
# Bioenergetics to balance water takes and instream habitat

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environment SOUTHLAND REGIONAL COUNCIL
Te Taiao Tonga

# Acknowledgments

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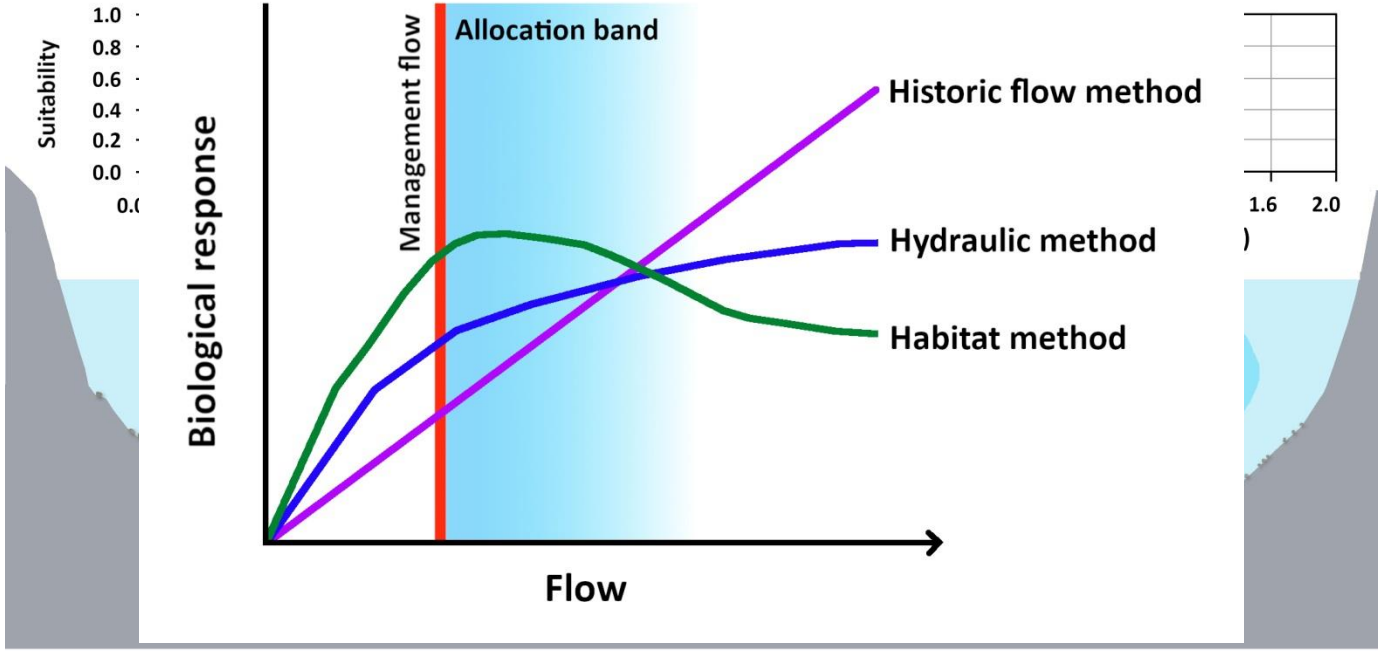
# Outline

- Allocation Method
- Relationship of invertebrate drift with flow
- Implications for water resource allocation

# Problem

- High allocation
- Increasing demand
- Looking for  a more ecologically robust method for water allocation (plan effectiveness)

# Allocation method




www.es.govt.nz

Hayes and Jowett 1994
Jowett and Hayes 2004

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# NREI study locations


- Bioenergetic modelling of a river reach to determine carrying capacity

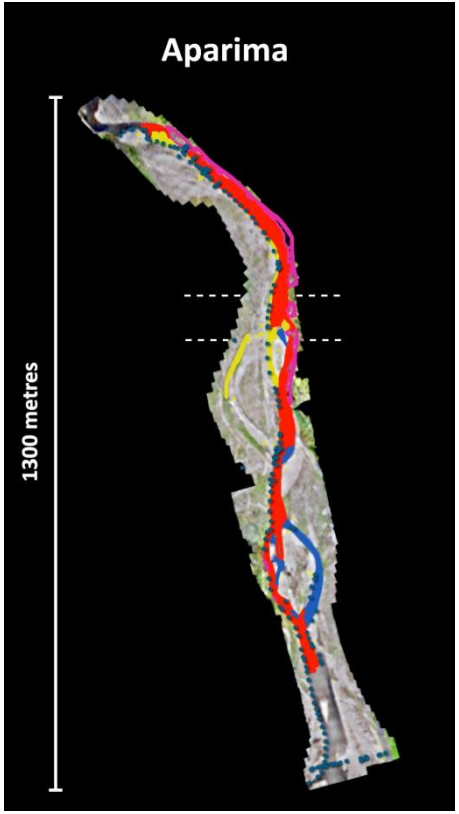
- Develop flow response (benthic entrainment curves) for each river

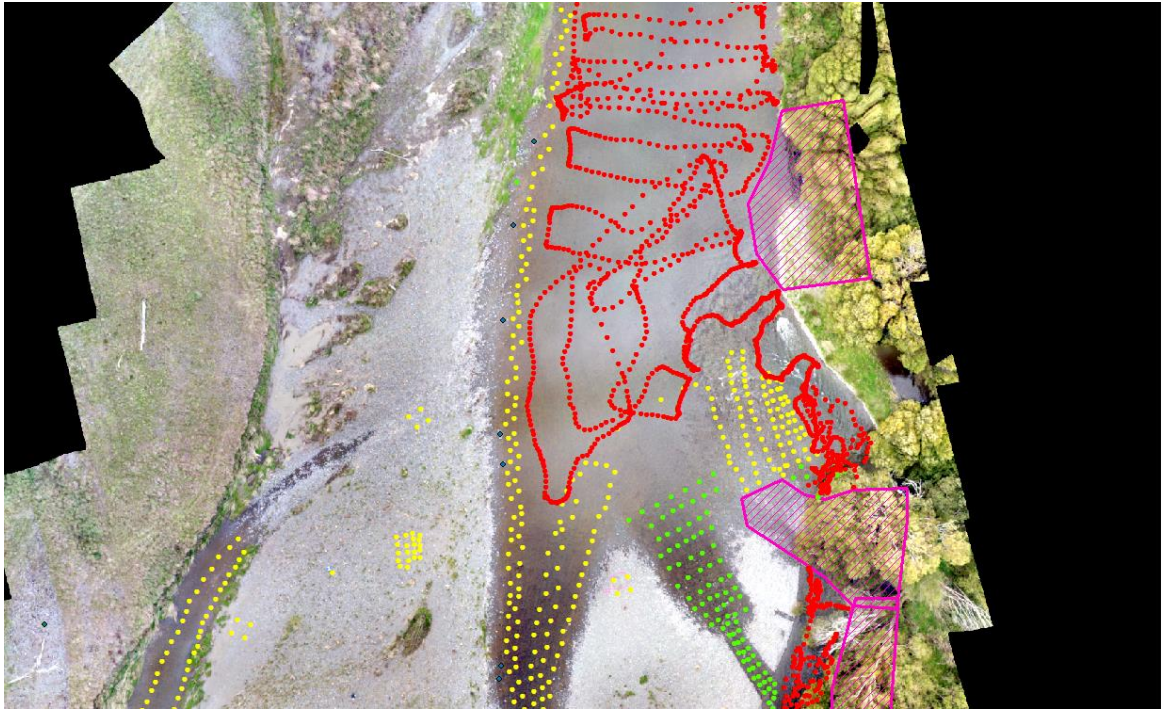
**Research aims**

1) To provide knowledge and predictive models to assess the effects of flow change on trout, and other drift-feeding fish

2) To assist decision making on minimum flow and water allocation

# What is NREI?



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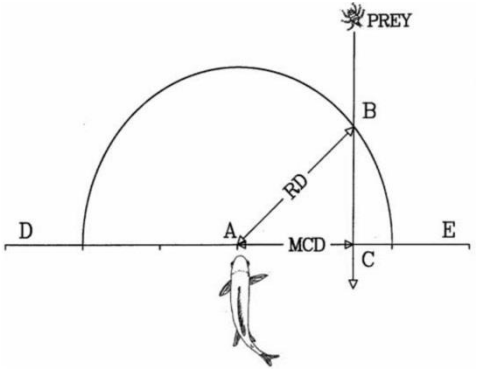
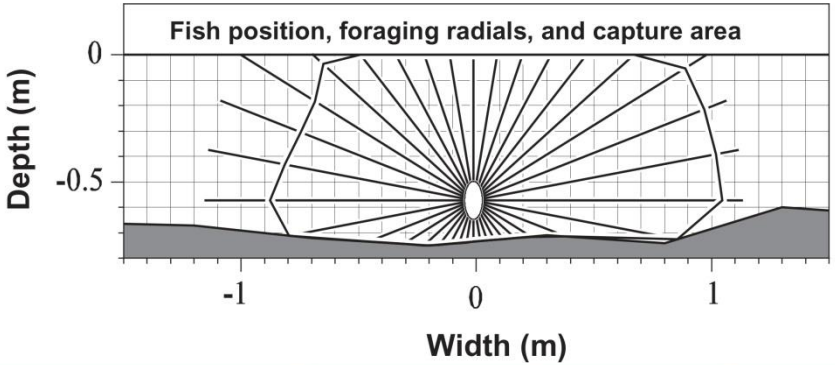
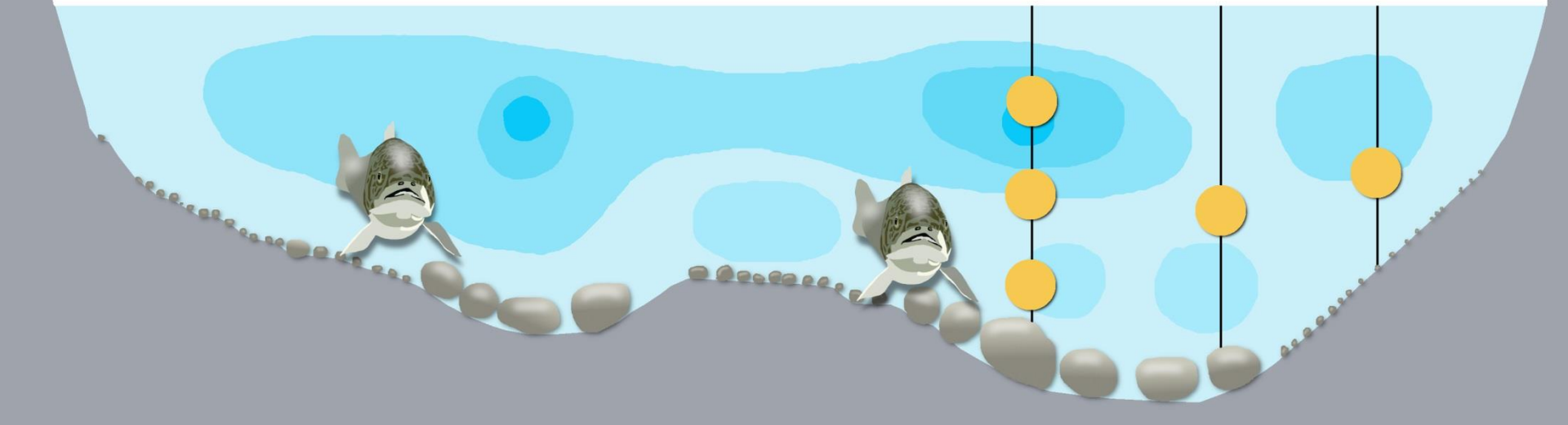
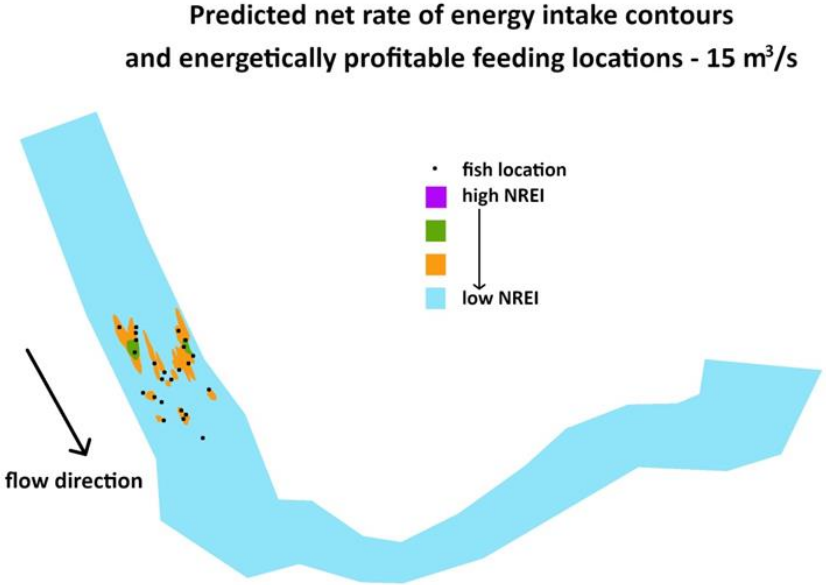
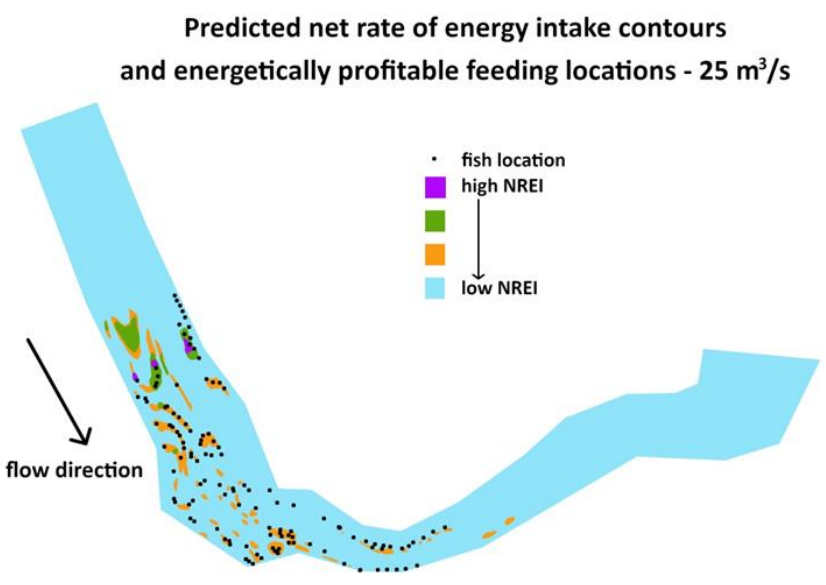

PREY
B
RD
D
A
MCD
E
C

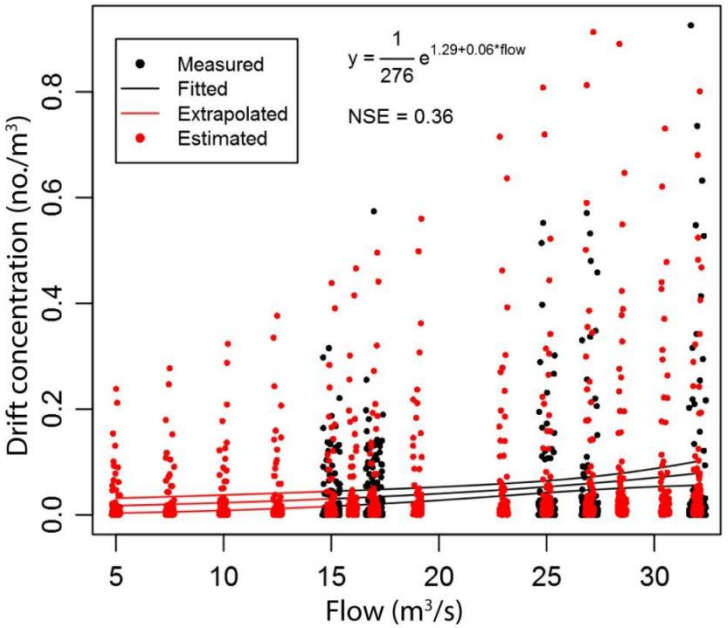

Fish position, foraging radials, and capture area
Depth (m)
0
-0.5
-1
0
1
Width (m)



# What is NREI?


Predicted net rate of energy intake contours
and energetically profitable feeding locations - 15 m³/s
fish location
high NREI
low NREI
flow direction


Predicted net rate of energy intake contours
and energetically profitable feeding locations - 25 m³/s
fish location
high NREI
low NREI
flow direction

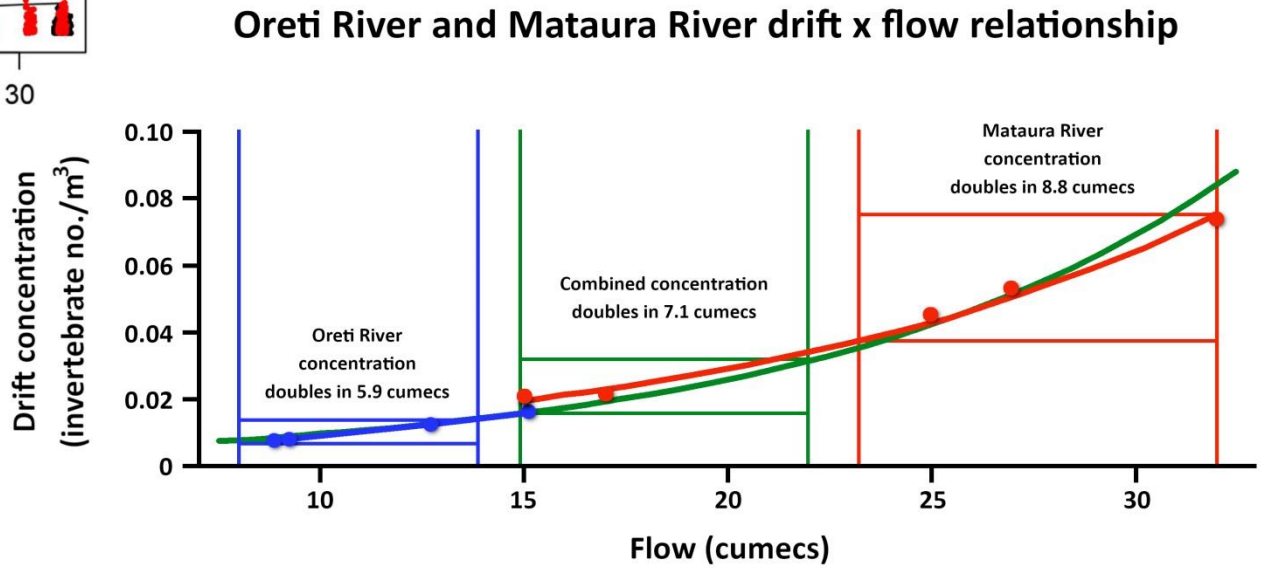



# Results

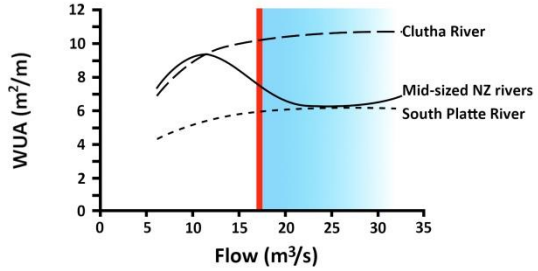
Good predictive reliability

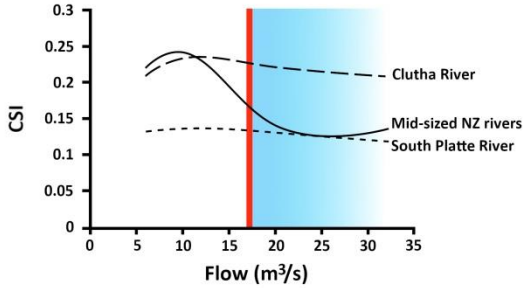
Key point for fish: Drift rate (~flux) = drift conc x velocity

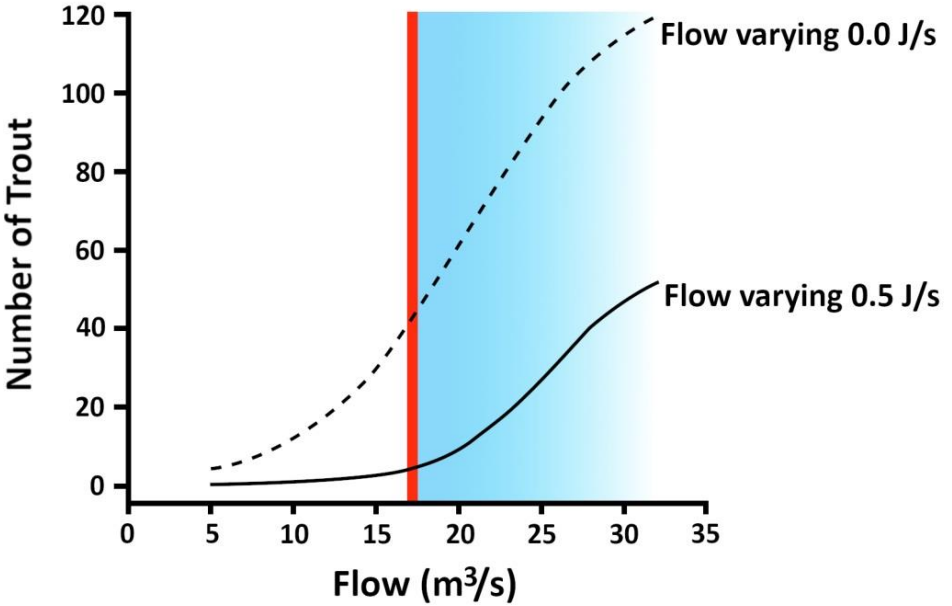
Consistency in relationship between two studies



# Results


WUA (m²/m)
Clutha River
Mid-sized NZ rivers
South Platte River
Flow (m³/s)


CSI
Clutha River
Mid-sized NZ rivers
South Platte River
Flow (m³/s)


Number of Trout
Flow varying 0.0 J/s
Flow varying 0.5 J/s
Flow (m³/s)

# Conclusions

- The NREI model will provide a robust ecologically realistic basis to make decisions on water allocation (gradient between competing water uses)
- Development of an environmental gradient that is an expression of life supporting capacity
- Traditional hydraulic habitat modelling may underestimate the benefits of flows (below through MALF to at least half median flow) for drift-feeding trout
- We are now working with NIWA and Cawthron to understand how the period of time that a river is at high flow affects the fishery