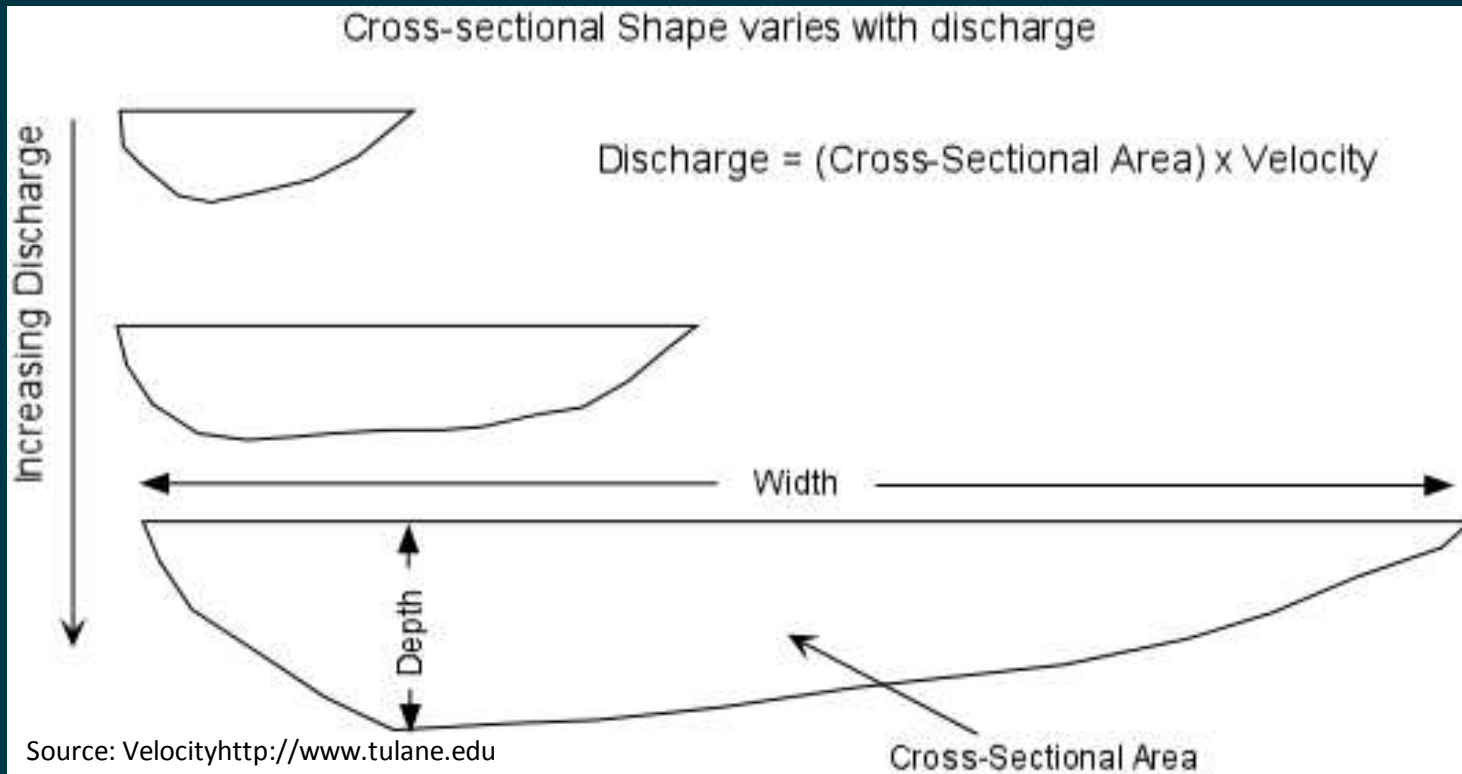
Island?

7 islands?

island

island

Island?

26 m³/s

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Flow

Cross-sectional Shape varies with discharge

Discharge = (Cross-Sectional Area) x Velocity

Increasing Discharge

Width

Depth

Cross-Sectional Area

- Large changes in flow ⟷ small changes in width, depth, velocity
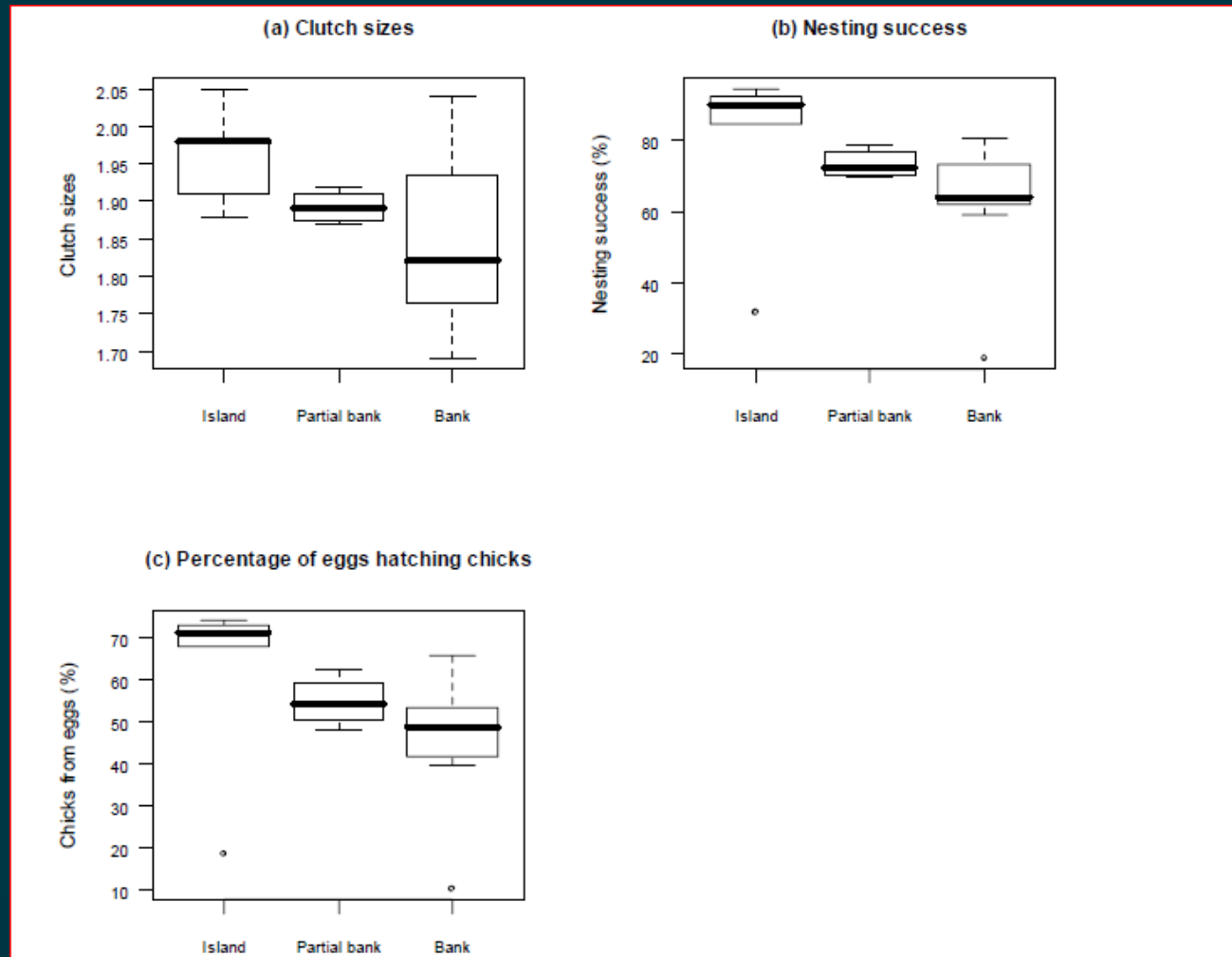
Data: 1. Boffa Miskell and Urtica Consulting 2007

- Terns on islands in Ahuriri, Ohau, Tekapo
- Even 0.06 m³/s flow protective
- Loss of flow → predation
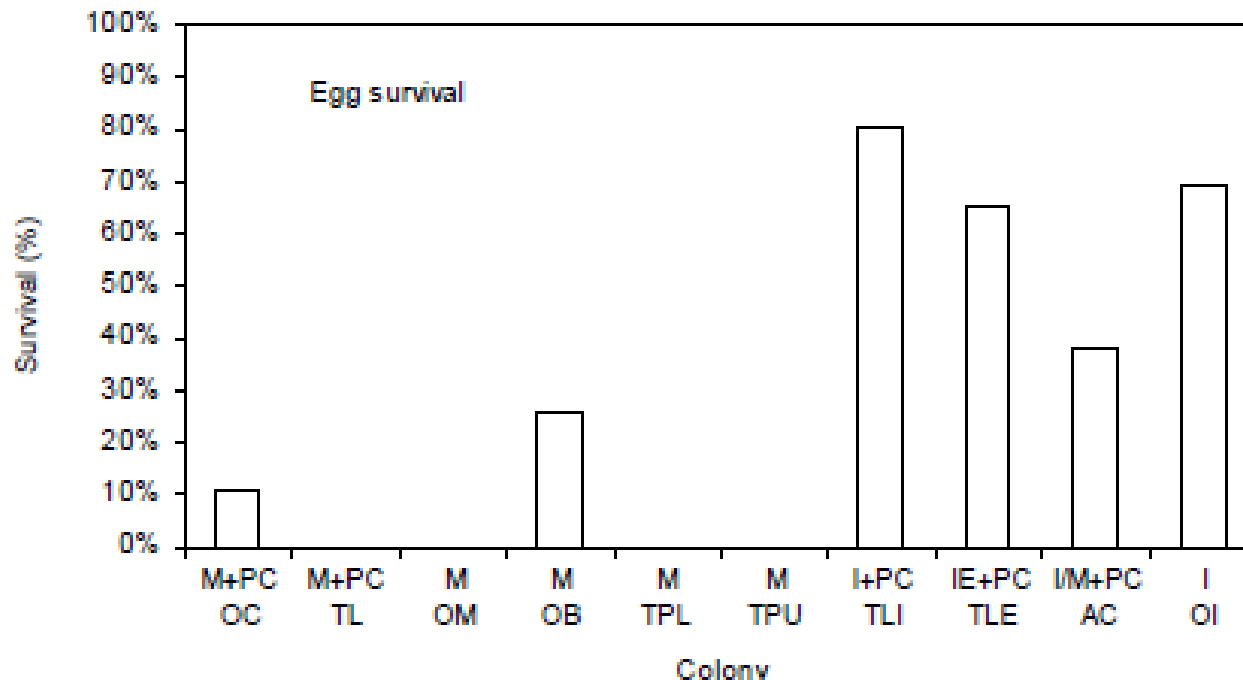
2. McClellan, 2009. Black-billed gulls, Southland

- Flows > 1 m³/s protective

3. Boffa Miskell and Urtica Consulting 2007, black-fronted terns, Wairau R.

- Highly variable, but islands safer for eggs and chicks, <u>on average</u>

- Loss of barrier → increased predation, sometimes

- No effect of:
  - Braid width, depth, velocity
  - Flow
  - Turbulence
  - Number of braids
  - Island area
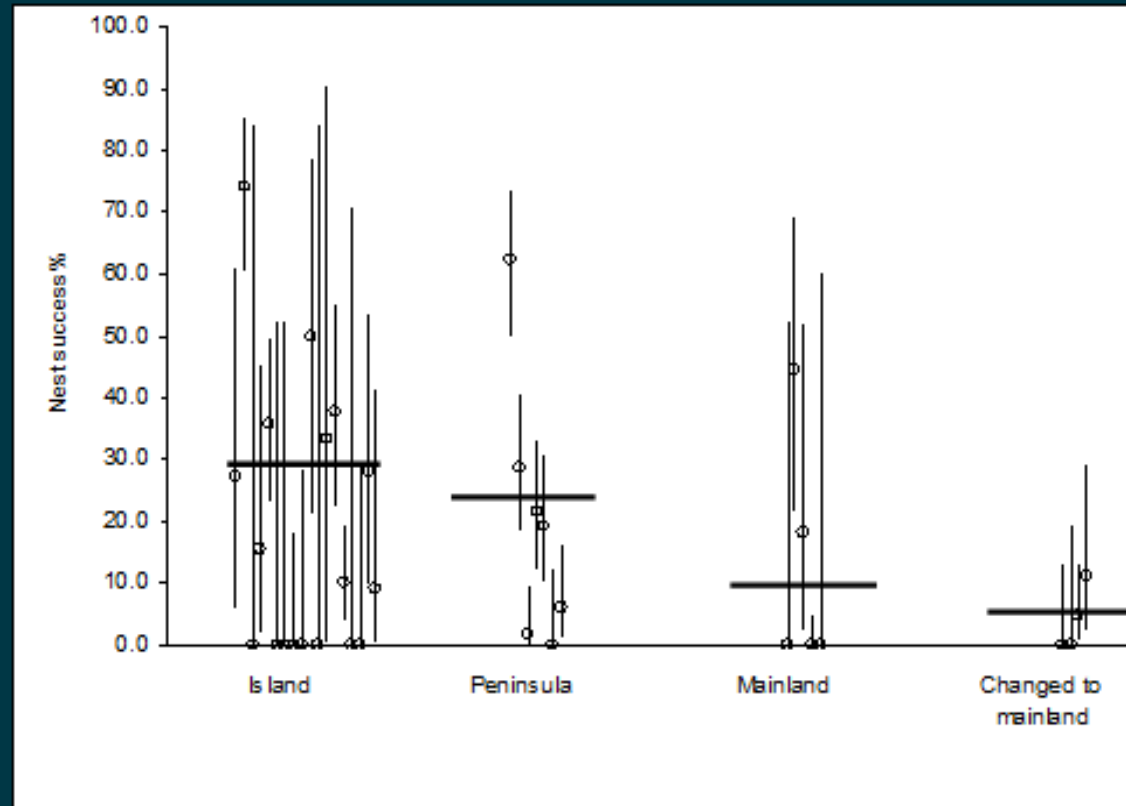
Conclusions & questions

- Yes, the 'moat effect' / 'safe island effect' is real. But…

- Highly variable

- Water is a <u>deterrent</u> not a barrier

- Very low flows can be protective

- Number and size of braids seems to have little effect

- Avian predation confuses the issue

- What constitutes optimal island habitat?

- How do different predators move over riverbeds?

- Are <u>reductions</u> in flow within nesting period more important than flow *per se?*

Management implications

- Protect established nesting islands:
  - Weed control
  - Predator control???
  - Gravel extraction

- Create islands? Maybe, but only if habitat is limiting?

- During nesting, avoid <u>declines</u> in flow that 'strand' nests?