Swimming against the tide gates

Paul Franklin

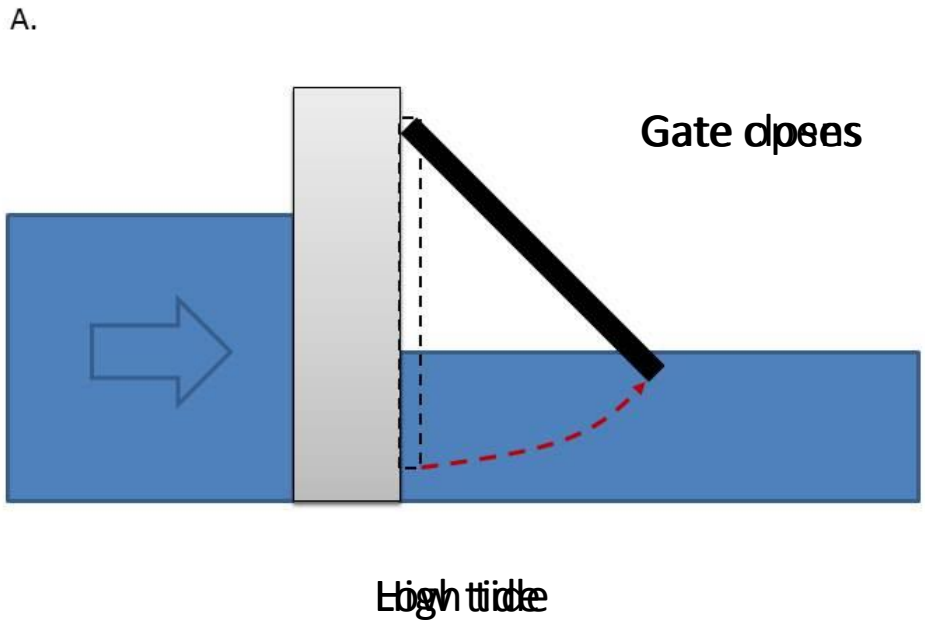
NIWA
Taihoro Nukurangi

Introduction

- Flood & tide gates used worldwide
- Act as physical barriers
- Modify aquatic environment
- Impact on aquatic communities

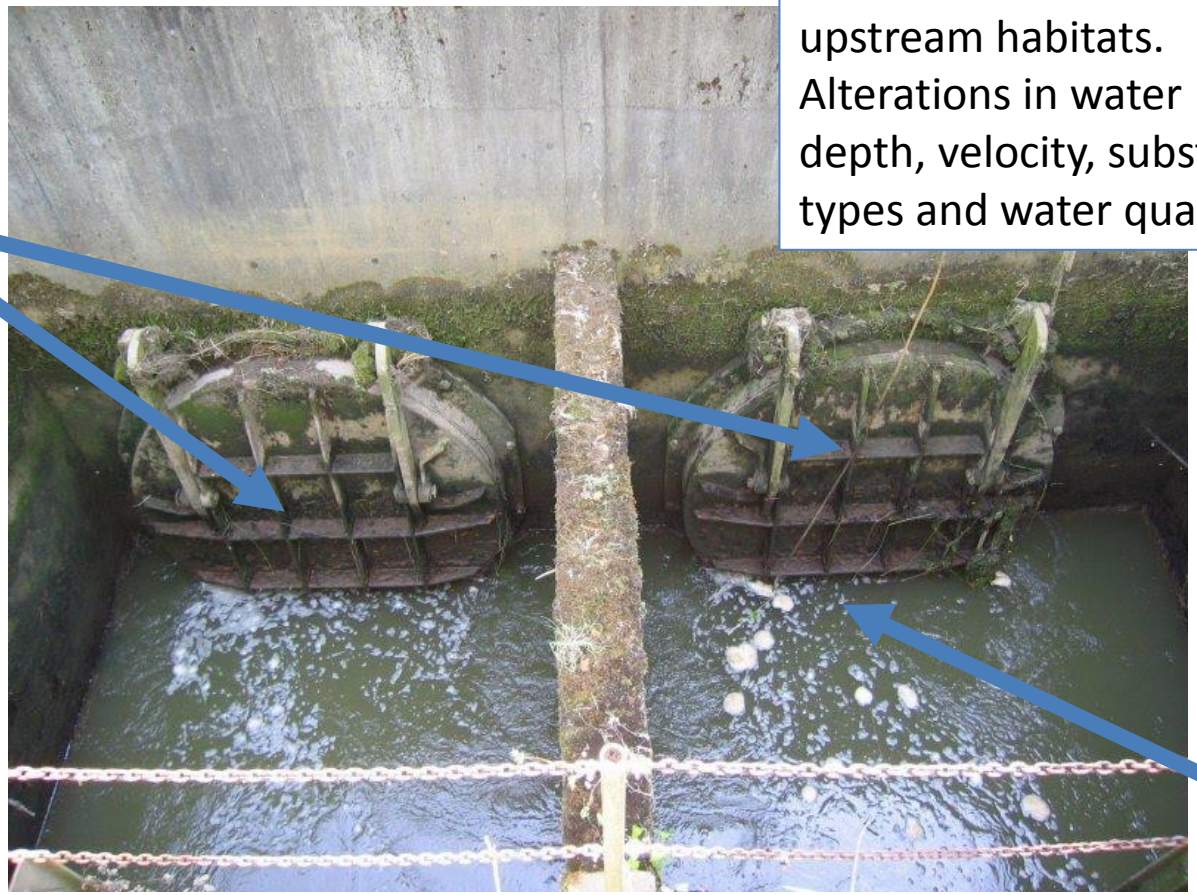
What are tide gates?

How do they work?



How do tide gates affect fish?

Closed gates block fish movements

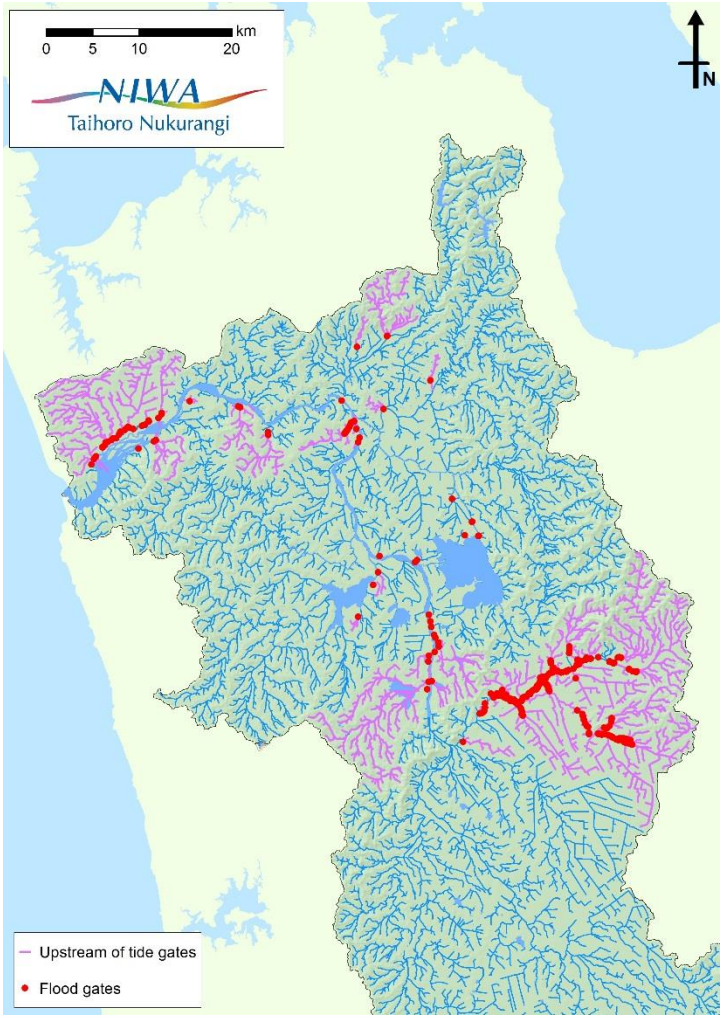


Loss of tidal variability in upstream habitats. Alterations in water depth, velocity, substrate types and water quality.

Fast & turbulent water when open restricts fish movement

How do tide gates affect fish?

- Lower Waikato catchment
  - Access to around 1,100 km of streams & rivers restricted
  - Includes c. 24% of suitable habitat for inanga
- Prevent fish from reaching critical habitats to complete life cycle
- Reduce abundance & diversity of fish



Research needs

- How do different gate types/configurations impact fish passage & instream habitat conditions?
- What characteristics of these structures have greatest influence on fish passage & habitat?
- How can we design effective retrofit solutions?
- How well do existing retrofit options work?

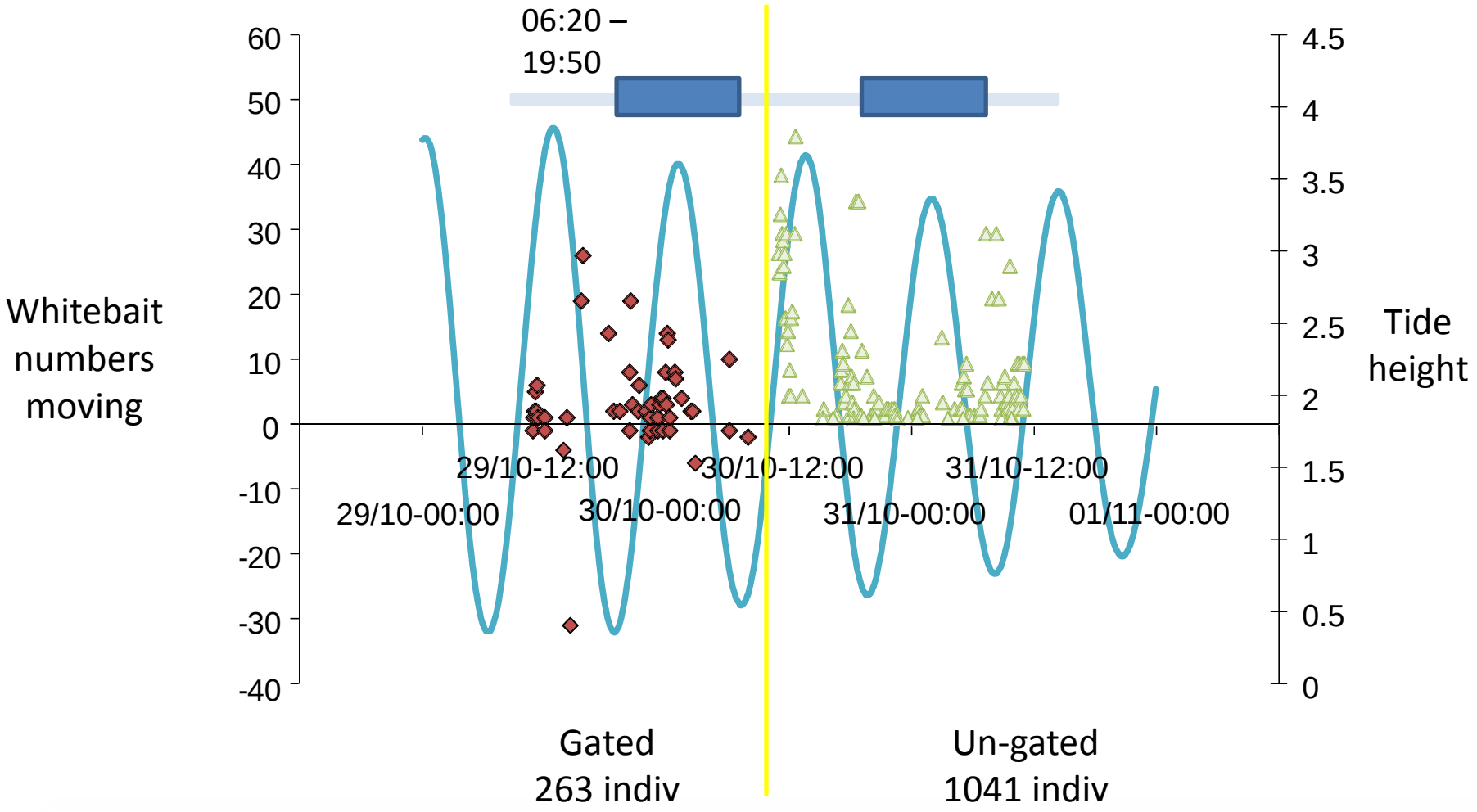
Case study: Motueka estuary

Un-gated culvert

Gated culvert

Doehring et al. (2011) Suitability of DIDSON to monitor juvenile fish movement at floodgates. NZJMFR 45:3 p 413-422

Case study: Motueka estuary



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Case study: Motueka estuary

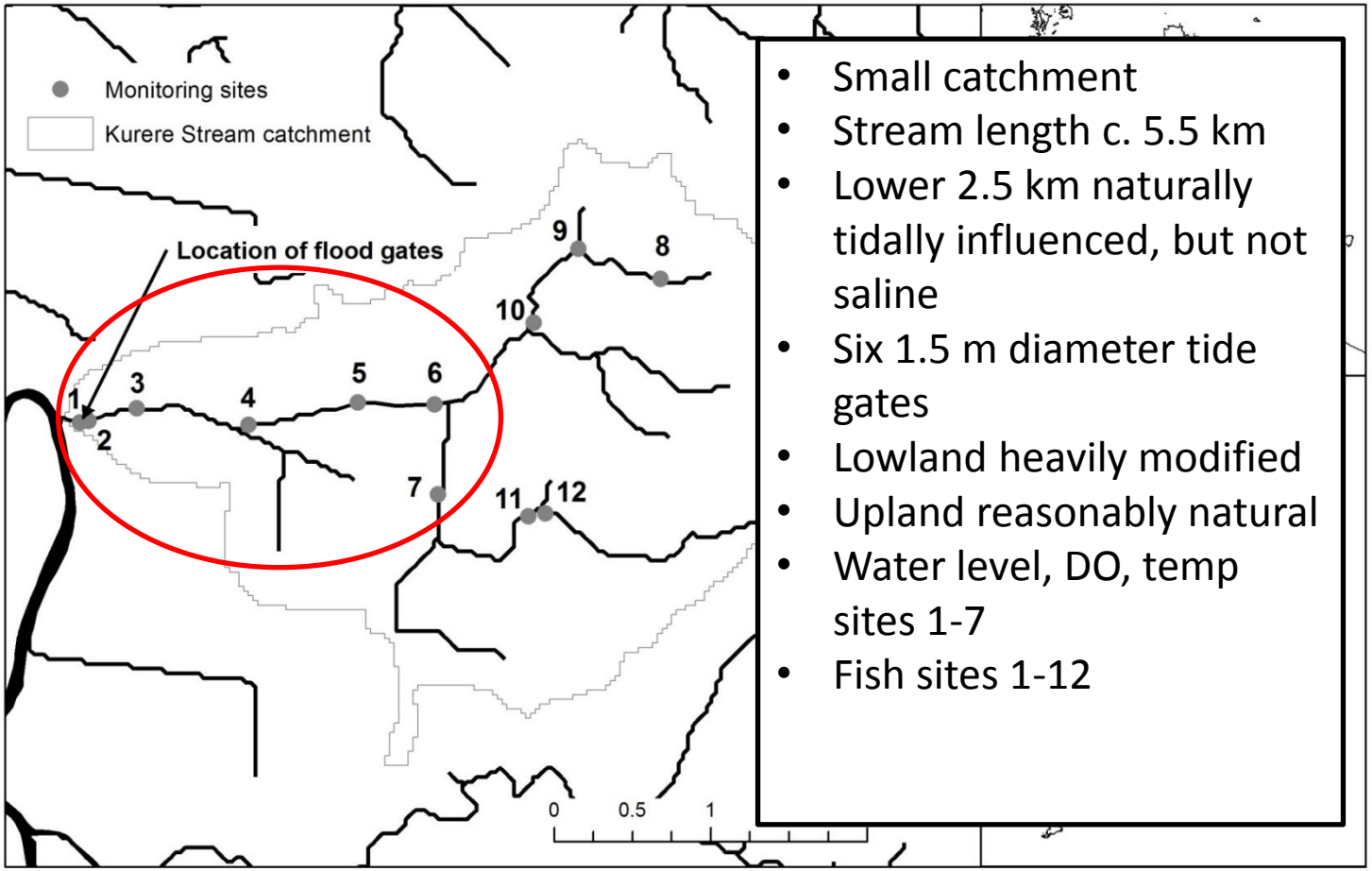
- Number of fish passing the gated culvert 75% less…however, some fish still able to pass
- Fish generally moving at low tide at both sites
- Greater proportion of fish moving at night at the gated site

Doehring et al. (2011) Suitability of DIDSON to monitor juvenile fish movement at floodgates. NZJMFR 45:3 p 413-422

Case study: Kurere Stream

- Investigate effects of tide gates on:
  - Fish passage
  - Aquatic habitat
- Evaluate potential mitigation options

Case study: Kurere Stream



- Small catchment
- Stream length c. 5.5 km
- Lower 2.5 km naturally tidally influenced, but not saline
- Six 1.5 m diameter tide gates
- Lowland heavily modified
- Upland reasonably natural
- Water level, DO, temp sites 1-7
- Fish sites 1-12

Case study: Kurere Stream

1. Do tide gates act as a physical barrier to migrating fish?

- Not completely true!
- Migratory fish present upstream
- Impacts on abundance?
- Aggregations of inanga observed downstream

Case study: Kurere Stream

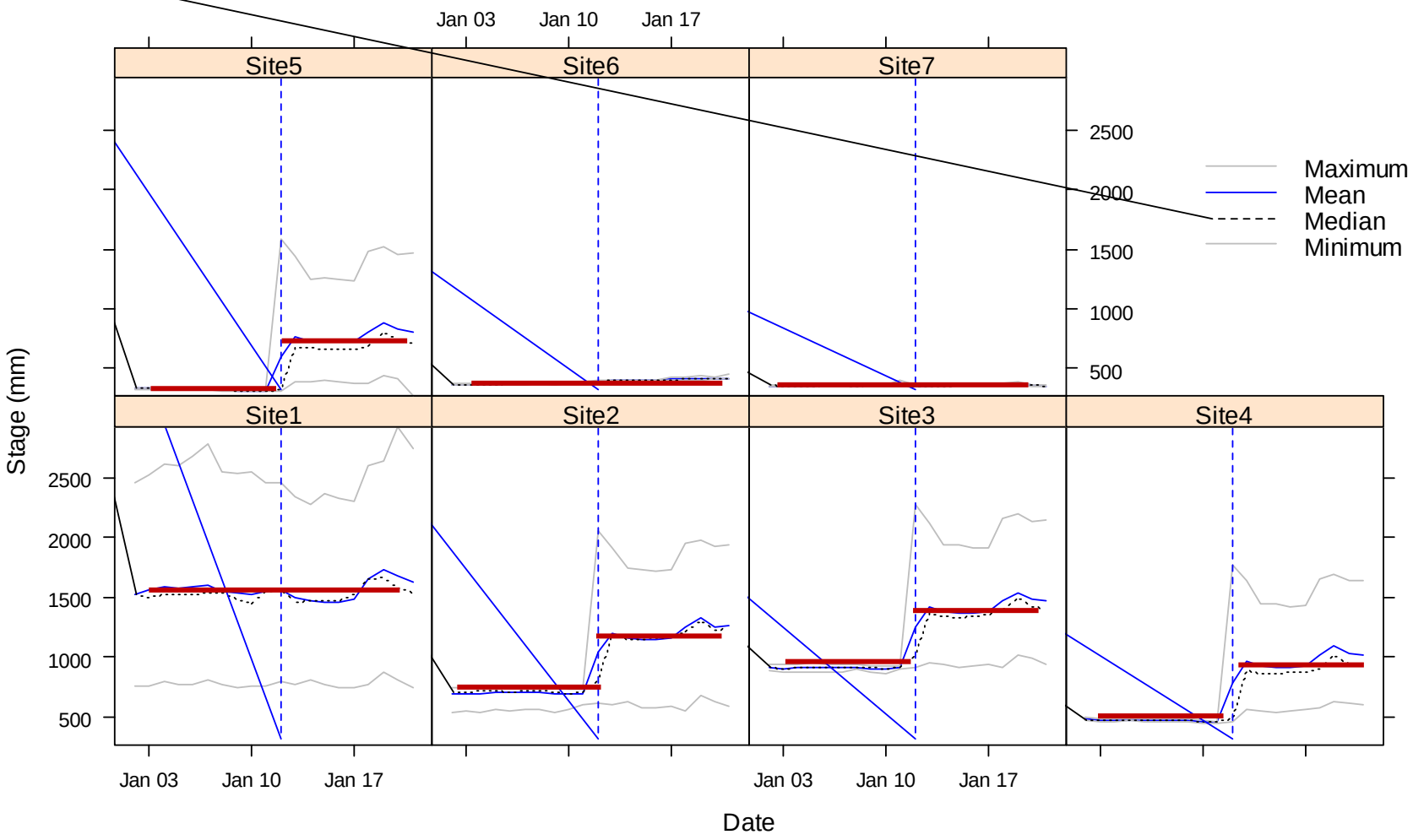
2. Do tide gates modify upstream aquatic habitats making them less suitable for fish?

- True for sensitive native fish species
- Low DO & high temperatures exceed known tolerance levels of some native fish
- Exotic species more tolerant – favoured in these habitats?
- Promotes proliferation of macrophytes

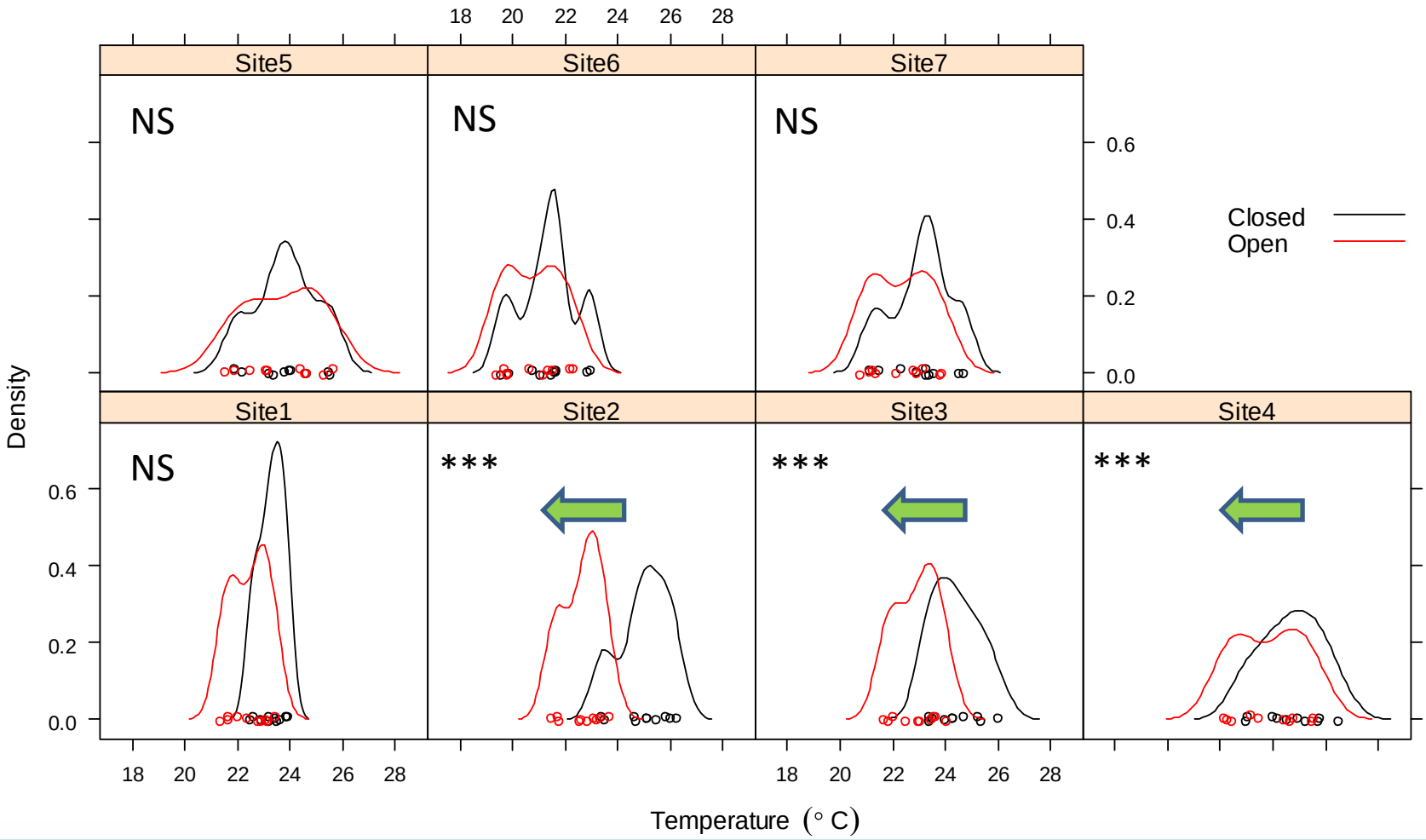
Case study: Kurere Stream

3. Can reintroducing partial tidal fluctuations improve aquatic habitat?

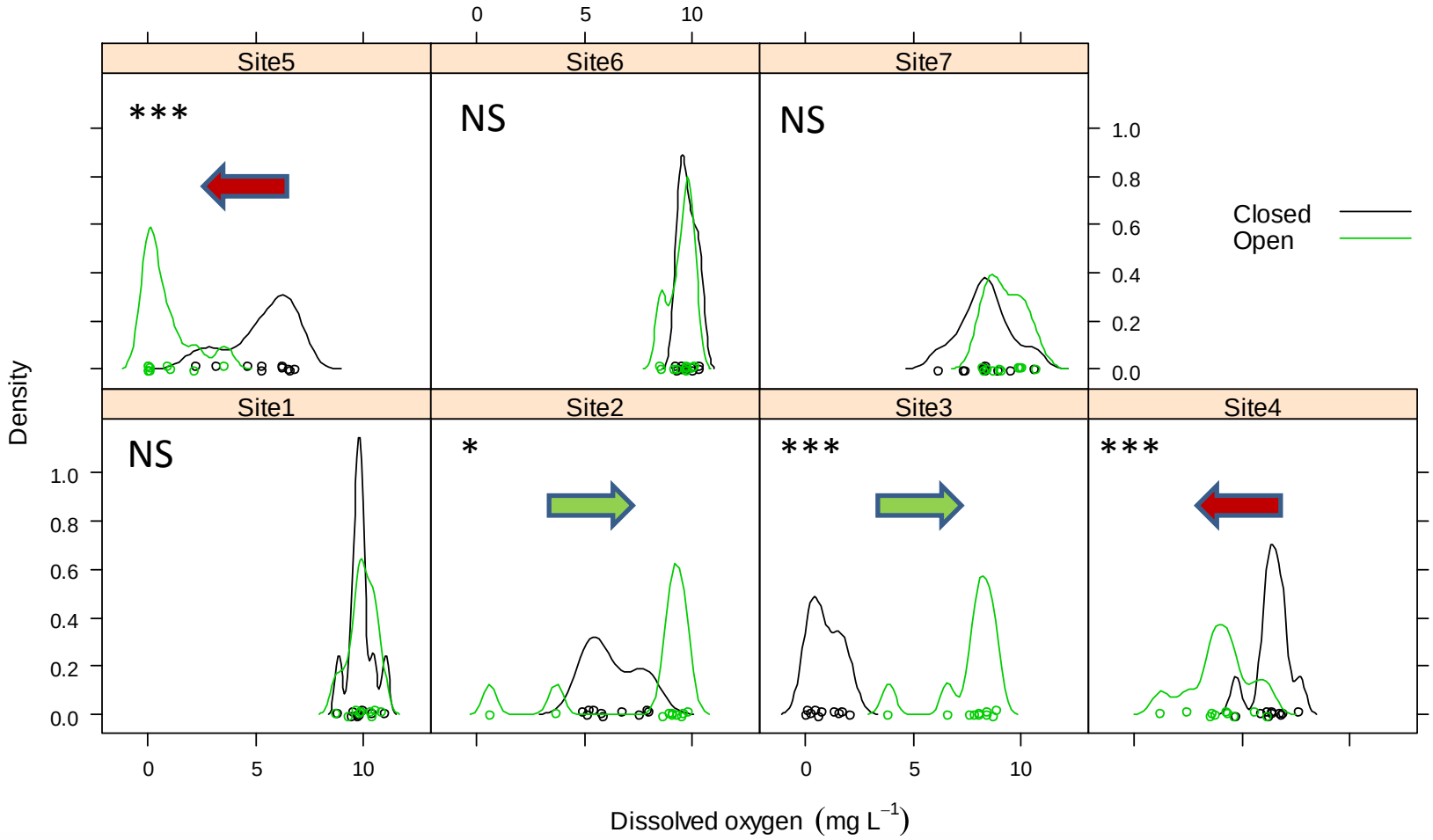
Case study: Kurere Stream



Case study: Kurere Stream



Case study: Kurere Stream



Case study: Kurere Stream

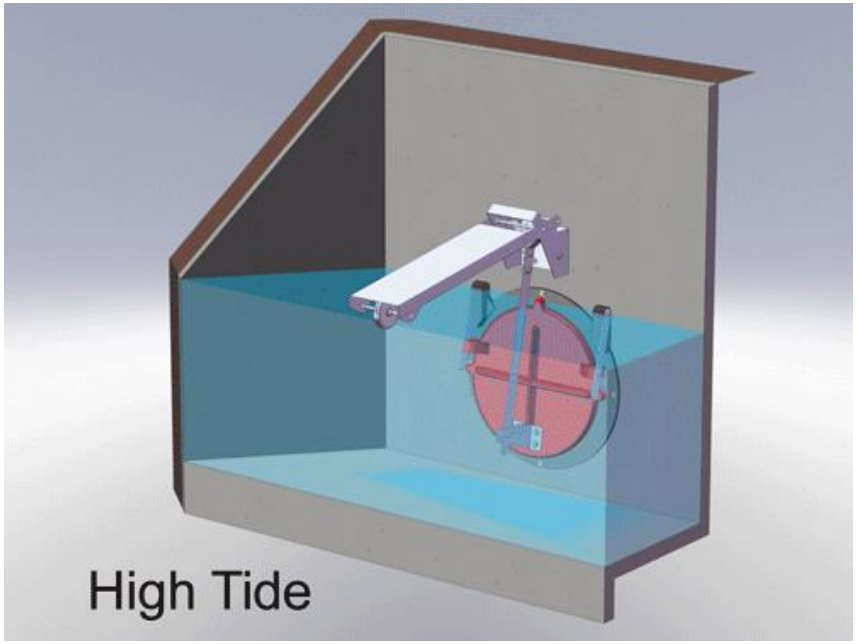
3. Can reintroducing partial tidal fluctuations improve aquatic habitat?

- Trial limited in scope, but indicates this is at least partially true
- In long-run would also help fish passage
- Transferability to other systems?
  - Everywhere is different!
  - Flood defence issues

What can be done?

- Remove them!
- Leave them open except when they're needed
- Alternative designs:
  - Side hung gates?
  - 'Fish friendly' gates?

'Fish friendly' gate



Credit: Kelly Hughes, ATS environmental

Conclusion

- Relatively little research on how tide gates impact the migration of native species
- Requires better understanding of fish life-cycles, behaviour, physiology & habitat requirements
- Best option is to not have a tide gate or leave it open as much as possible