STRESSED: USING METAGENOMICS TO IDENTIFY STRESSORS IMPACTING LAKES

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FunEA

OUR LAKES OUR FUTURE
Te Mana o Te Wai, Te Mauri o Te Wai

Lakes380
Our lakes' health past, present, future
www.lakes380.com

THE STATE OF LAKES

Lakes under unprecedented pressure

Limited information (~5% monitored)

Monitoring - mostly trophic lake index

Time consuming /resource-intensive

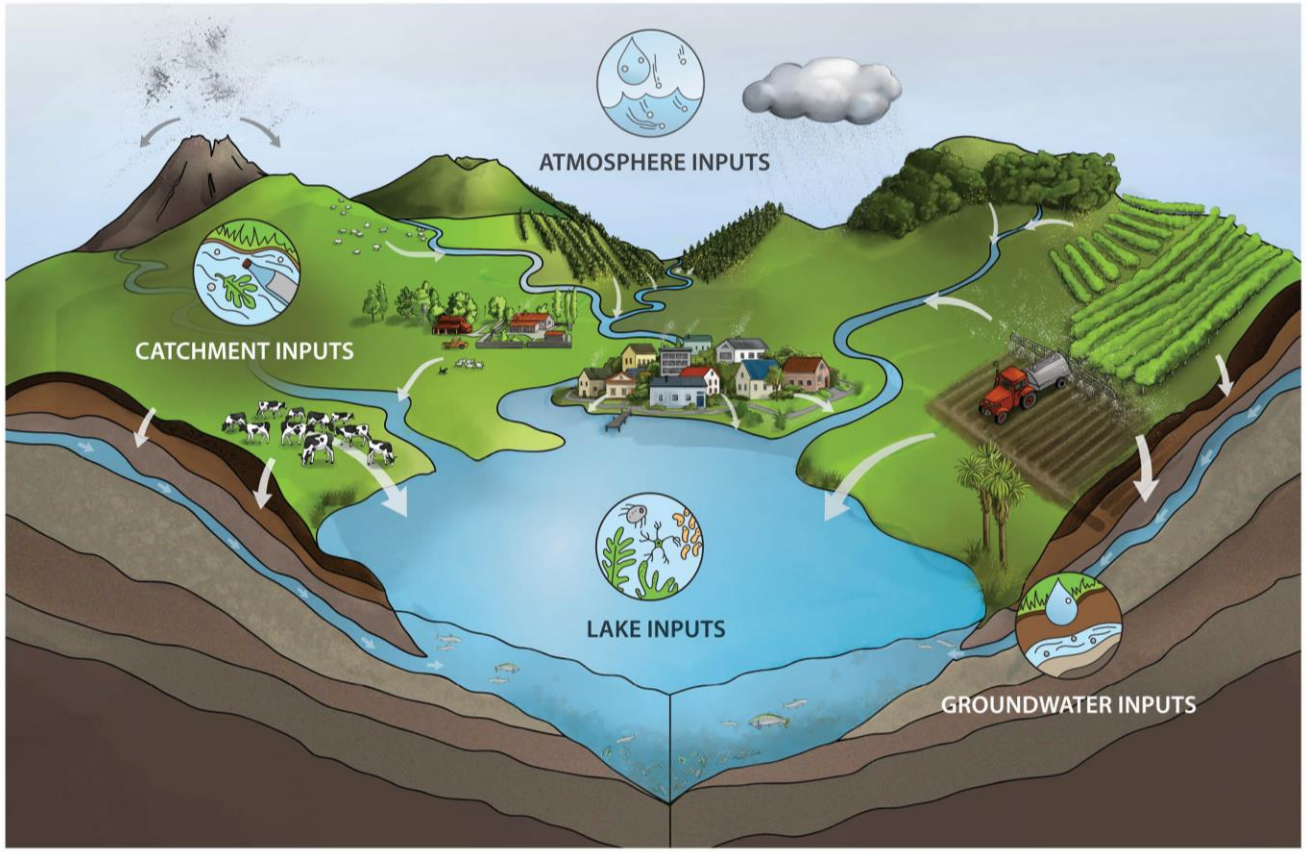
Can molecular methods provide complementary/ alternative information?

DEVELOPMENT OF A MOLECULAR INDEX FOR MONITORING LAKE TROPHIC STATE

Sediments - archives within lake processes and catchment inputs

Bacteria - vital biogeochemical cycling

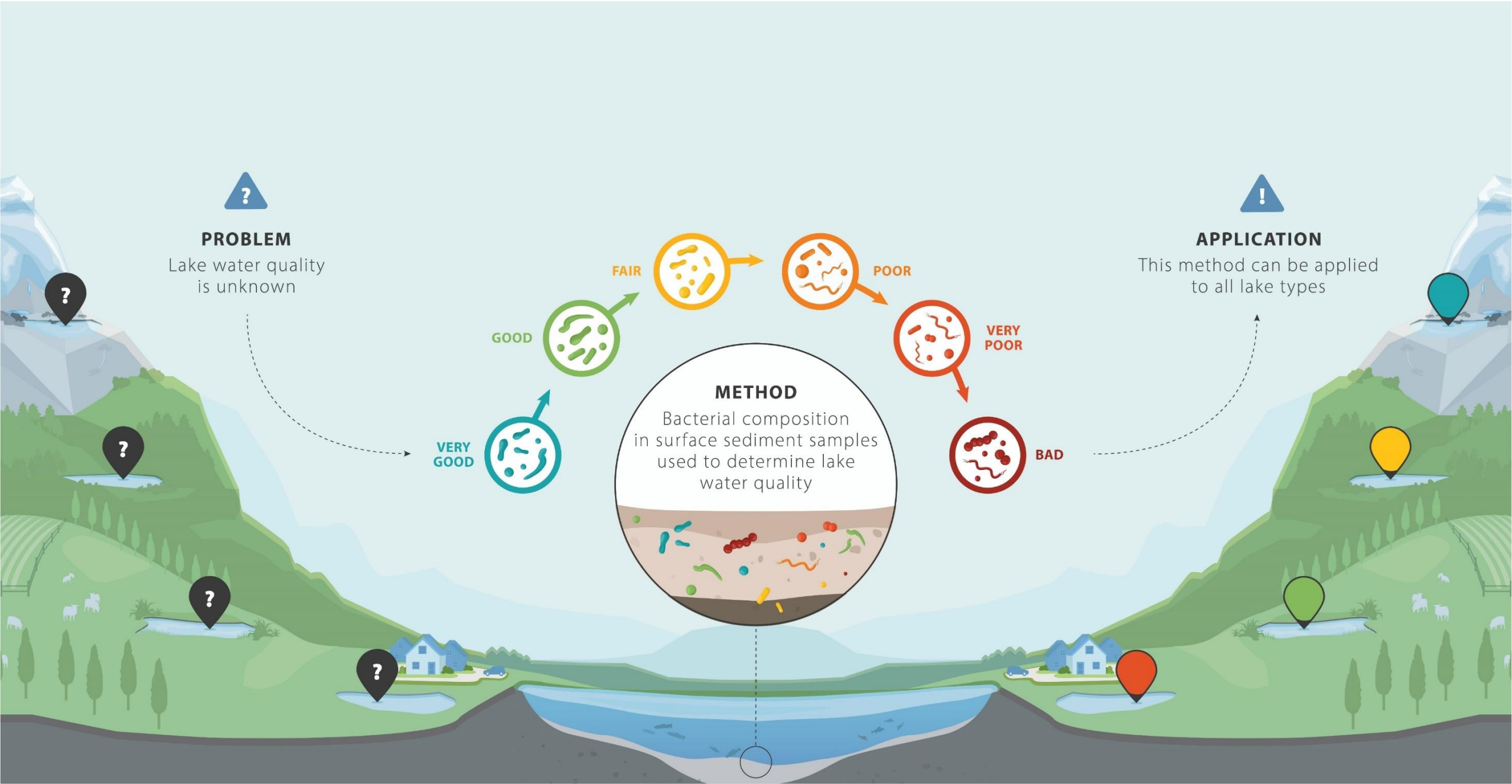
Bacteria - respond rapidly to environmental changes

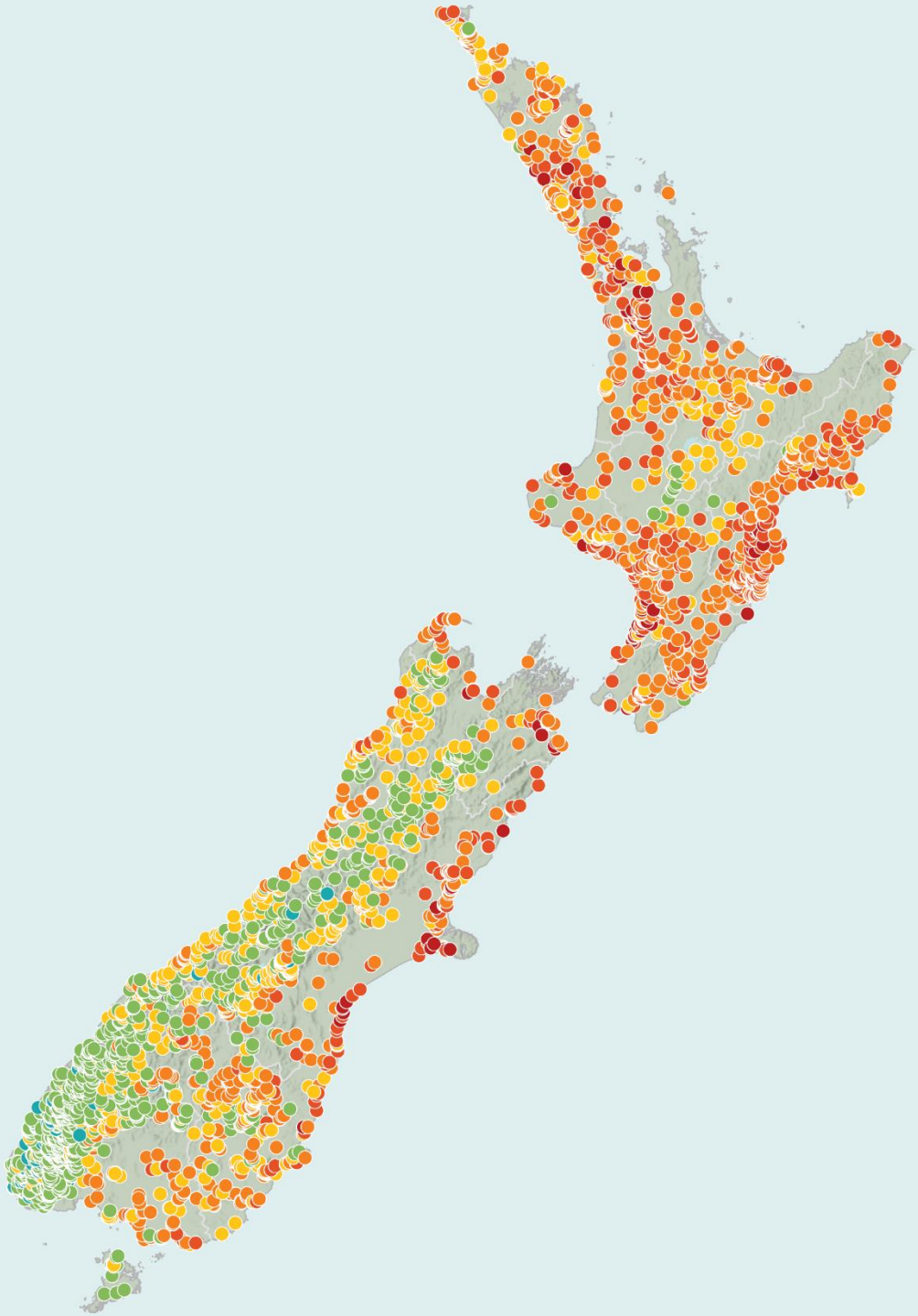


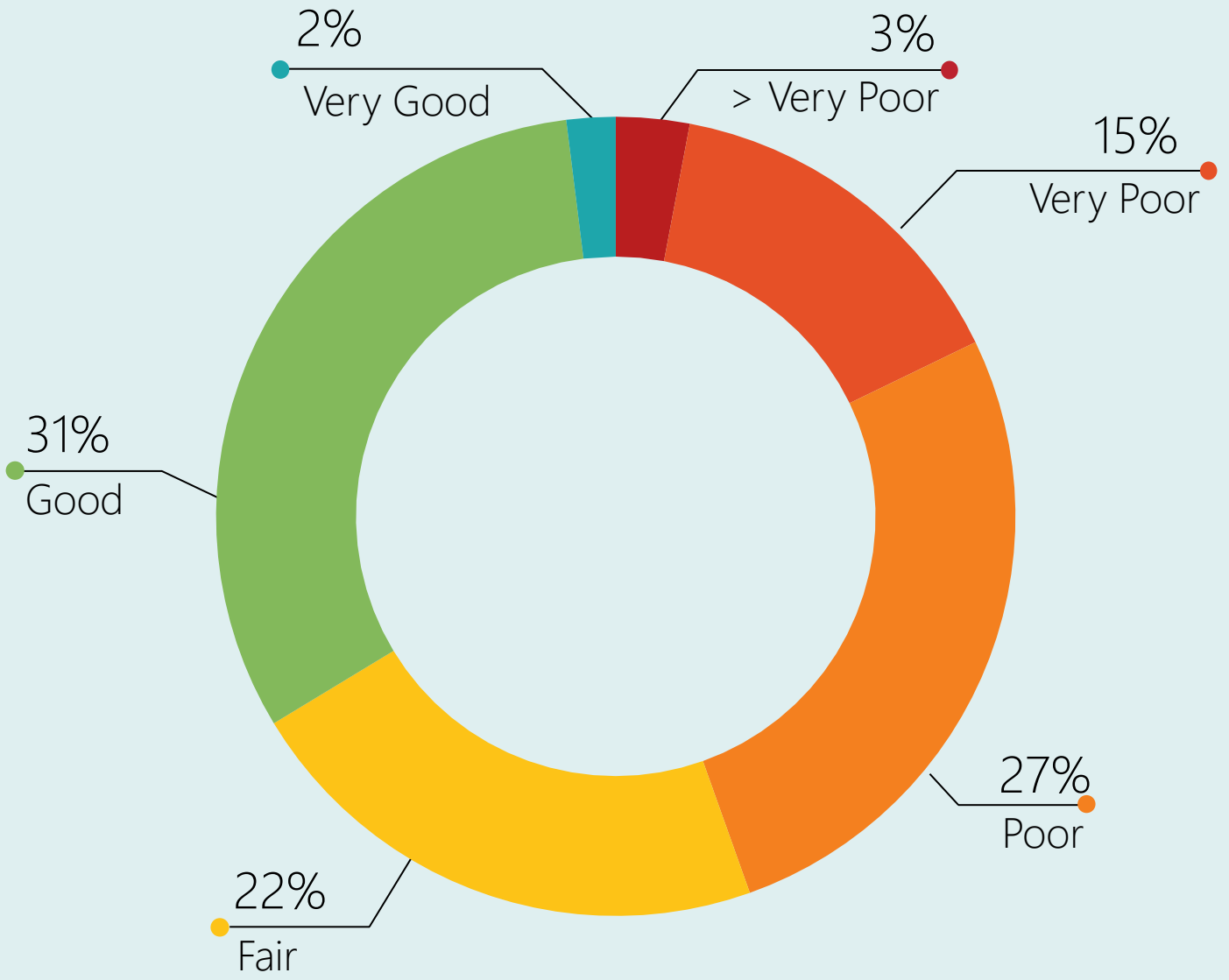
Source www.lakes380.com

Sediment Bacteria Trophic Index

Pearman et al., STOTEN, 2022







Wood et al., Inland Waters, 2023

BEYOND TROPHIC STATE

Eutrophication not the only stressor impacting lakes

Other factors:

Acidification - Introduced species - Heavy metals

Salinity – Sewage - Combustion products

Limited information on alternative factors

Can metagenomics identify which stressors are impacting a lake?

Functional evidence approach to prioritise lake restoration

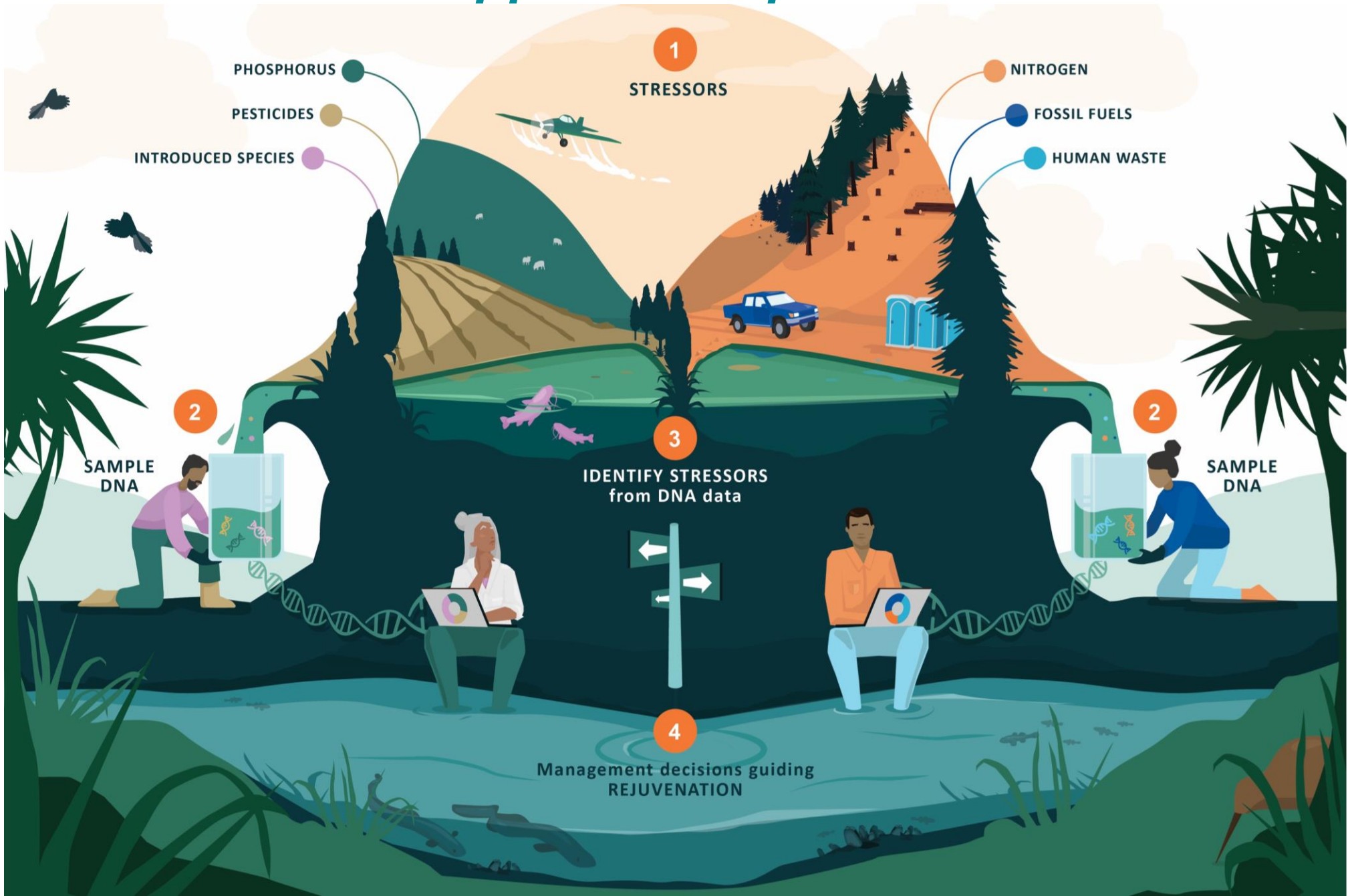
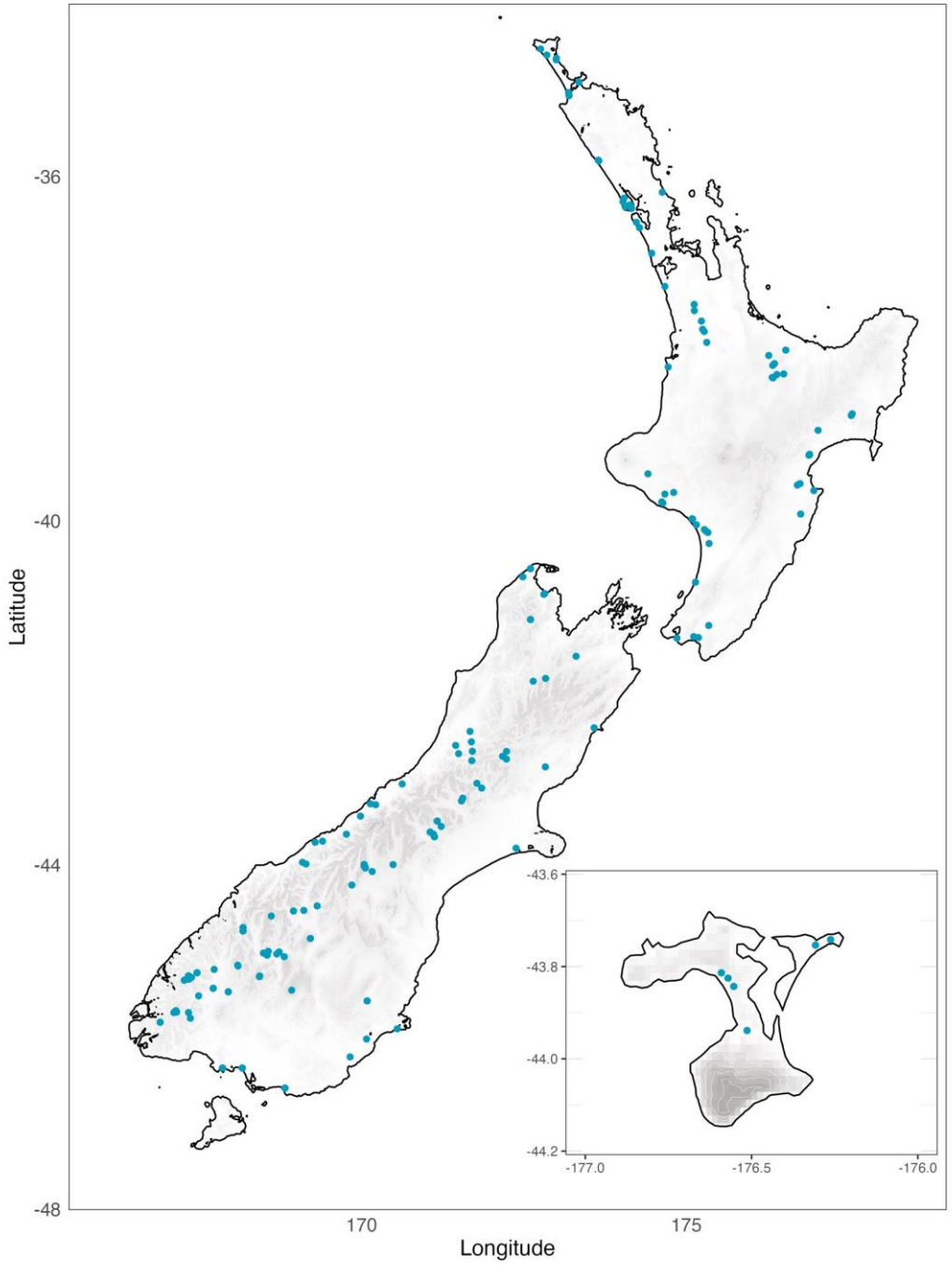


Image by Jacqui Stuart



LAKE GENE CATALOGUE

>150 lakes spread across Aotearoa NZ

> 220 samples surface sediment sequenced and assembled

>150 million non-redundant predicted open reading frames (ORFS)

>60 million ORFS annotated with a KEGG ID.

NATIONAL SCALE PATTERNS

Correlation between the taxonomic and functional changes in the community.

Trophic state affects the functional potential of lake sediment communities

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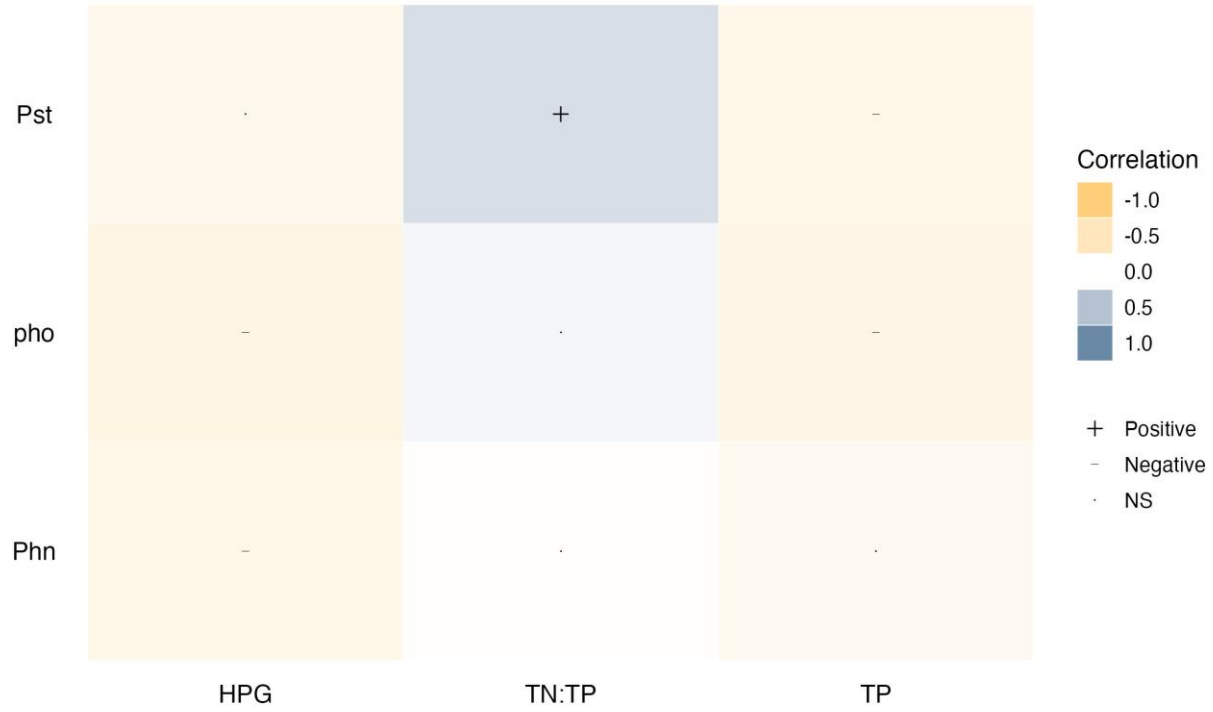
PHOSPHORUS

Vital for cell growth and can be limiting factor for growth

The use of phosphate in fertilizer has impacts on lake health



Phospate transporters (Pst + pho) positively correlated with TN : TP ratio and negatively with TP ratio

- P limited lakes have more transporters

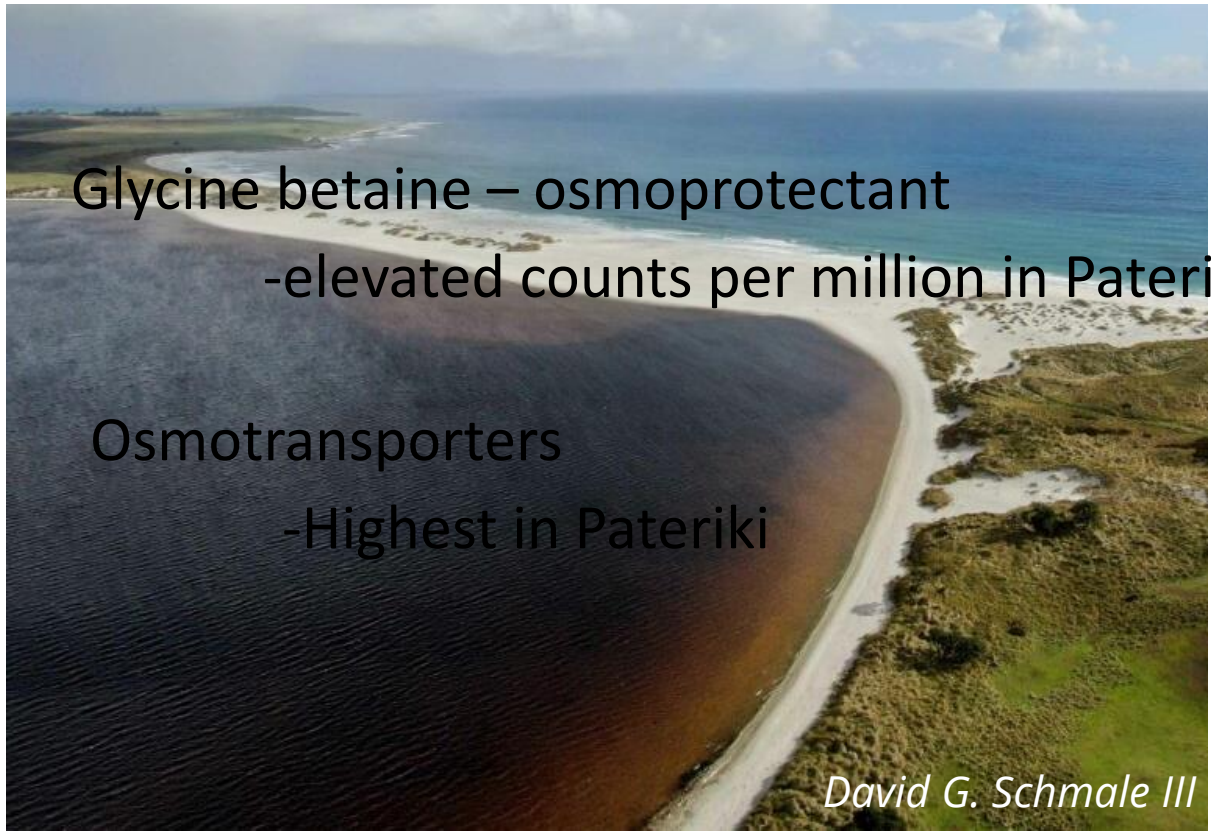
Negatively correlated with High Productivity Grassland (HPG)

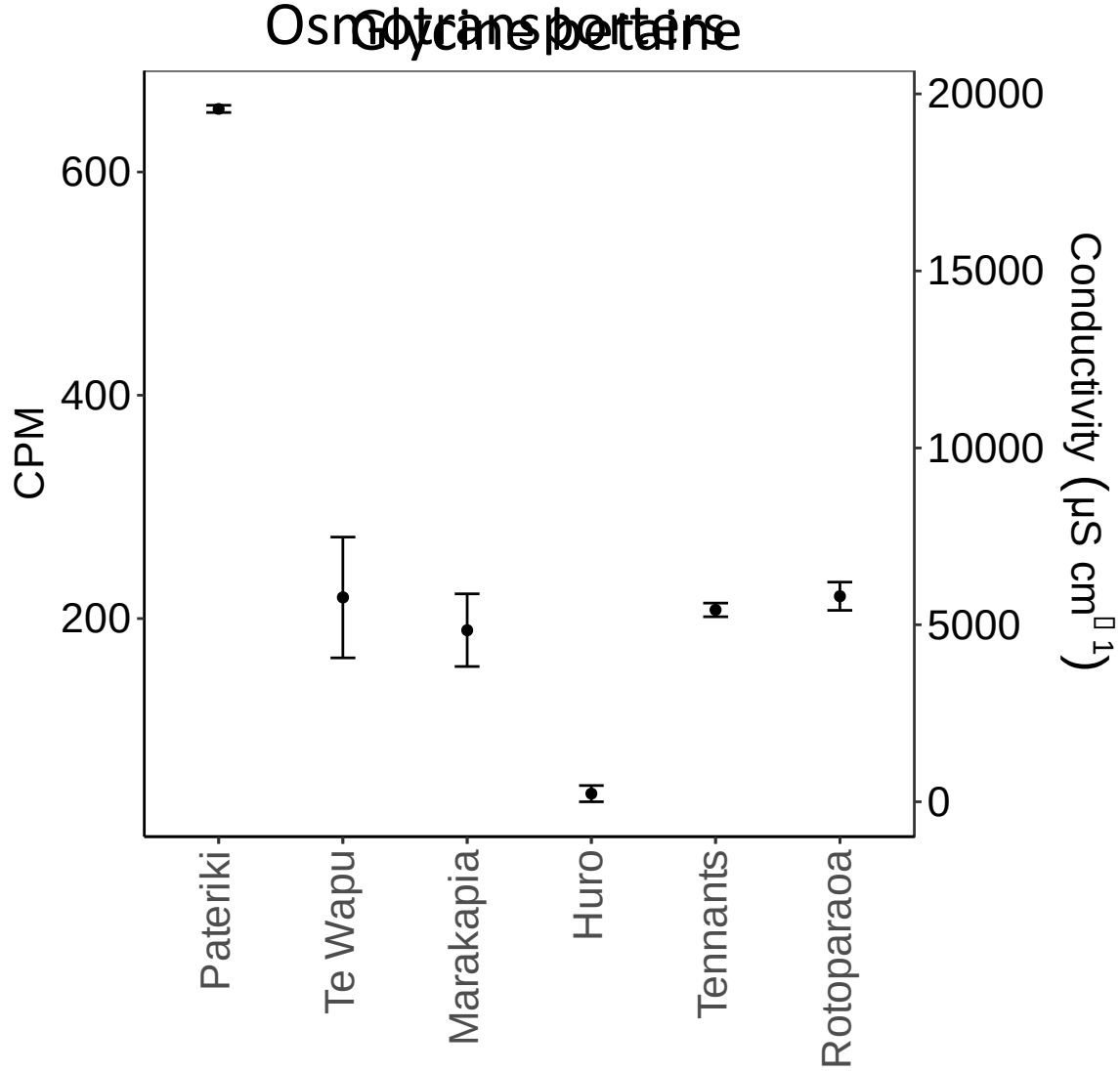
Phosphonate transporters showing similar although weaker trends

THE CHATHAM ISLANDS – THE TALE OF SALINITY

Six coastal dune lakes

Pateriki and Te Wapu have saline influences





CONCLUSION

Large scale DNA studies in lakes can provide valuable information on the health of Aotearoa – New Zealand lakes

Going beyond trophic state will provide a better foundation for the rehabilitation of lakes

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QUESTIONS?