

1



2



3



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# Determining the spatial variability of nitrate removal in a woodchip bioreactor through high frequency monitoring at multiple locations

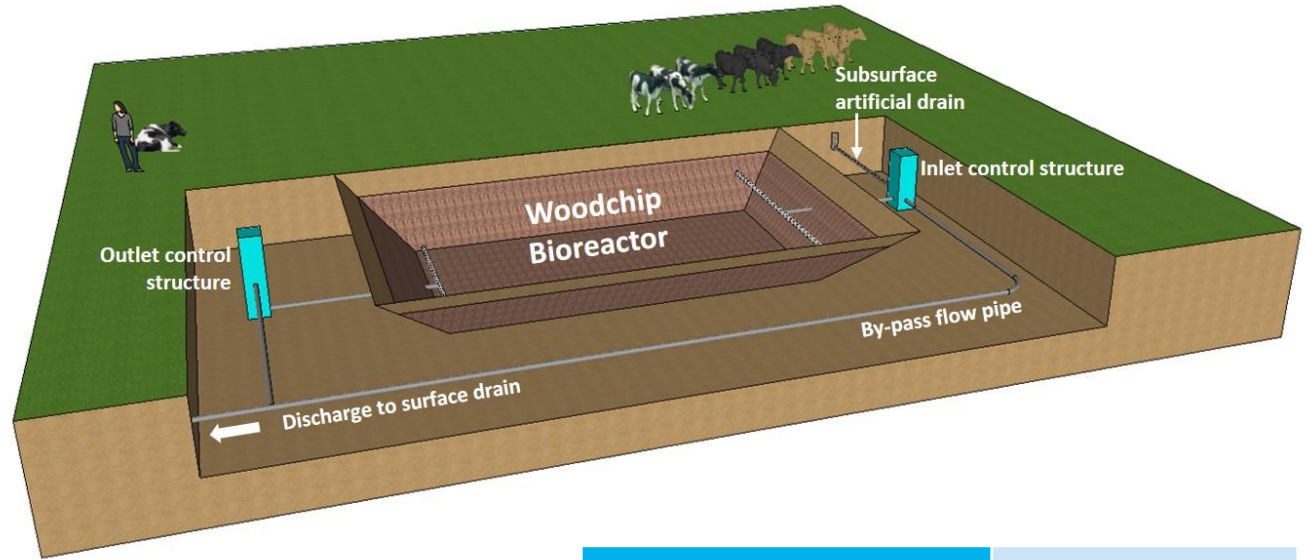
A Rivas<sup>1</sup>, G Barkle<sup>2</sup>, B Maxwell<sup>3</sup>, B Moorhead<sup>1</sup>, R Stenger<sup>1</sup>, L Schipper<sup>4</sup>, F Birgand<sup>3</sup>, J Clague<sup>1</sup>

# Study site



Tatuanui, Waikato region  
North Island, NZ

# The Tatuanui bioreactor



Effective volume	approx. 60 m <sup>3</sup>
Woodchip material	Untreated Pine
Drainage area	0.65 ha

# Bioreactor construction



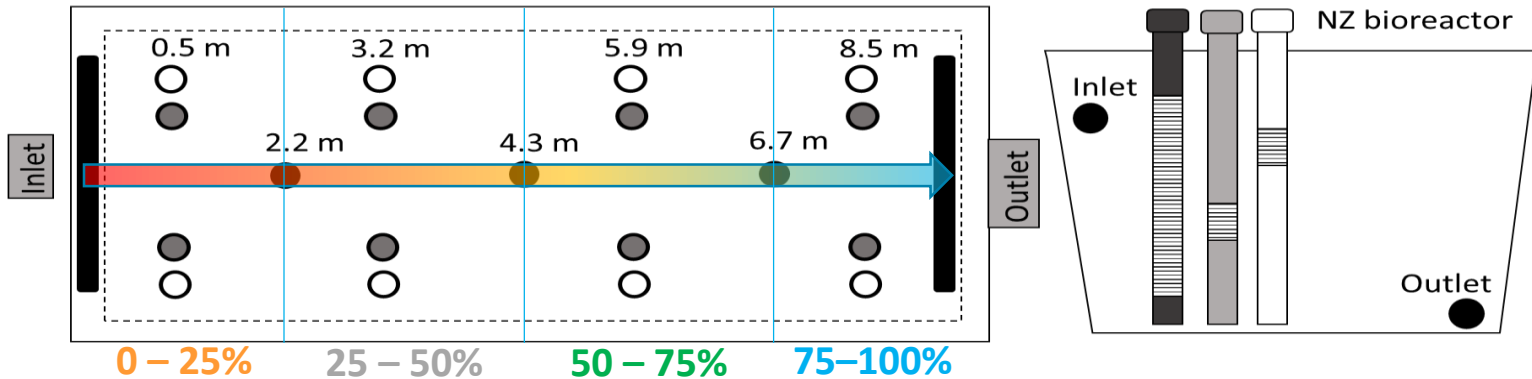
# The Tatuaniu bioreactor

Instrument control panels,  
solar panel and rain gauge

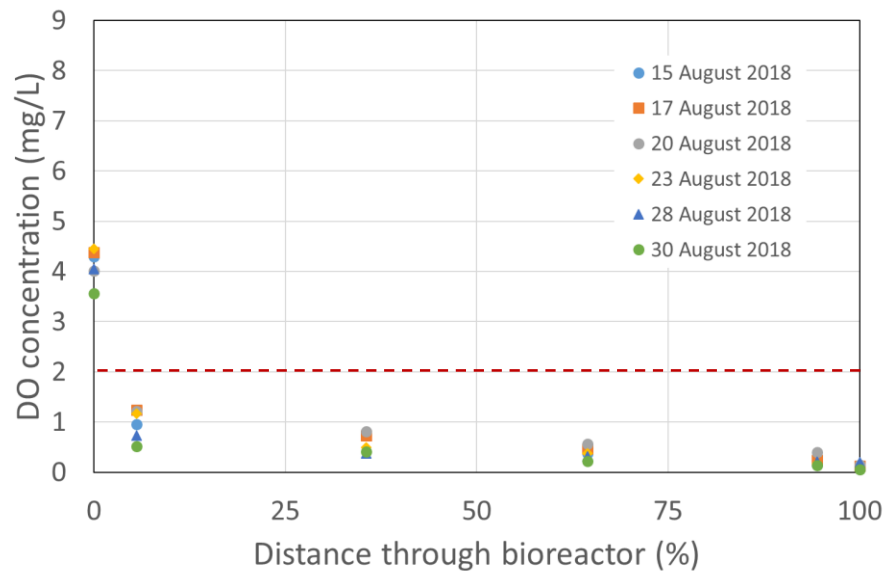
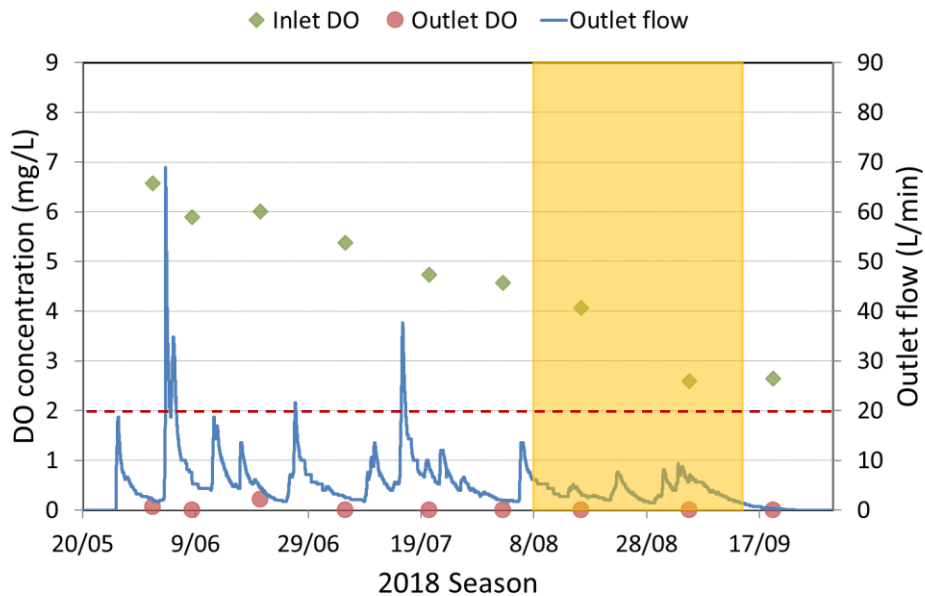
**OUTLET** control box, stilling  
well, and auto sampler



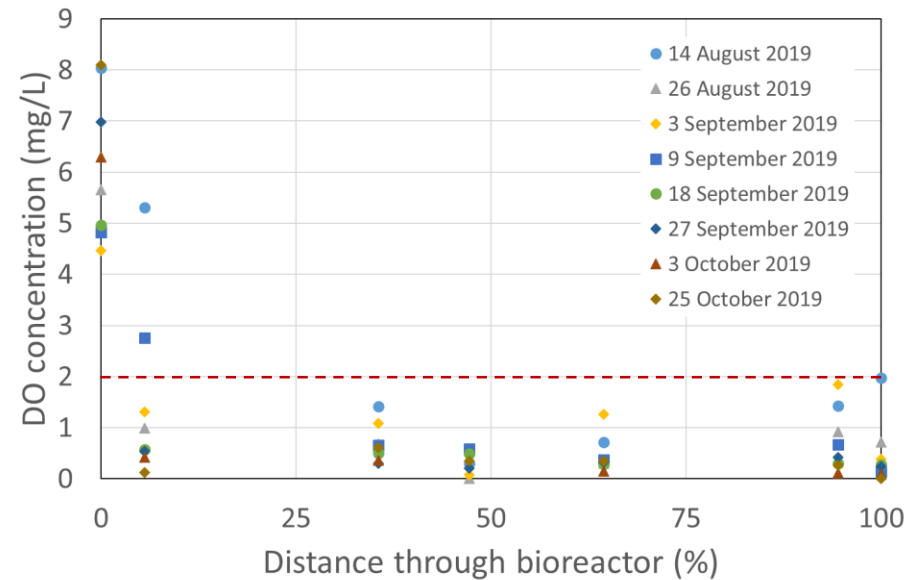
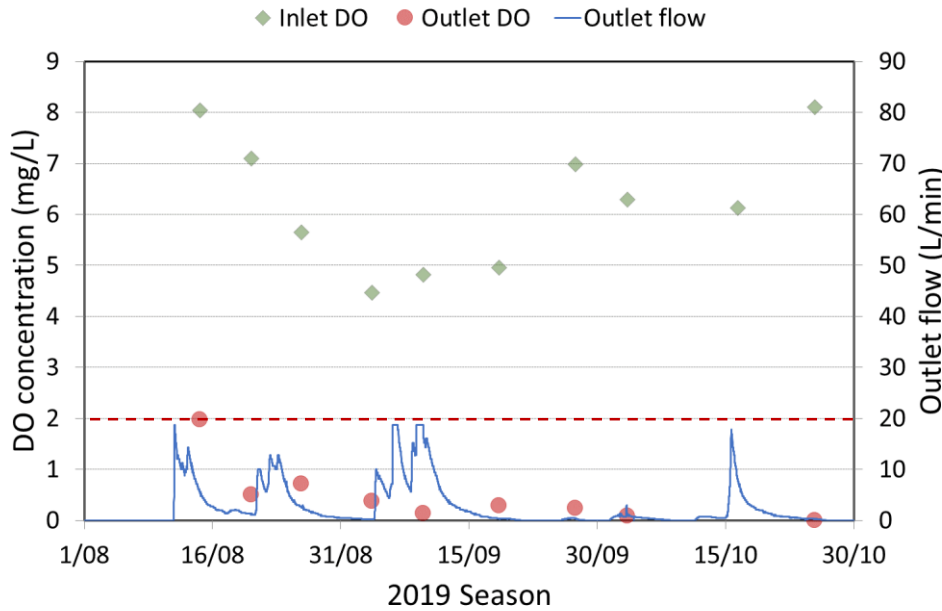
**INLET** control box,  
stilling well, and  
auto sampler



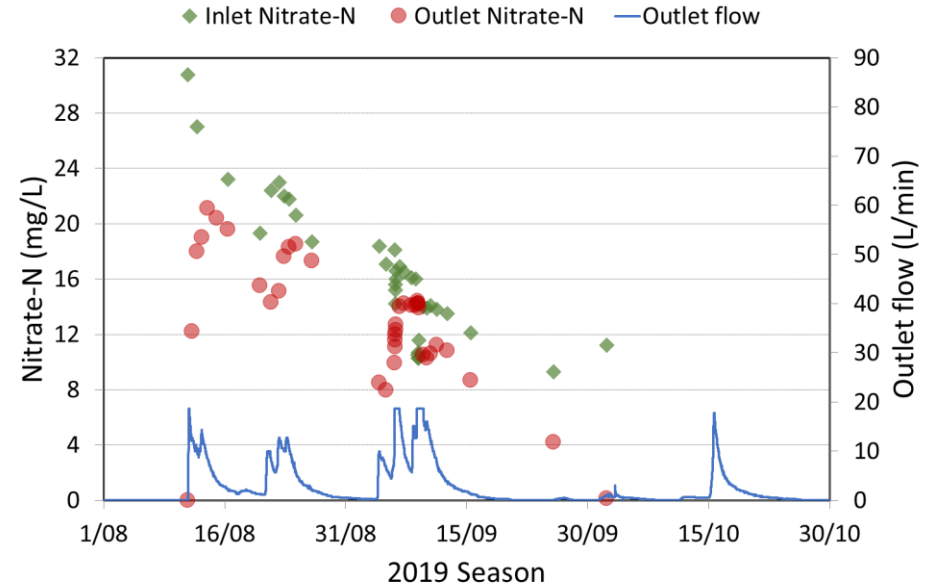
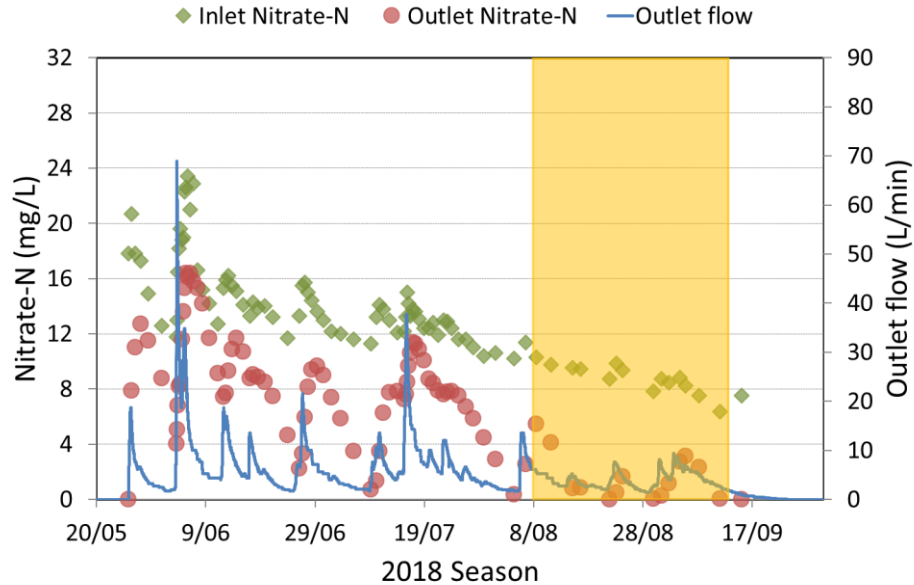
# DO concentrations



# DO concentrations

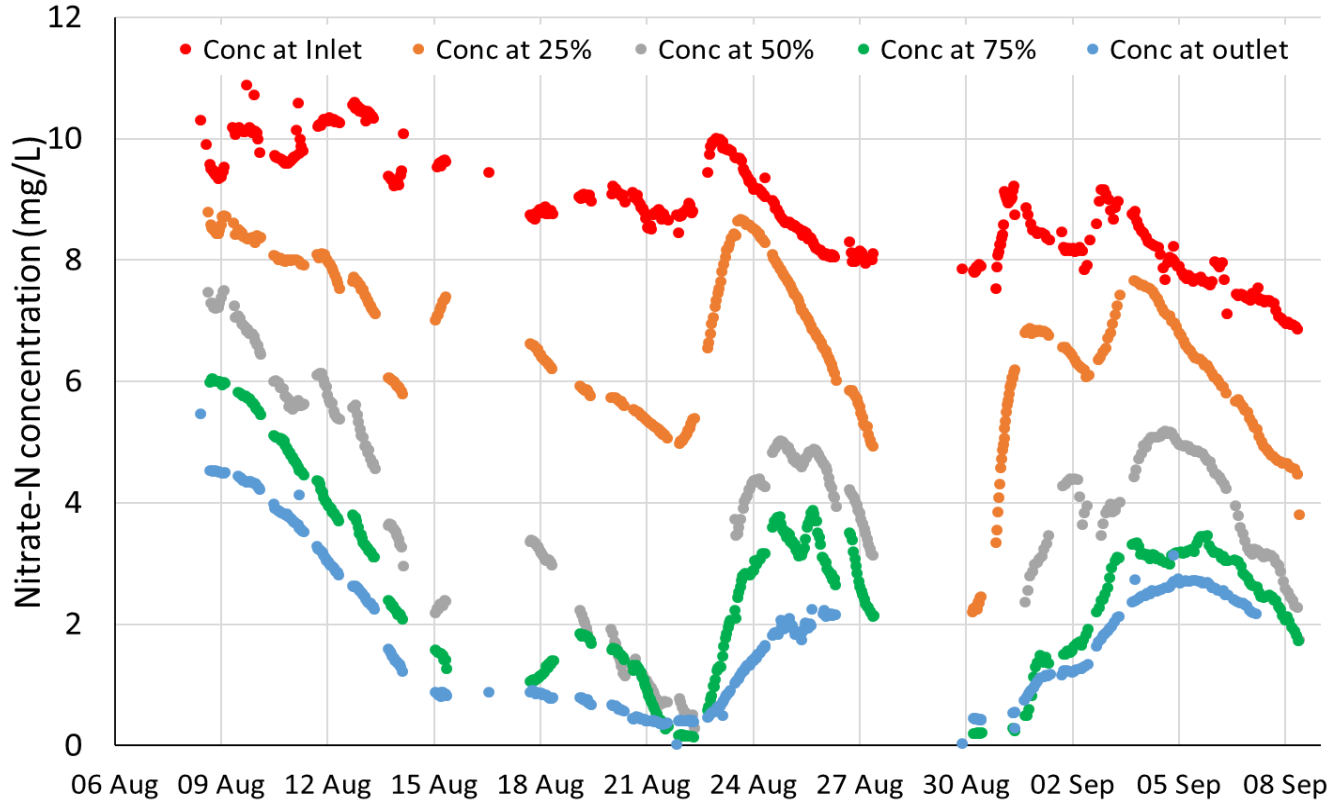


# Nitrate concentrations



2018

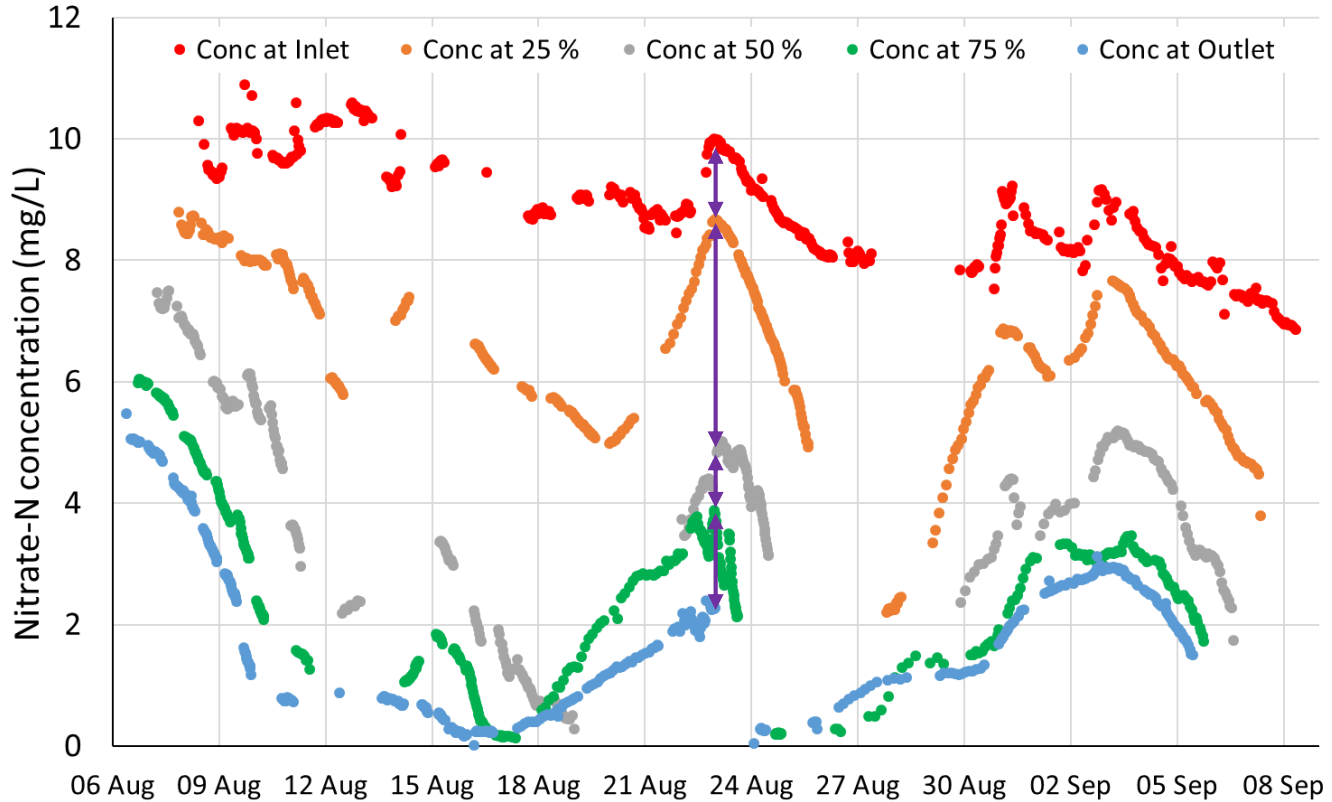
# Nitrate concentration at each location





2018

# Nitrate concentration corrected to the Inlet time



## Measures of nitrate removal

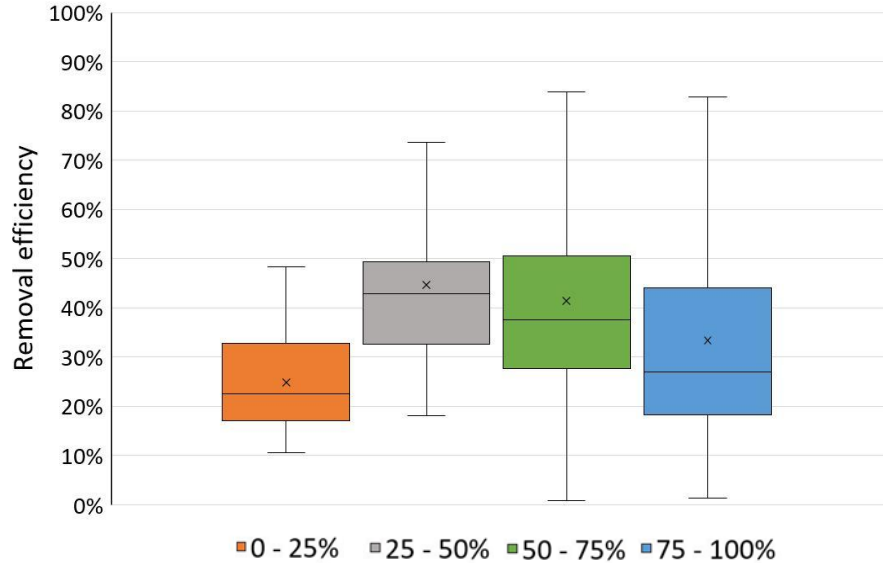
$$\text{Removal Efficiency (\%)} = \frac{\text{Nitrate removed}}{\text{Inflow nitrate load}} \times 100$$

Nitrate removed = Inflow nitrate load – Outflow nitrate load

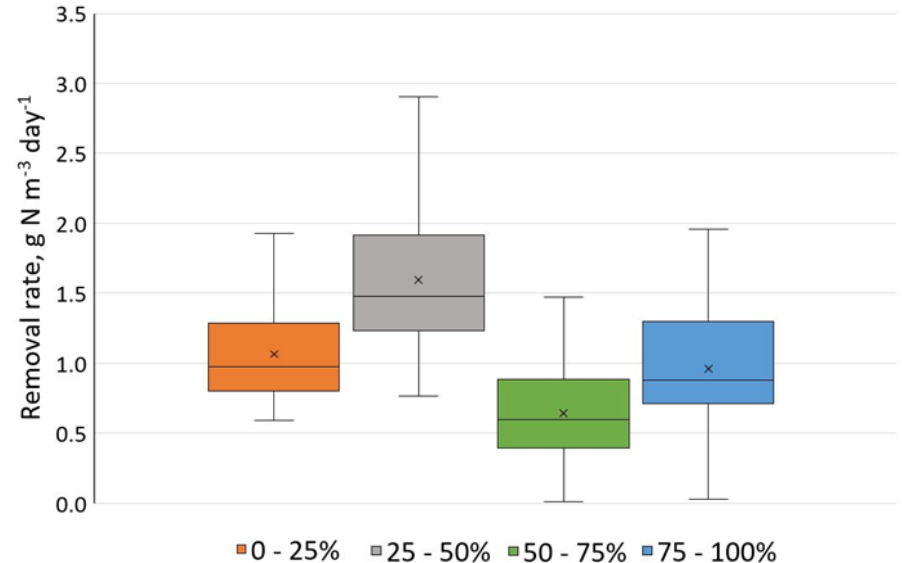
$$\text{Removal rate (g N m}^{-3}\text{day}^{-1}\text{)} = \frac{\text{Nitrate removed}}{(\text{bioreactor volume}) \times (\text{time})}$$

2018

# Nitrate removal – 2018 Season



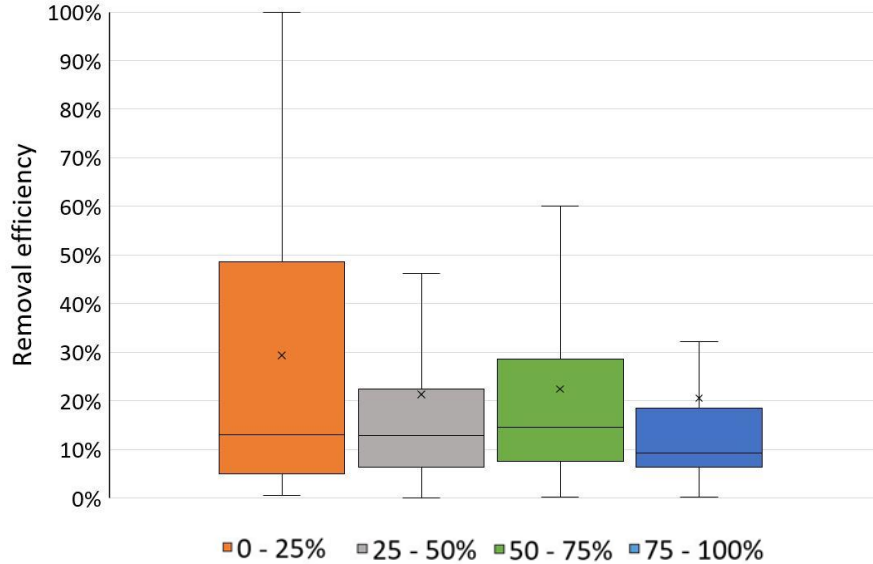
Removal efficiency



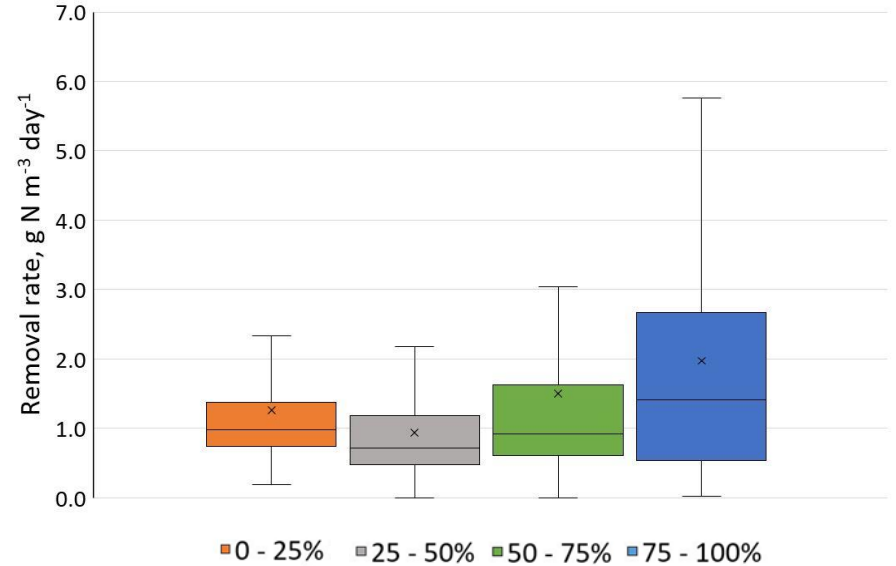
Removal rate

2019

# Nitrate removal – 2019 Season



Removal efficiency



Removal rate

## Preliminary conclusions

- With low inflow nitrate concentrations, nitrate removal becomes limited in the second half of the bioreactor
- At non N-limiting conditions, all quarters seem to perform reasonably similar

**Thank you for your attention!**

This research forms part of the MBIE-funded and **ESR**-led research programme  
**‘Enhanced Mitigation of Nitrate in Groundwater’**

as well as the MBIE-funded and **NIWA**-led research programme  
**‘New Technologies to Double the Effectiveness of On-farm Diffuse Pollution  
Mitigation’**



**MEASURE. MODEL. MANAGE.**