

Spatial and temporal effects of consumer nitrogen recycling in a large oligotrophic lake



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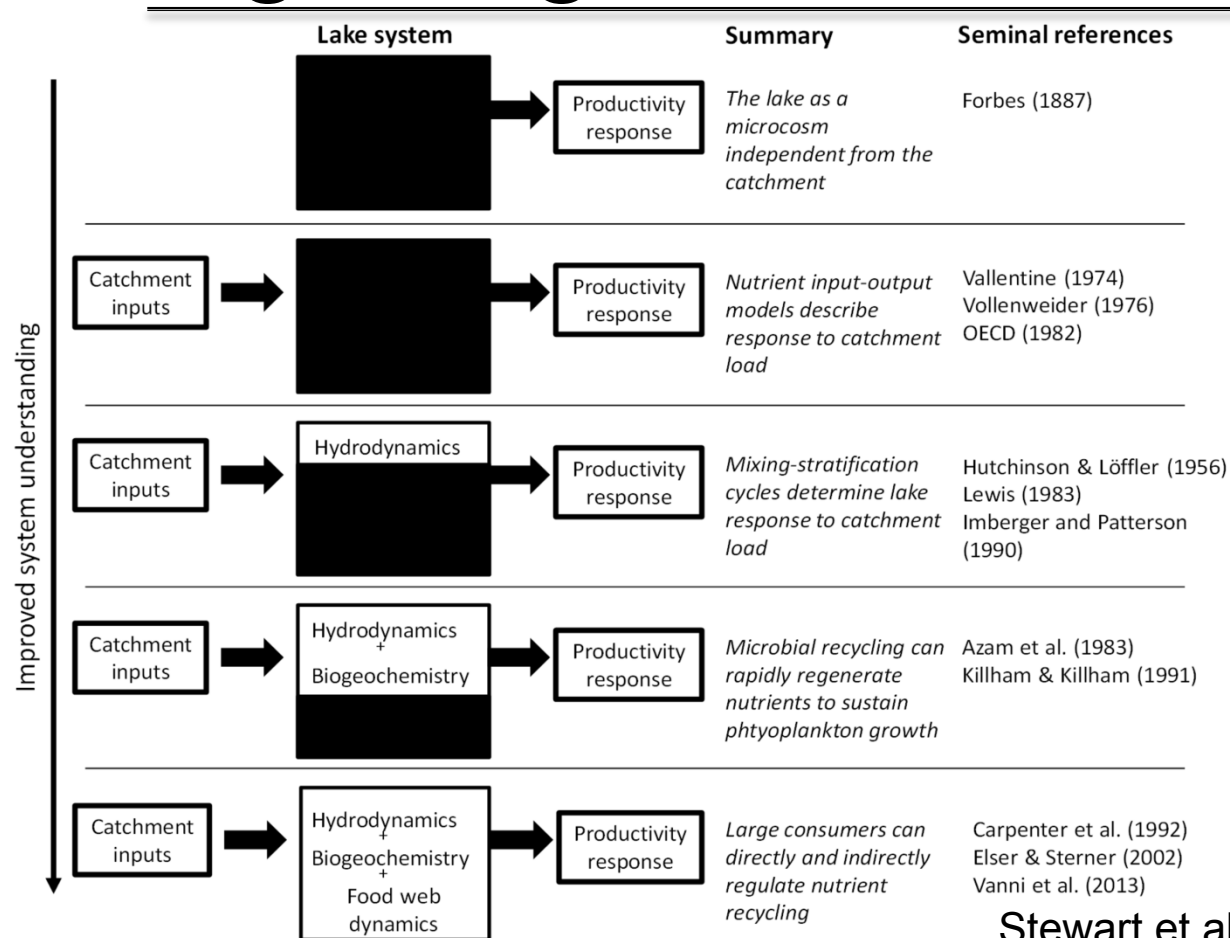


Photo: Warrick Powrie

Objective

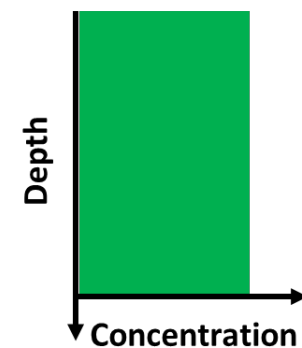
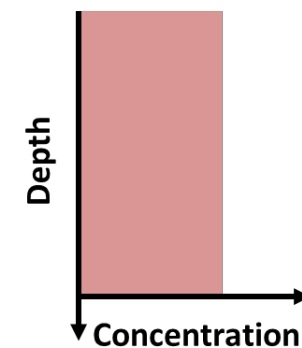
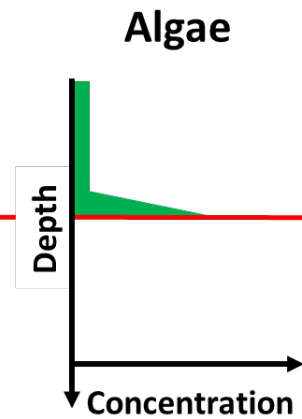
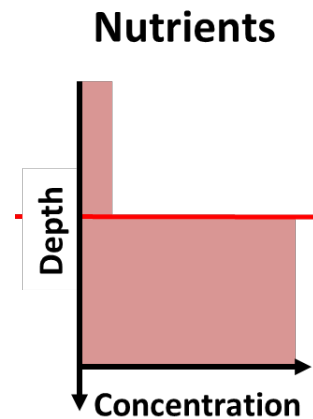
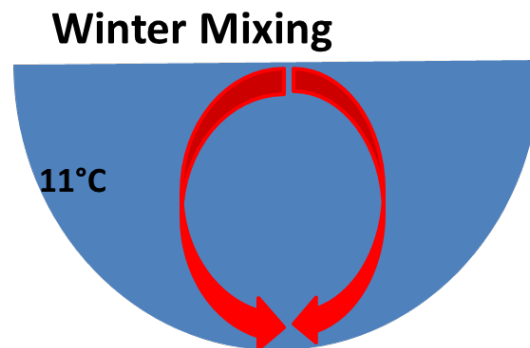
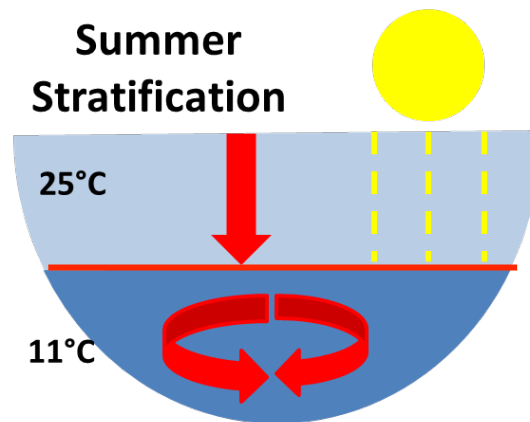
Demonstrate the strong consumer nitrogen cycling interactions observed in a large oligotrophic lake – Lake Taupō and should be considered in management

Integrating CNR into lakes

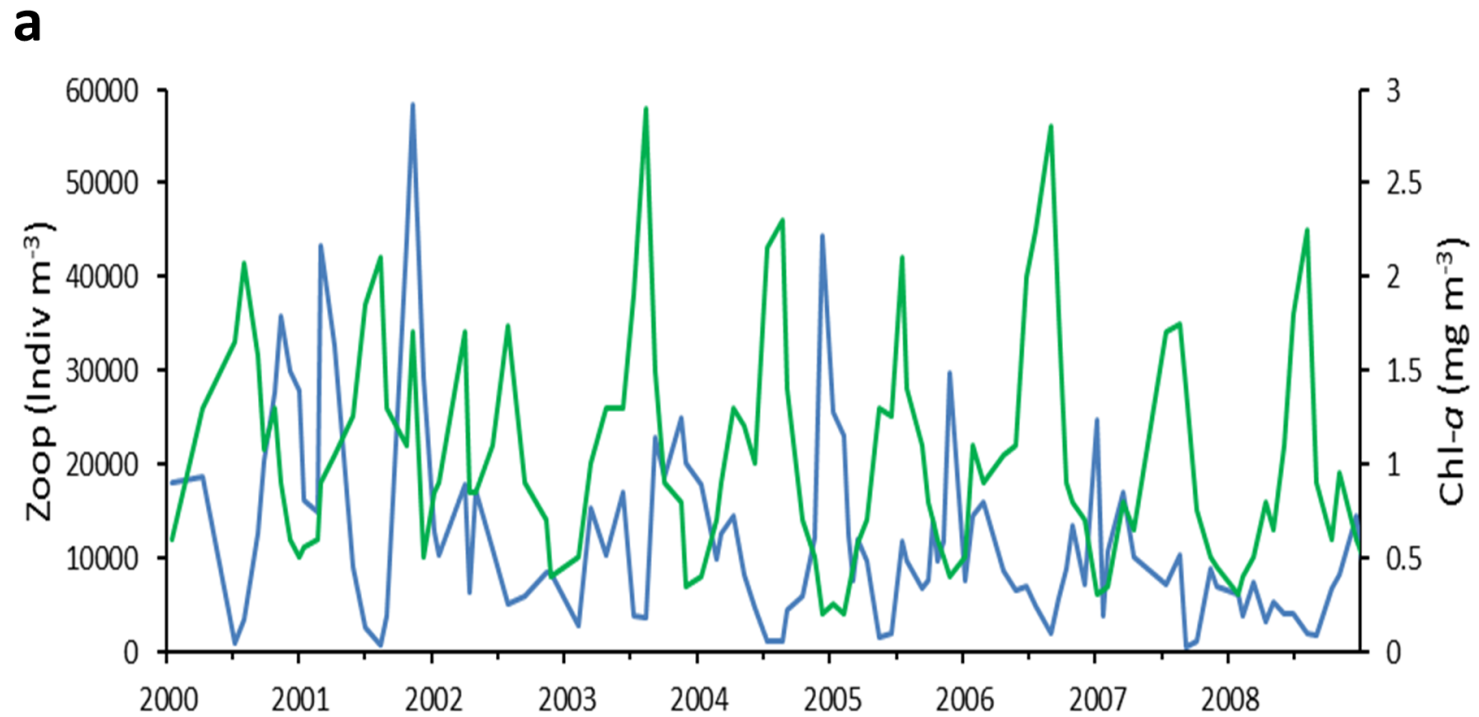


Stewart et al. *in press*

Context: Lake Taupō annual cycle

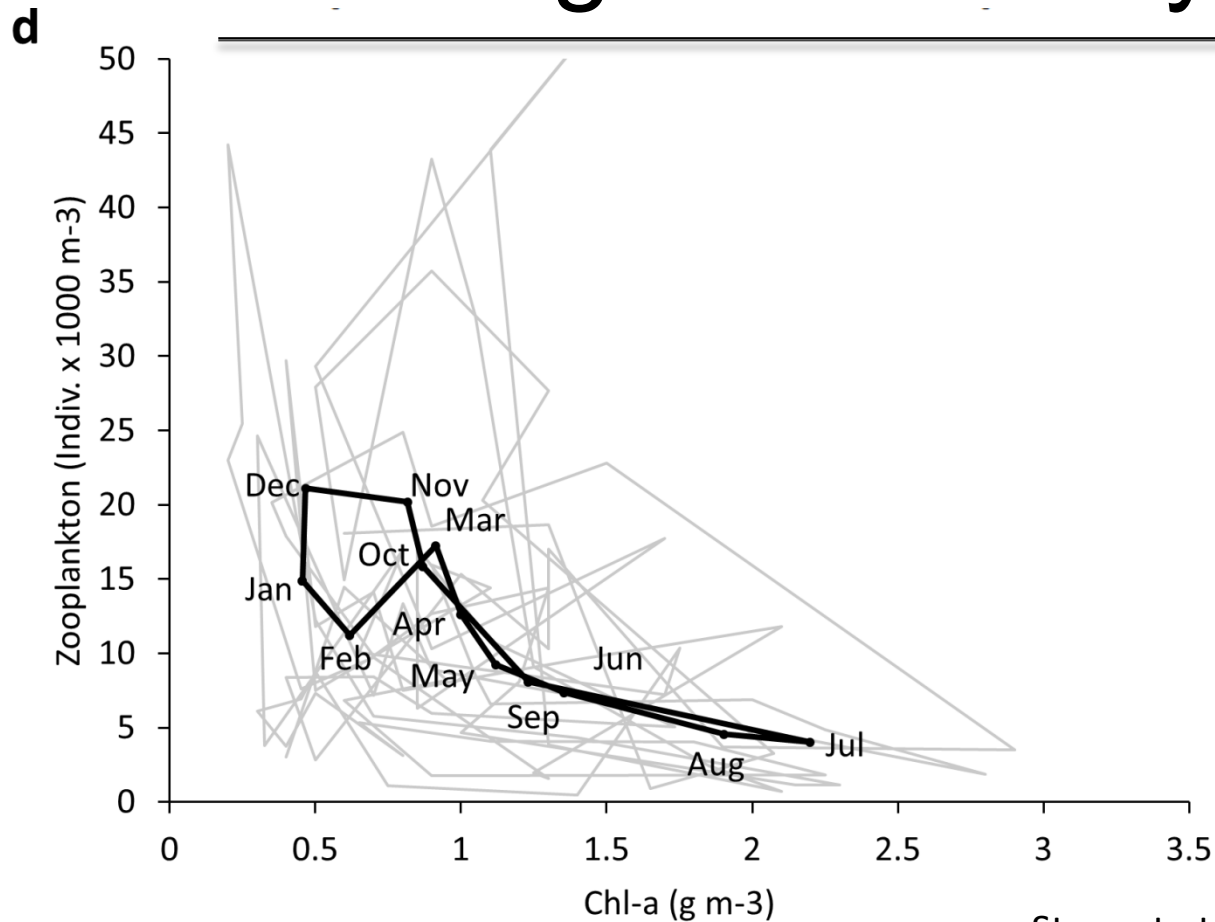


Considering food web dynamics



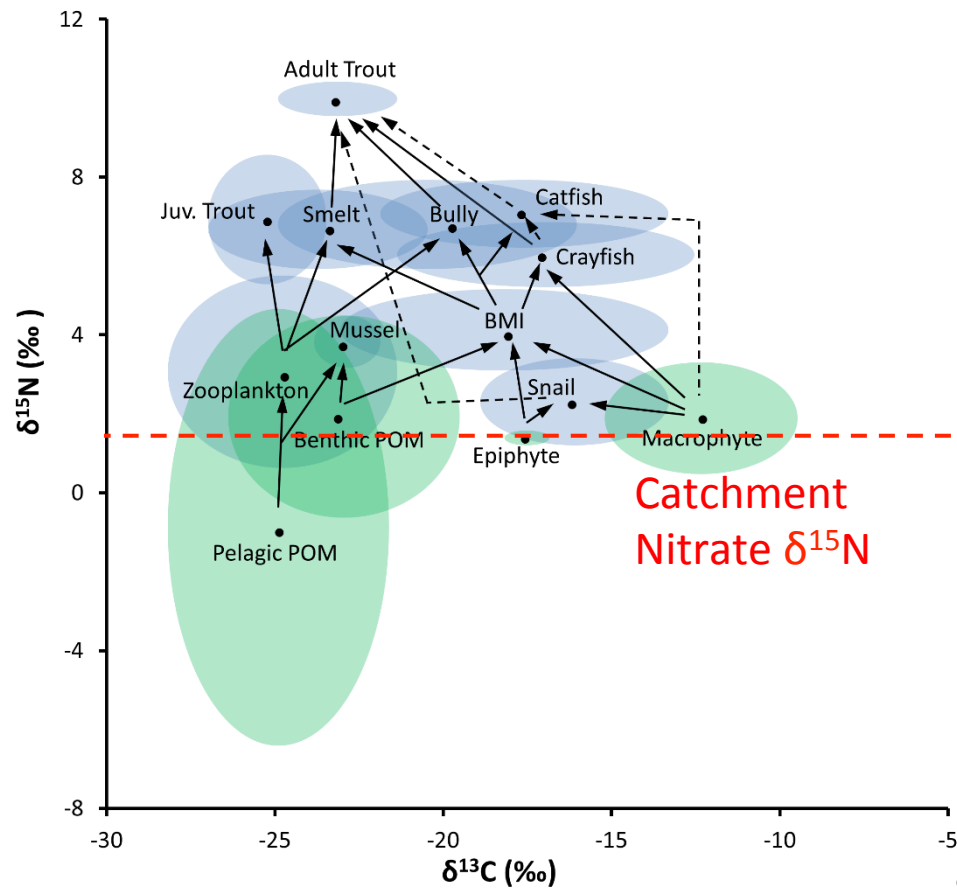
Stewart et al. 2017 *Freshwater Biology*

Considering food web dynamics



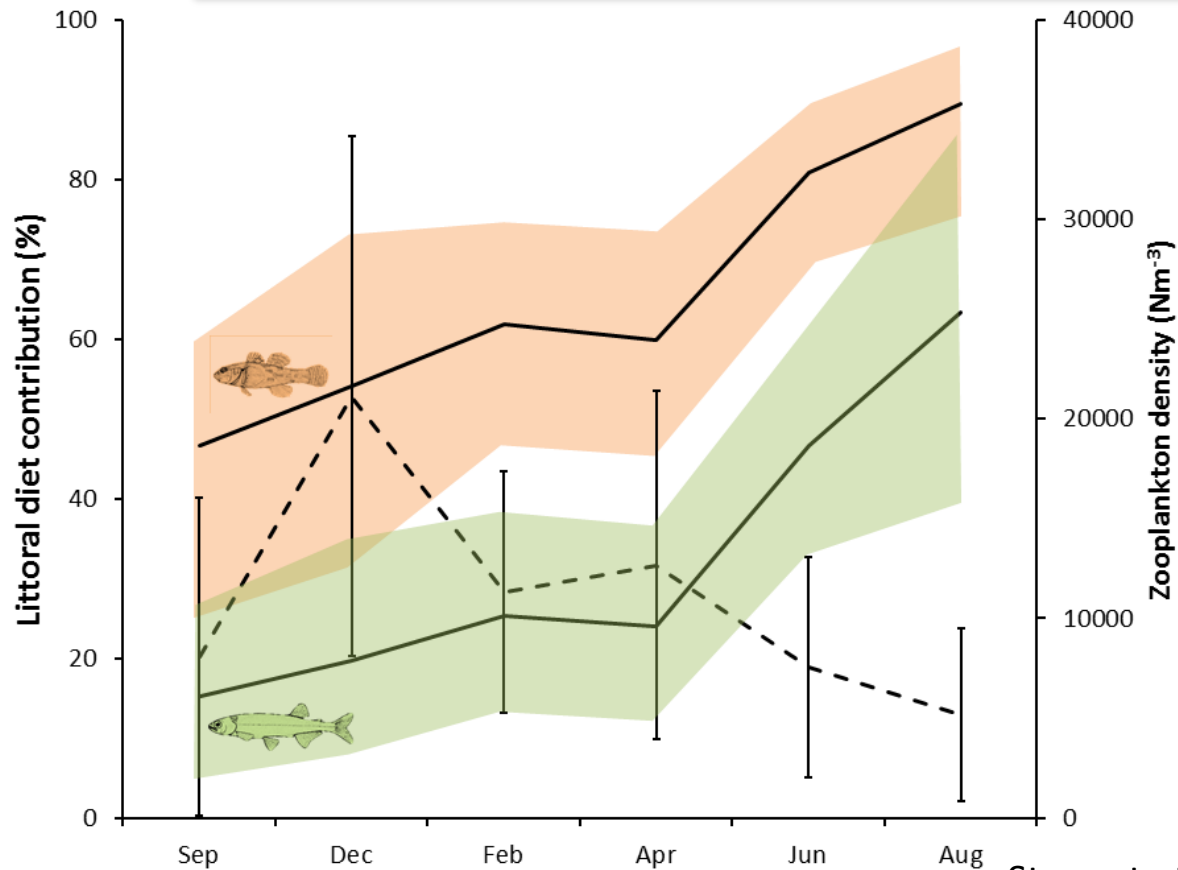
Stewart et al. 2017 *Freshwater Biology*

Fuelling the food web



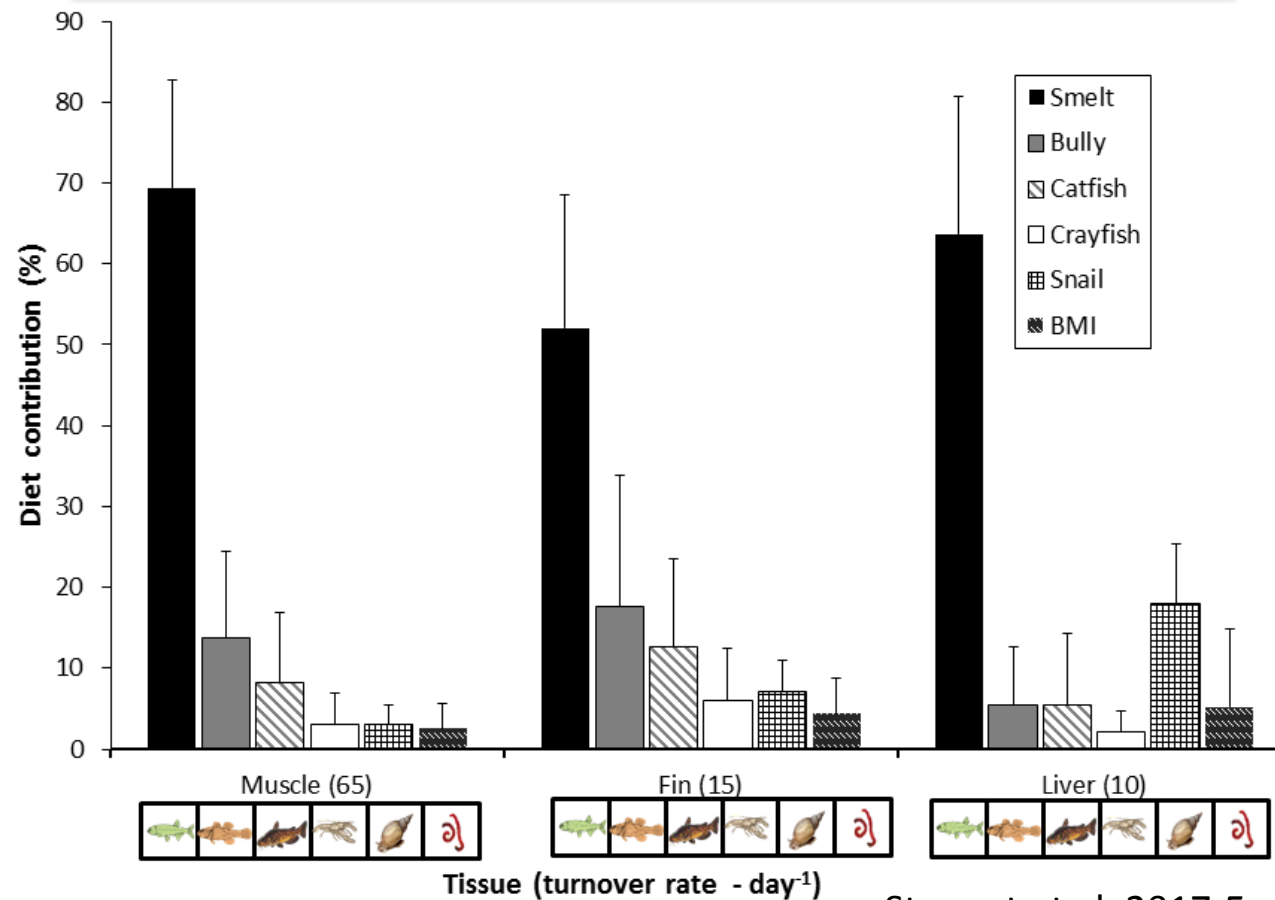
Stewart et al. 2017 *Freshwater Biology*

Considering food web dynamics



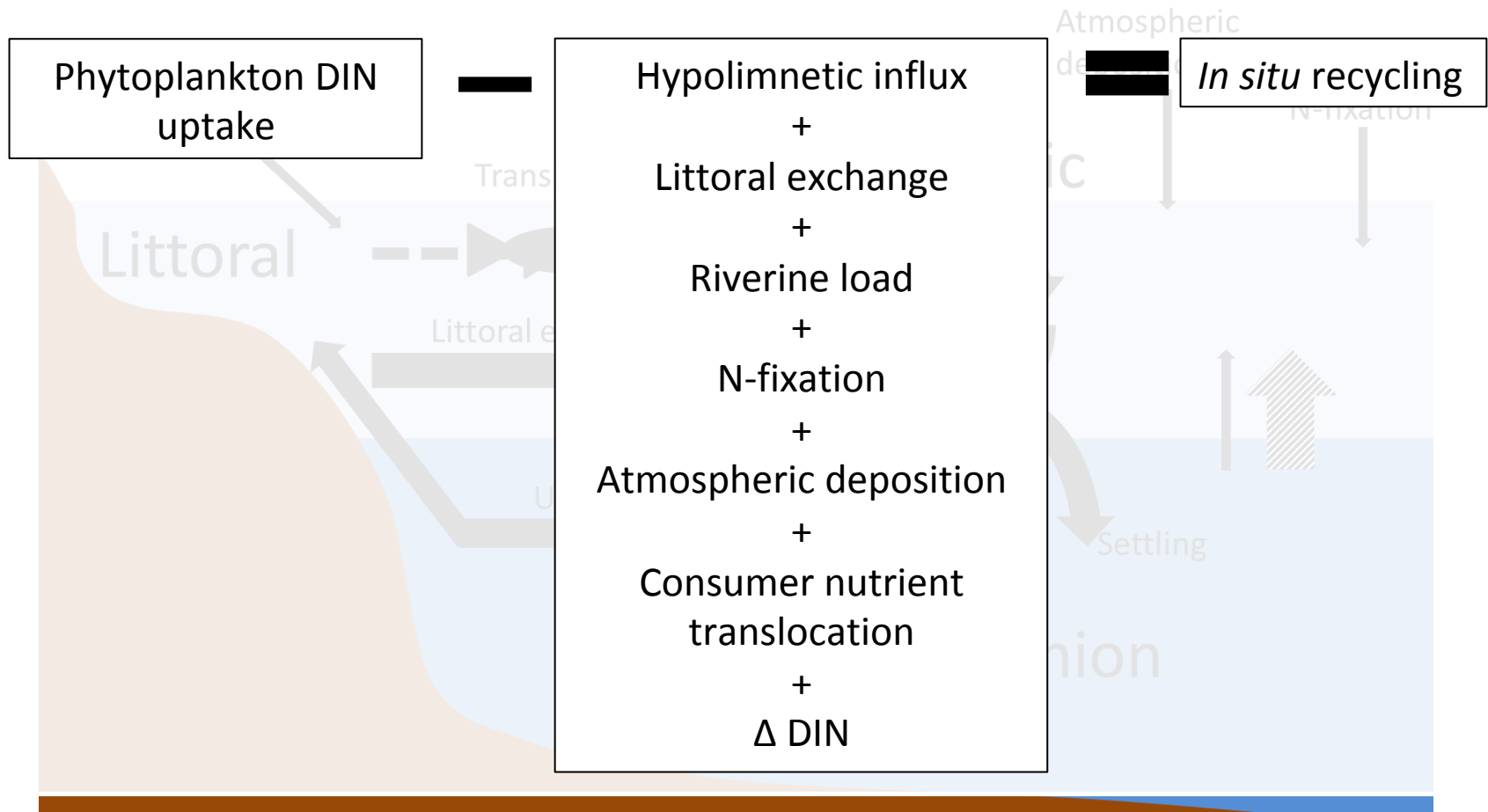
Stewart et al. 2017 *Freshwater Biology*

Changes in trout diet

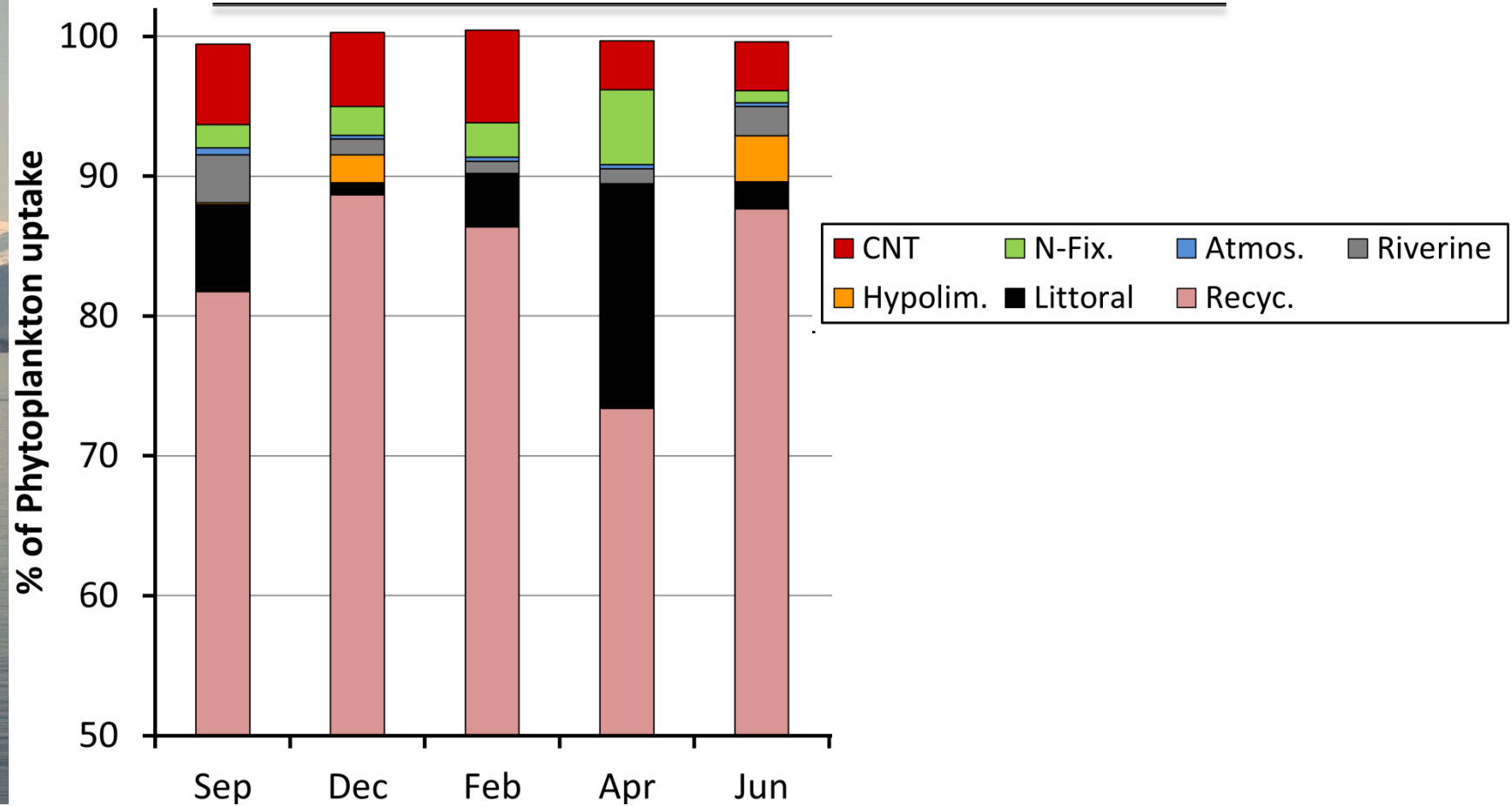


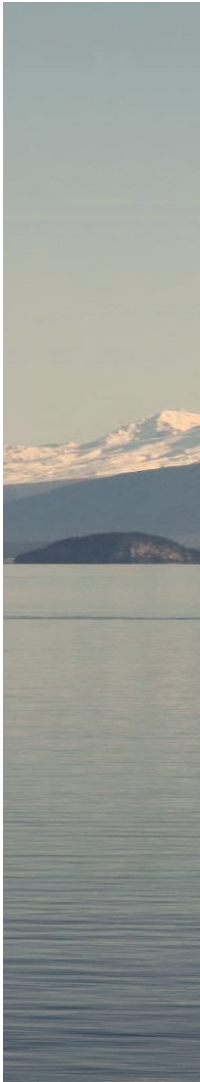
Stewart et al. 2017 *Freshwater Biology*

Evidence for CNR - mass-balance

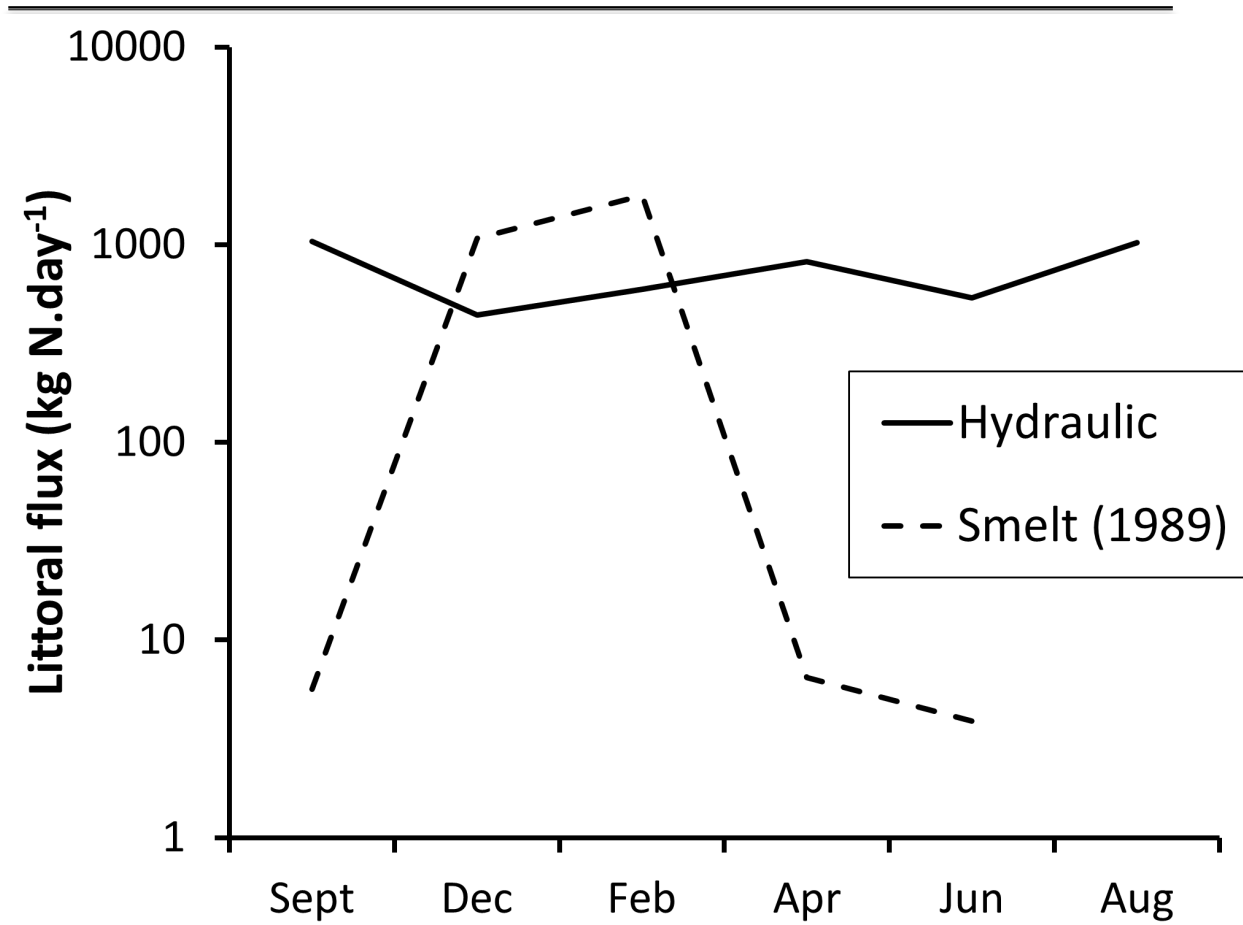


Evidence for CNR - mass-balance



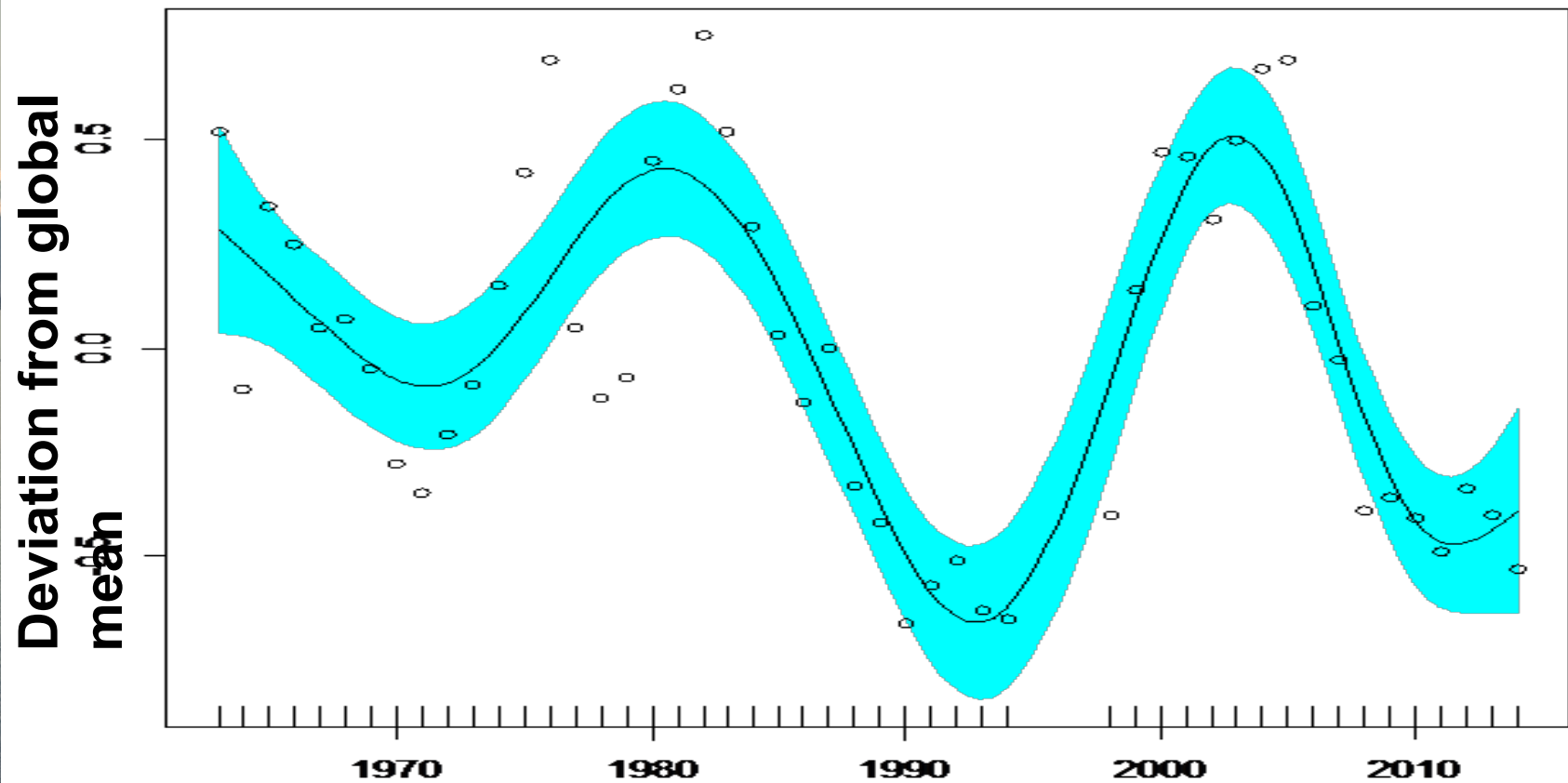


Evidence for CNR - mass-balance

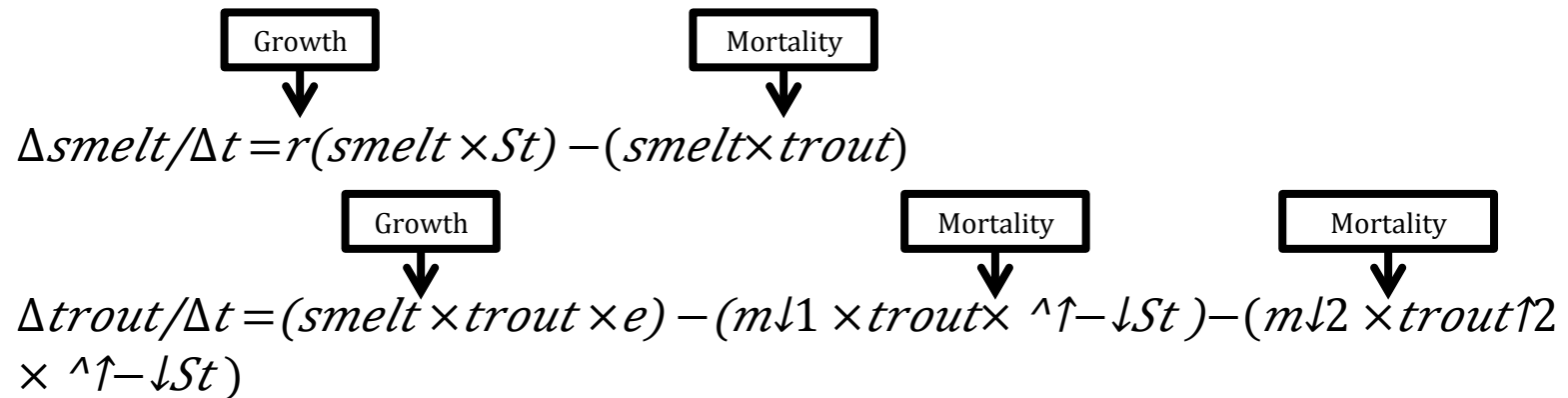


Long-term food web effects

Annual trout spawning in Lake Taupō

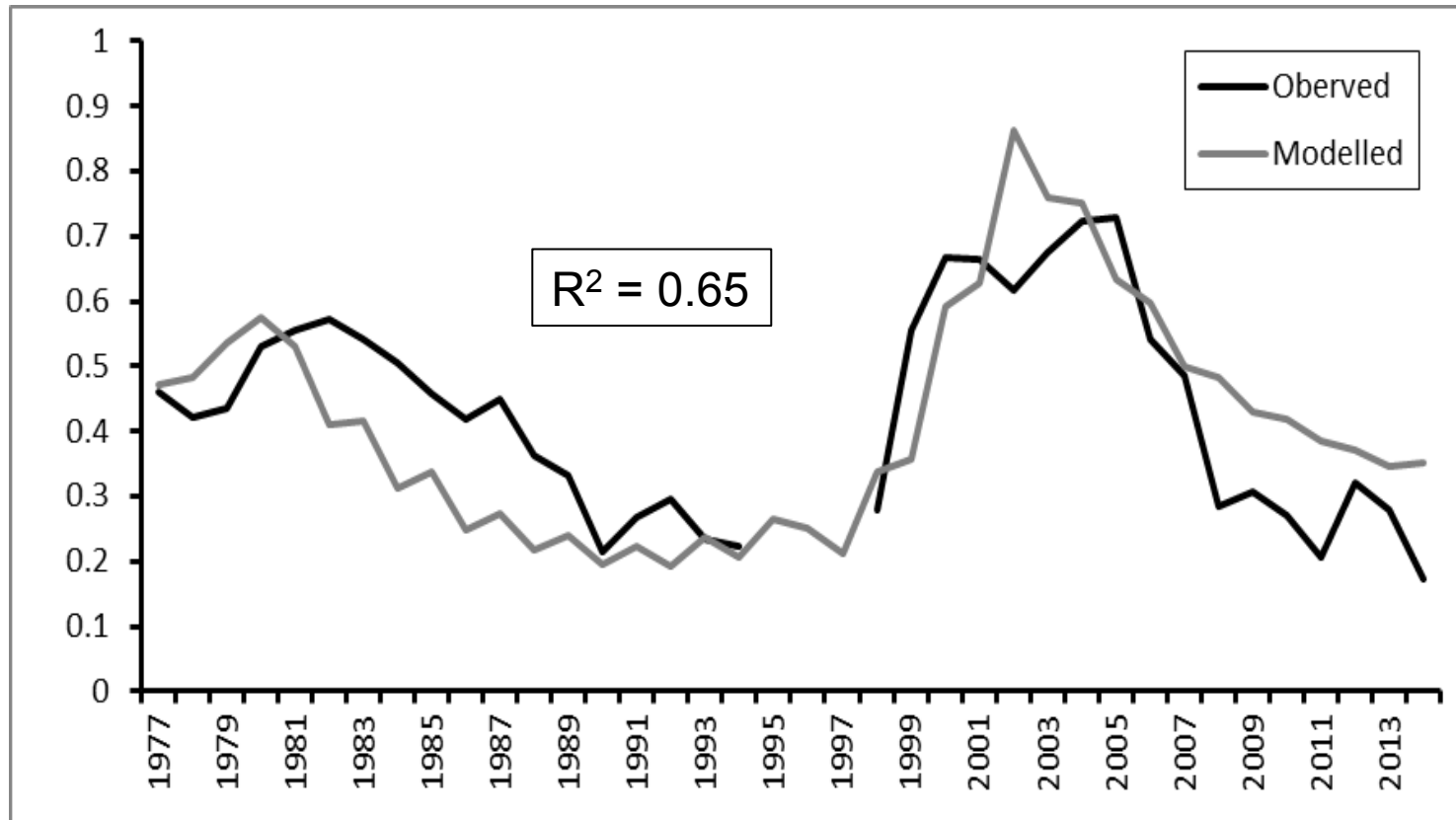


So... lets try using this information to model the trout population

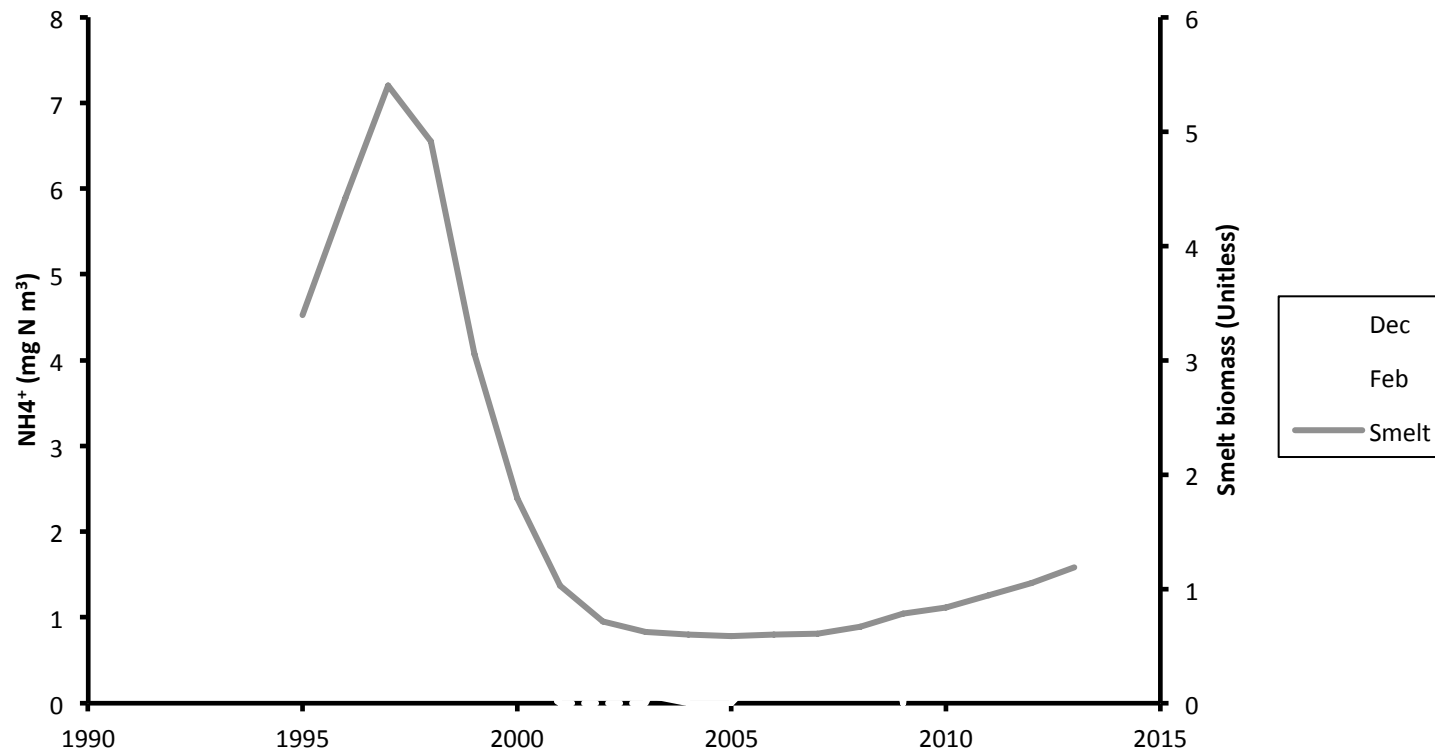


- r = growth of smelt
- m_1 & m_2 = trout mortality
- e = energy conversion efficiency
- St = index for the number of days mixed

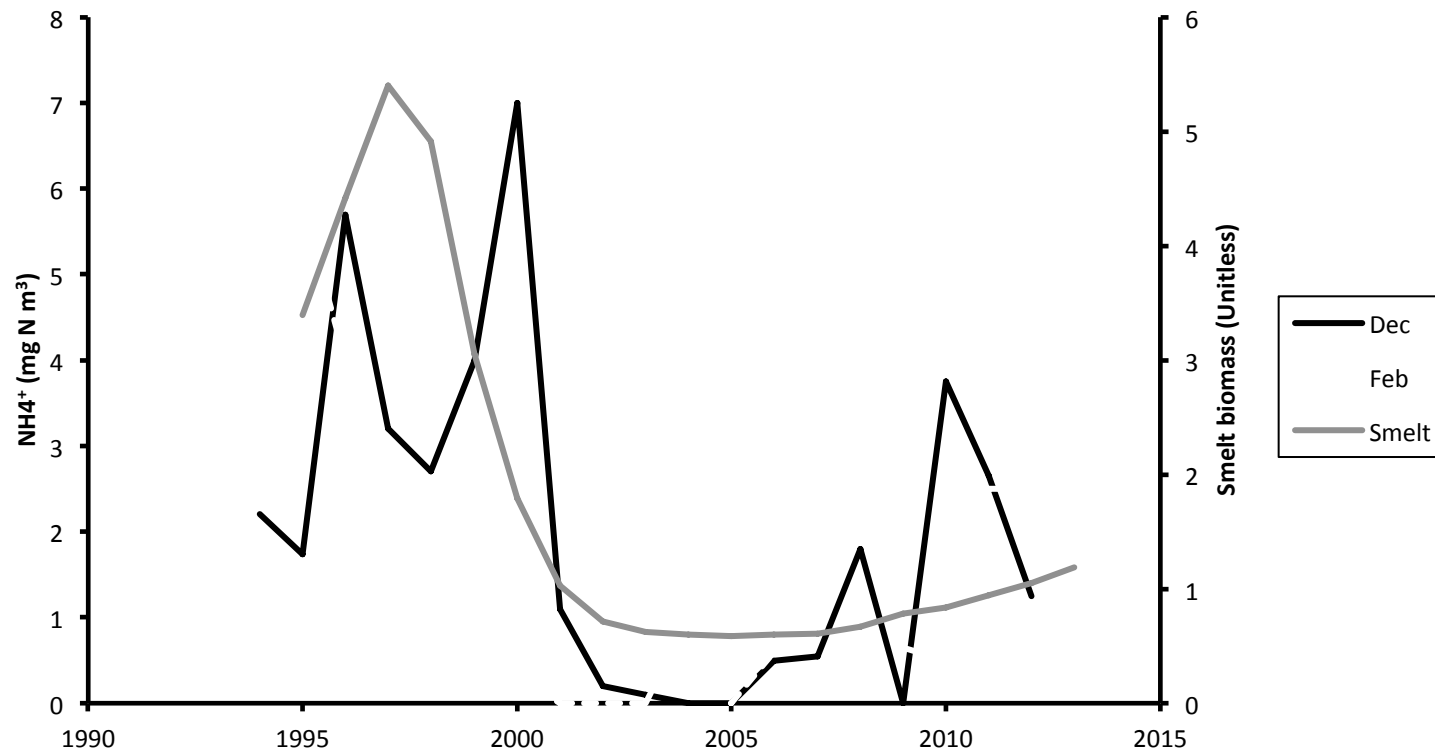
Trout biomass



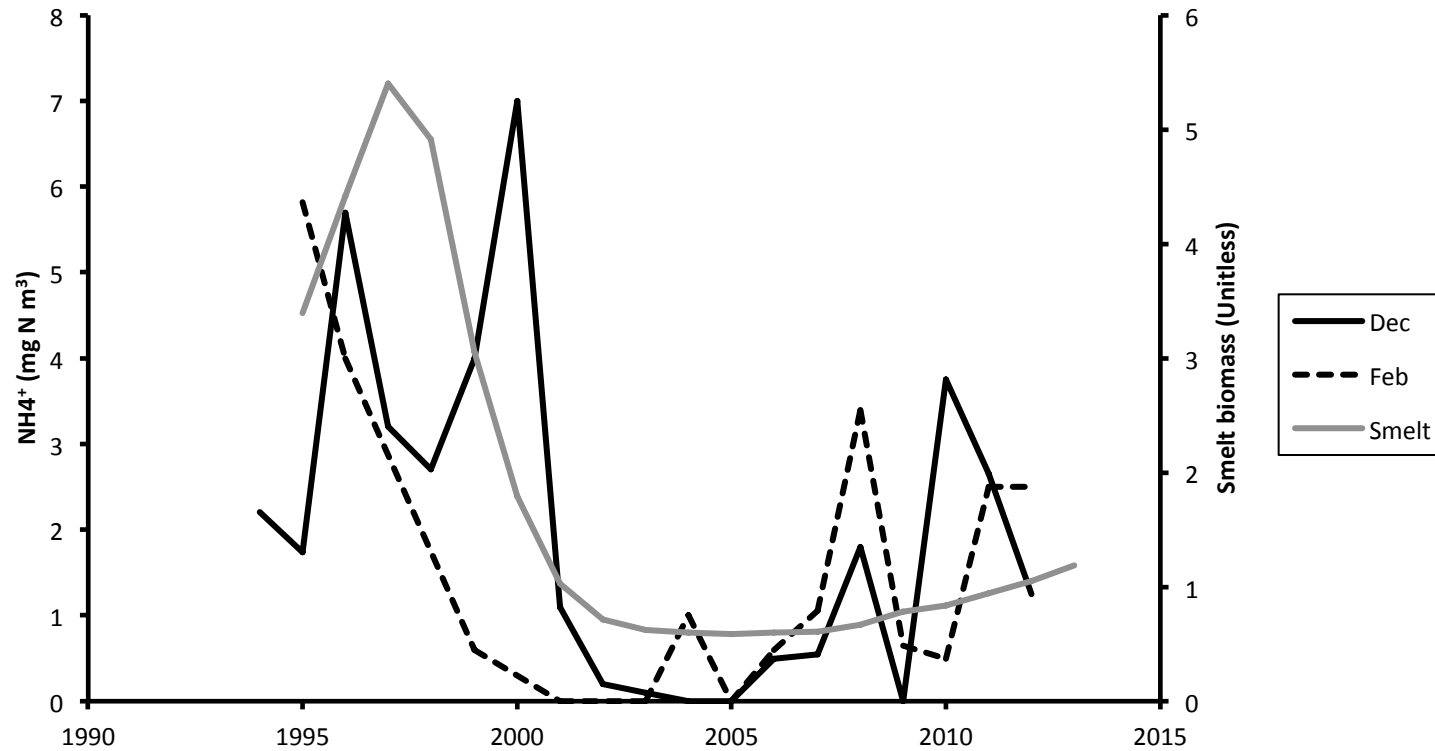
Smelt effect on N-cycling



Smelt effect on N-cycling



Smelt effect on N-cycling



Acknowledgements

Funding:

- Advocates for the Tongariro River is association with:
- Pharazyn Charitable Trust, Taupo District Council and the Department of Conservation
- MBIE “lakes resilience” programme.



- Andy Philips and the team at NIC: Stable isotope analysis
- Dudley Bell, Warrick Powrie, Dr Nick Bradford, John Crowley, Chester Boyes and Anna Sintenie: field assistance
- Ron Ram (UoW): Nutrient analyses
- Chester Boyes and Warrick Powrie: Photographs

Questions



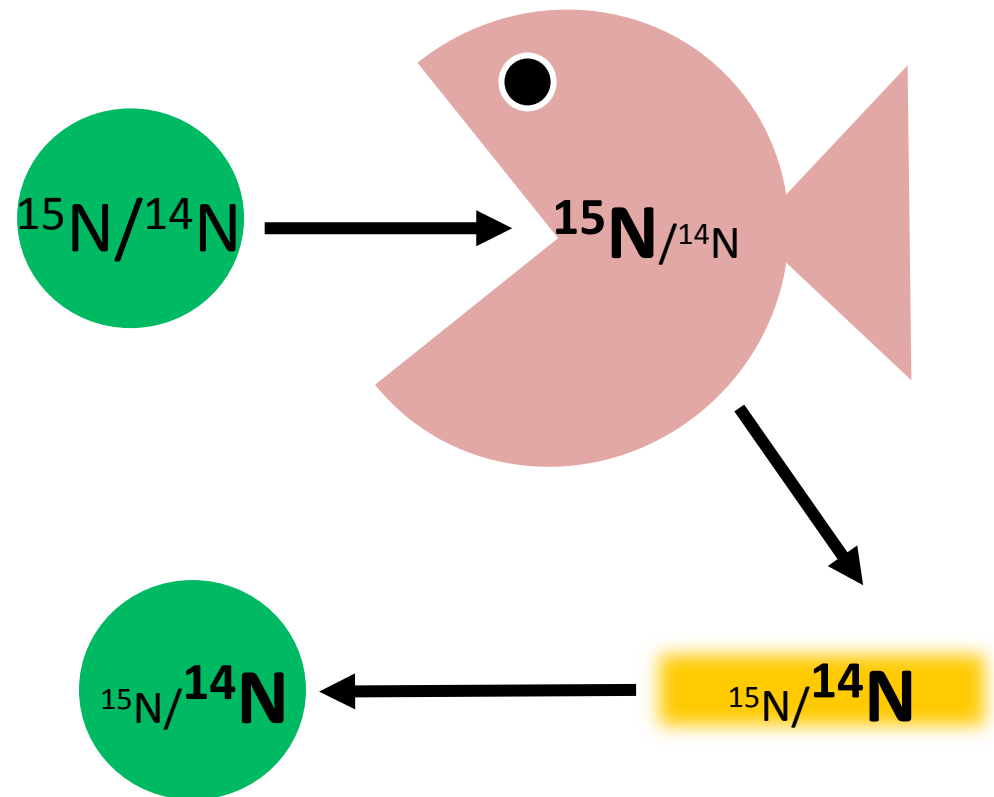
@SimonDStewart_N

Photo credit: Chester R. Boyes

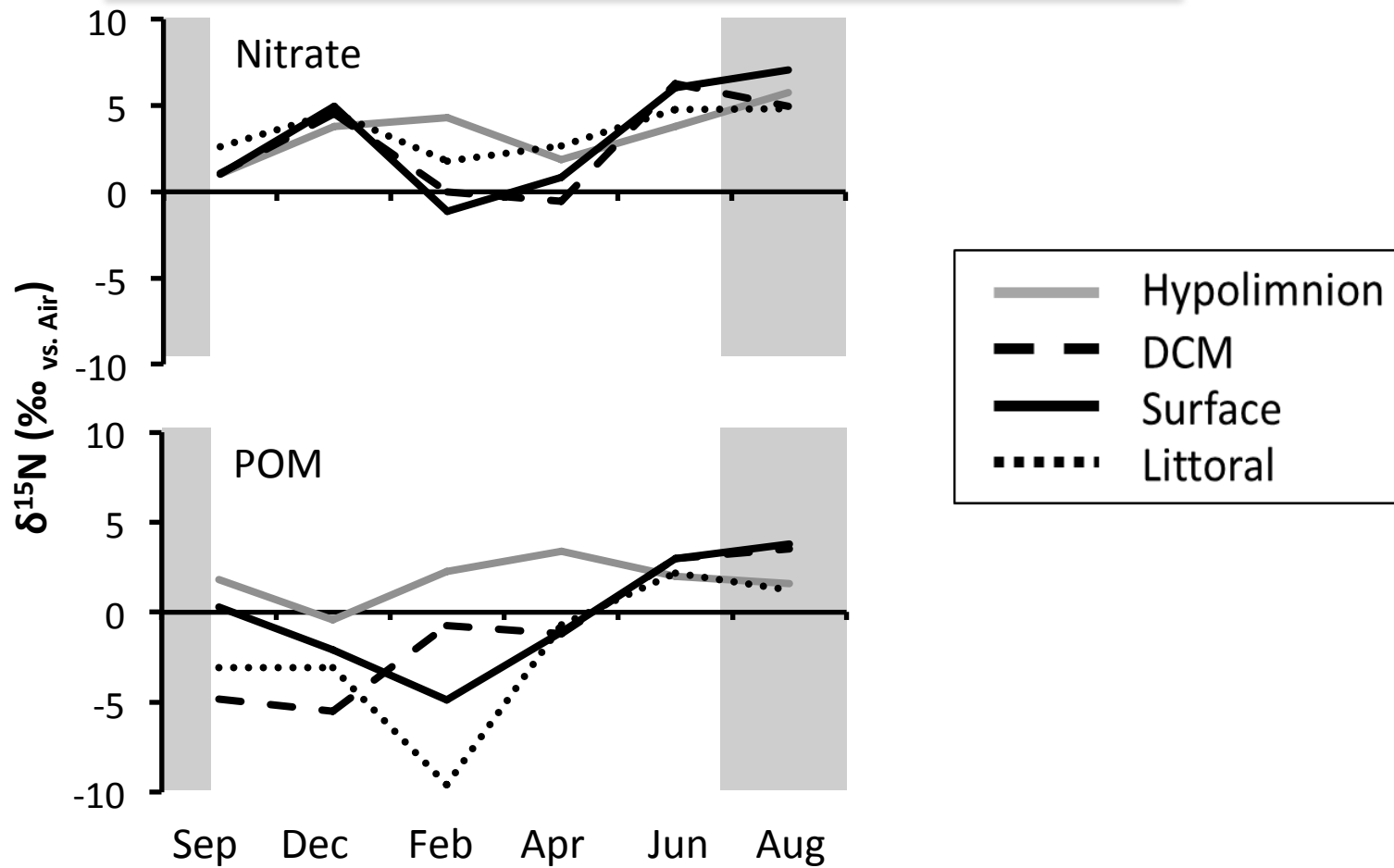


Evidence for CNR – stable isotopes

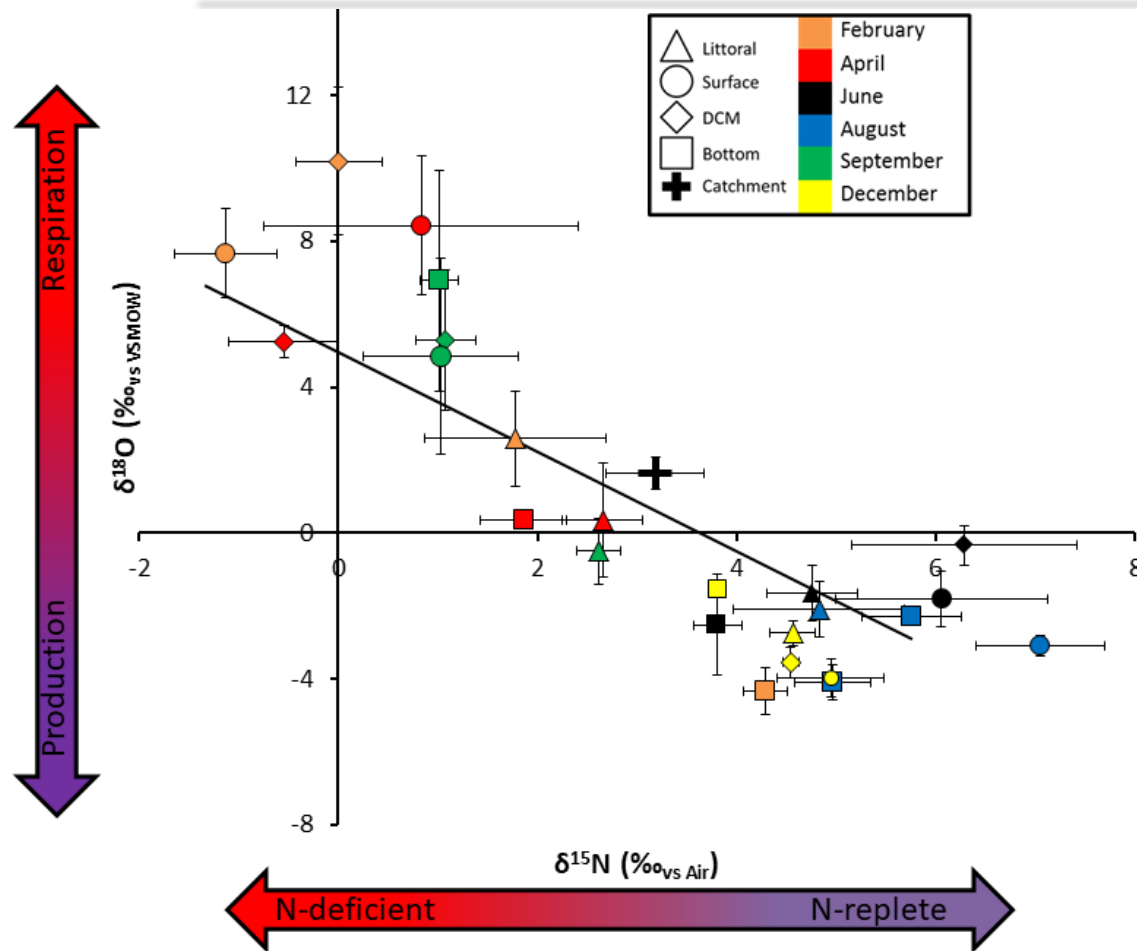
$\delta^{15}\text{N}$ – “You are what you eat, plus 3‰”



Evidence for CNR – stable isotopes



Evidence for CNR – stable isotopes





Summary

- CNR is a significant influx of N to support primary production in Lake Taupō:
 - Strong correlations show the contribution of CNR to the DIN pool
 - Evidence of CNR contributions were strongest during summer stratification – when nutrient availability was low and the lake was net-heterotrophic
- These findings present a case for considering food web dynamics when management is aimed towards specific nutrient concentration targets