National Park & Wildlife Service

epaResearch

Rialtas na hÉireann
Government of Ireland

PHYSICO-CHEMICAL CHARACTERISATION OF PROTECTED OLIGOTROPHIC LAKES IN IRELAND

Giovanni Cappelli[1], Emma Gray[1], Martin Gammell[1], Cillian Roden[2] and Heather Lally[1]
[1] Marine and Freshwater Research Centre (MFRC), Galway-Mayo Institute of Technology, Dublin Road, Galway City, Ireland.
[2] Roden Ecology, Kinvara, Co. Galway

MARINE AND FRESHWATER RESEARCH CENTRE
LÁRIONAD TAIGHDE MARA AGUS FIOR UISCE

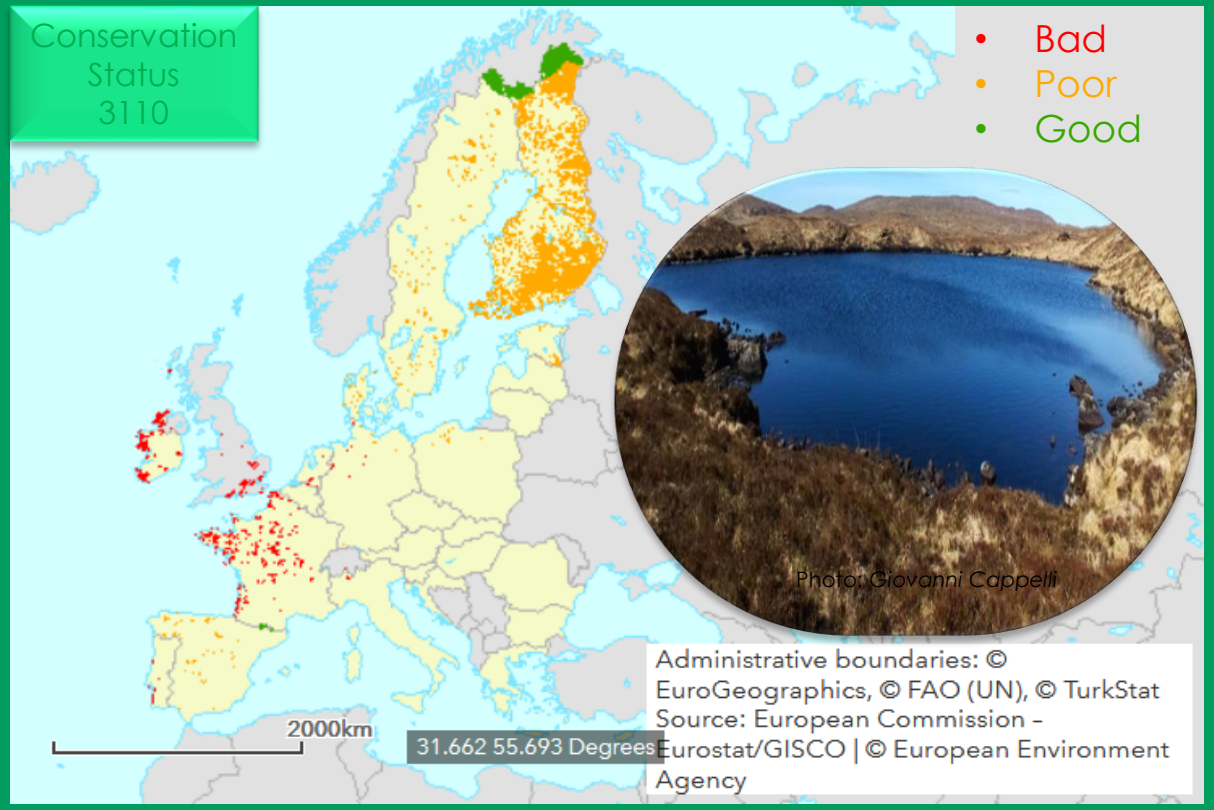
Ollscoil Teicneolaíochta an Atlantaigh
Atlantic Technological University

Photo: Giovanni Cappelli

INTRODUCTION

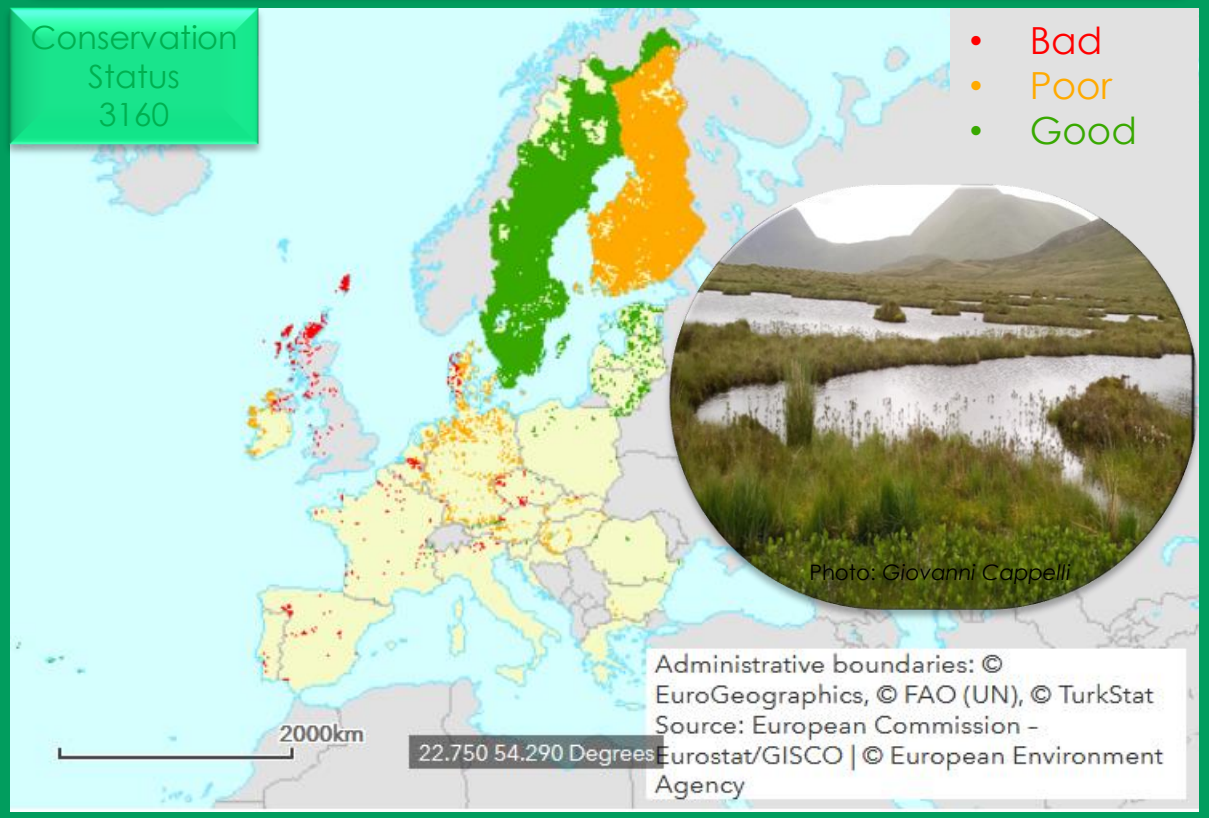
3110: Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)

On sloping shores of small (usually a few hectares) and shallow lakes; low alkalinity; isoetid flora like *Isoetes* and *Lobelia*.



3160: Natural dystrophic lakes and ponds

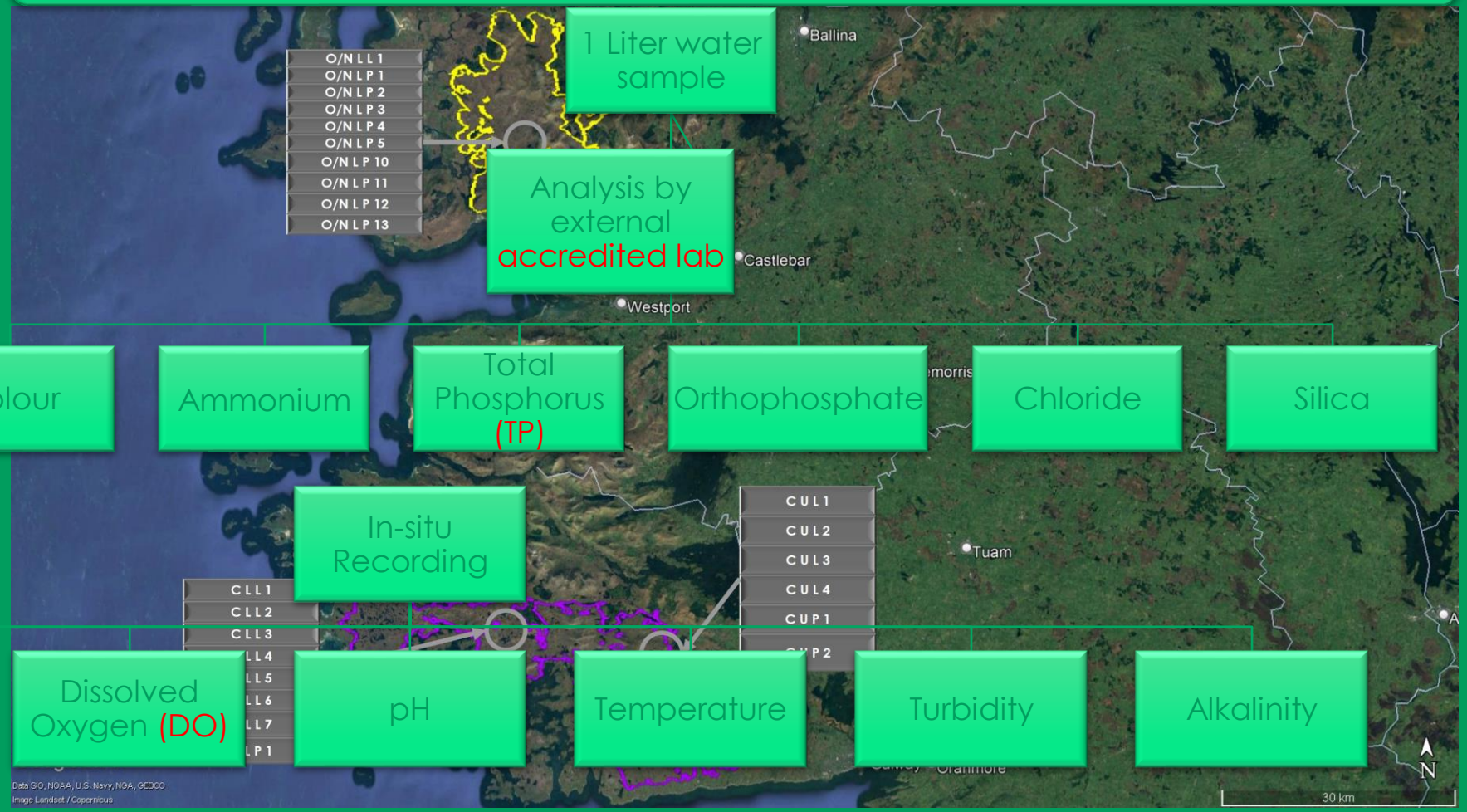
Small lakes and bog ponds; highly acidic brownish waters; poorer macrophytes richness, dominated by *Sphagnum*.



METHODS

24 lakes and ponds from 3 sites in Connemara Bog Complex Special Areas of Conservation (SAC) & Owenduff/Nephin SAC

Monthly sampling for 12 months (Mar 2021 – Feb 2022)



1 Liter water sample

Analysis by external accredited lab

Colour

Ammonium

Total Phosphorus (TP)

Orthophosphate

Chloride

Silica

In-situ Recording

Conductivity

Dissolved Organic Matter (DOC)

Dissolved Oxygen (DO)

pH

Temperature

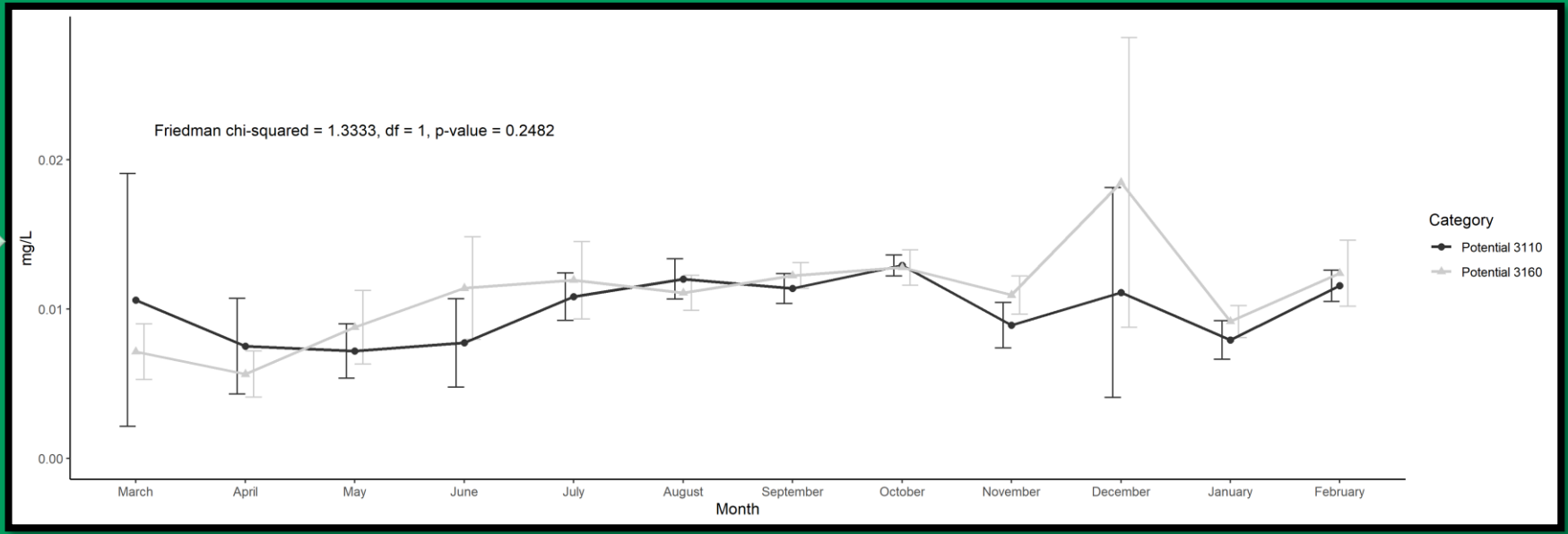
Turbidity

Alkalinity

Results

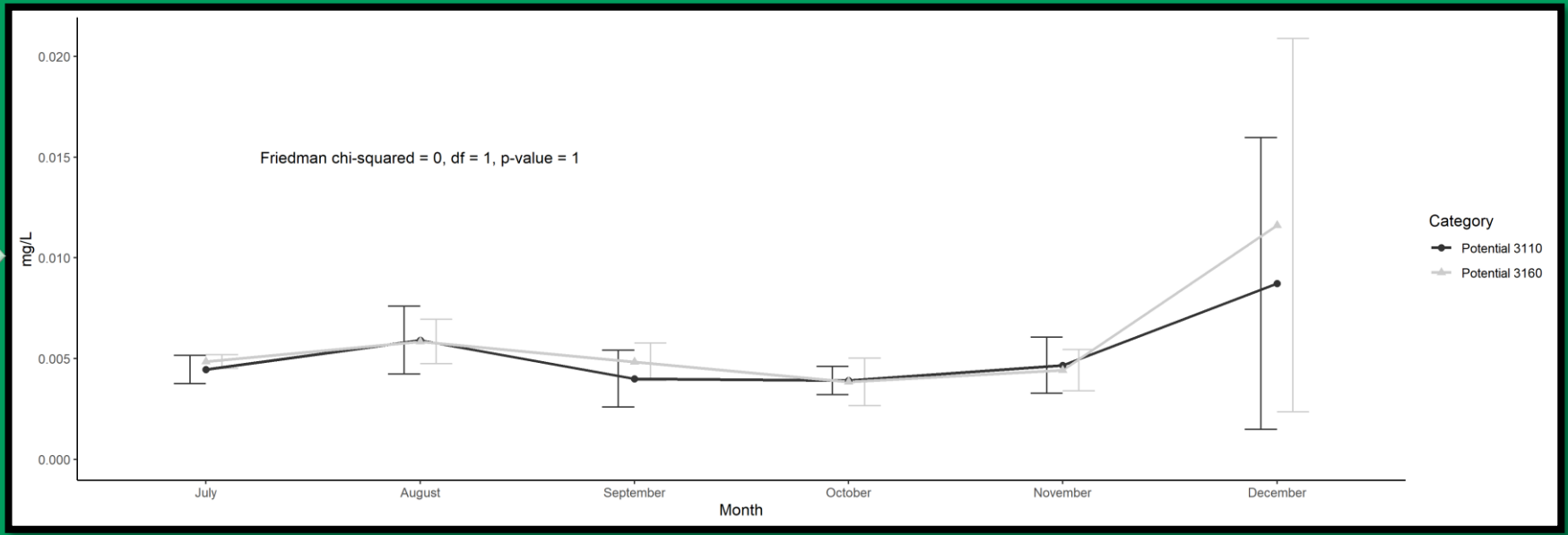
TP

- Low levels of TP in both lake habitats with no significant differences over the 12 month sampling period
- Average:
  3110 = 0.0100 mg/L
  3160 = 0.0113 mg/L



Ortho-phosphates

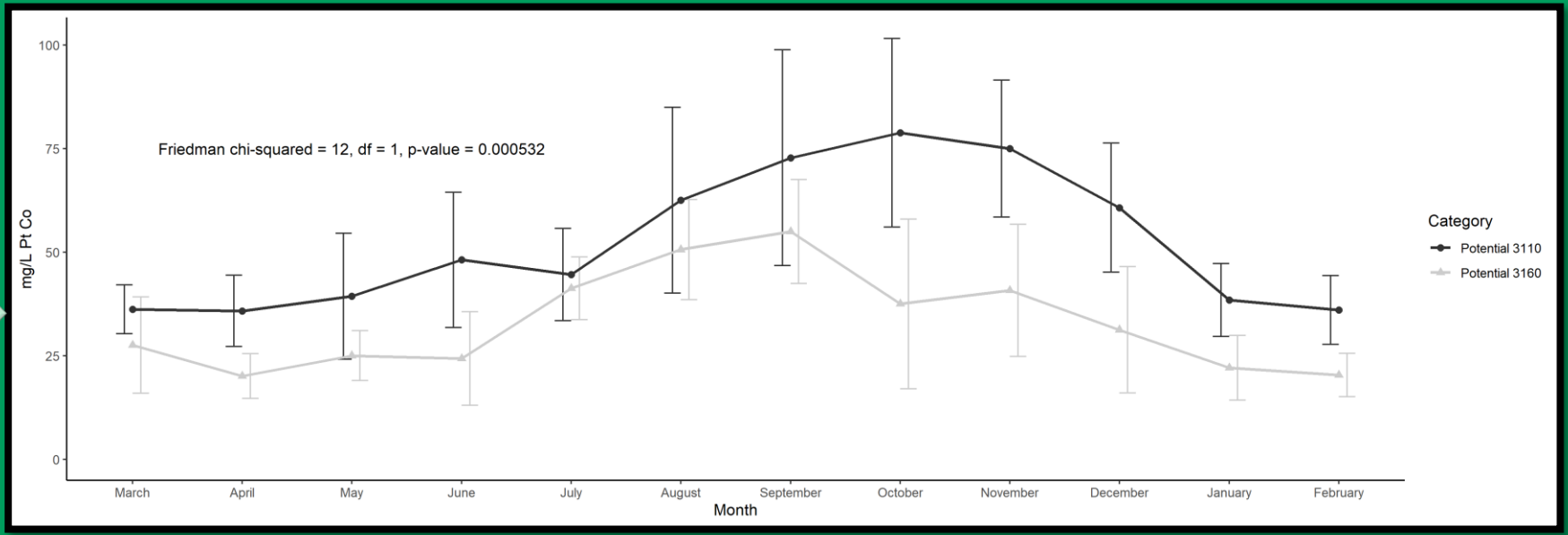
- Low levels of Orthophosphates in both lake habitats with no significant differences over the 12 month sampling period
- Average:
  3110 = 0.0054 mg/L
  3160 = 0.0059 mg/L



Results

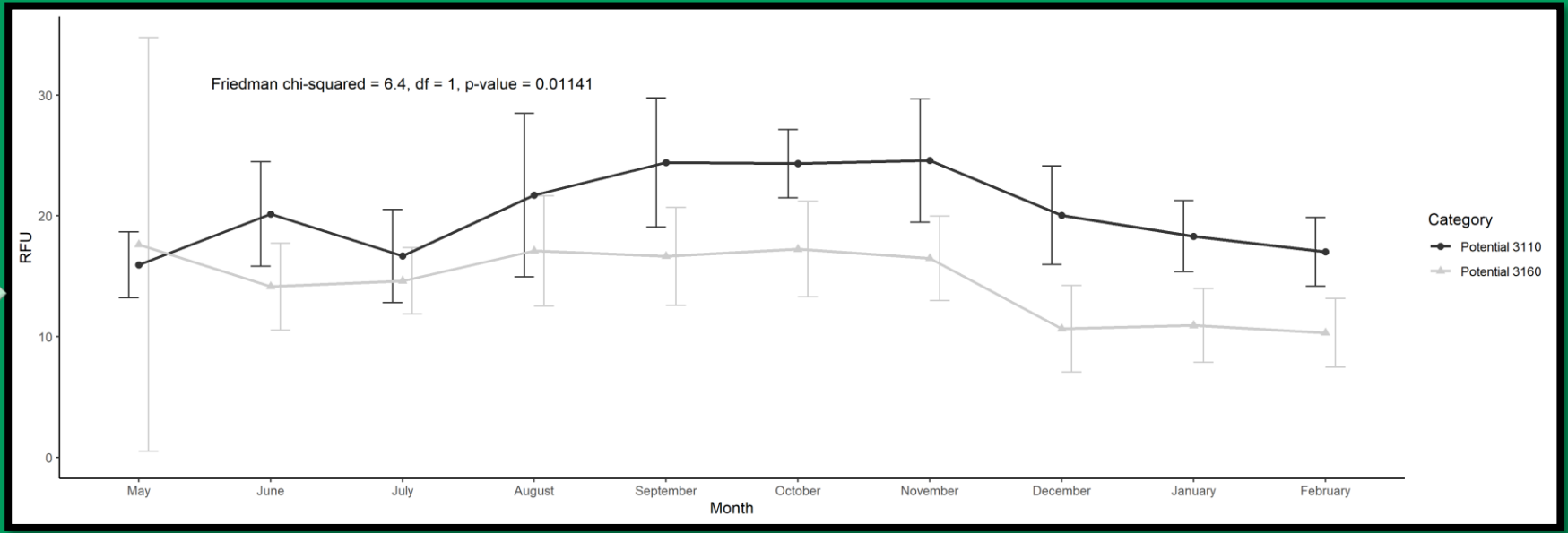
Colour

- Significantly higher levels of colour in 3110 lake habitats
- Average:
  3110 = 52.61 mg/L PtCo
  3160 = 33.57 mg/L PtCo



DOC

- Similarly, significantly higher levels of DOC were found in 3110 lake habitats
- Average:
  3110 = 20.36 RFU
  3160 = 14.15 RFU

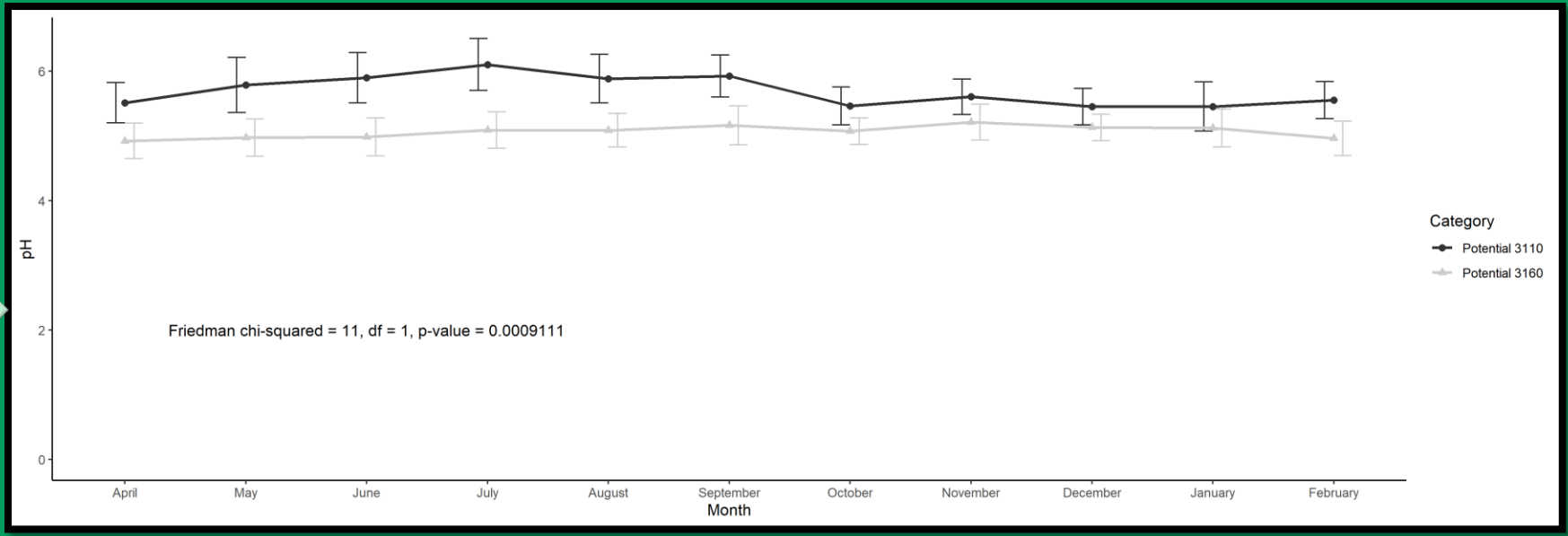


Results

pH

- Overall stable pH levels, with 3160 lake habitats having significantly lower acidic waters

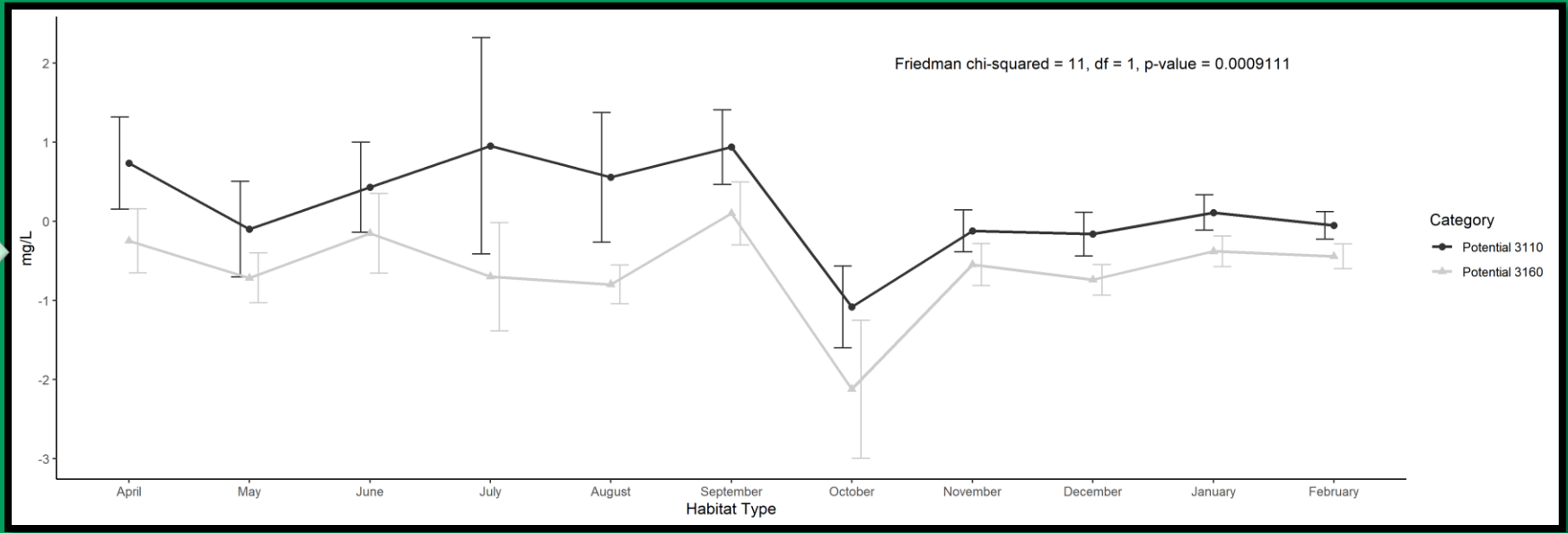
- Average:
  3110 = 5.7
  3160 = 5.1



Alkalinity ($CaCo_3$)

- Strong differences in the calcium content between the lake habitats,with 3110 lake habitats significantly higher than 3160

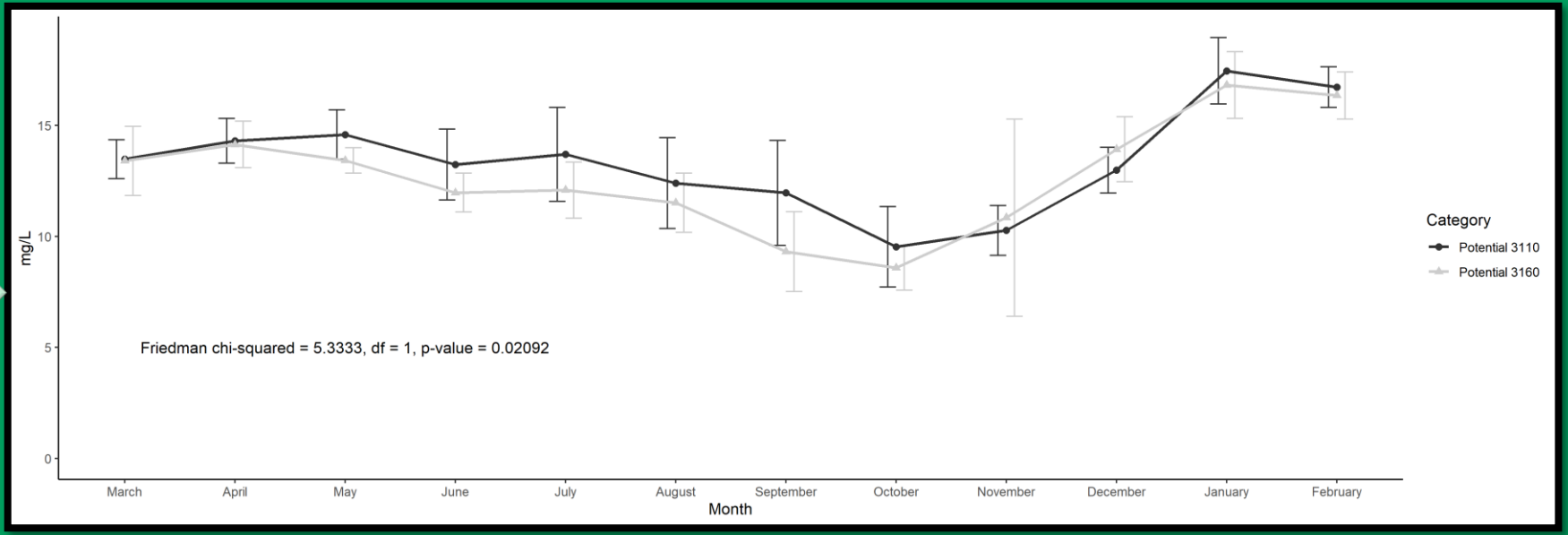
- Average:
  3110 = 0.21 mg/L
  3160 = - 0.62 mg/L



Results

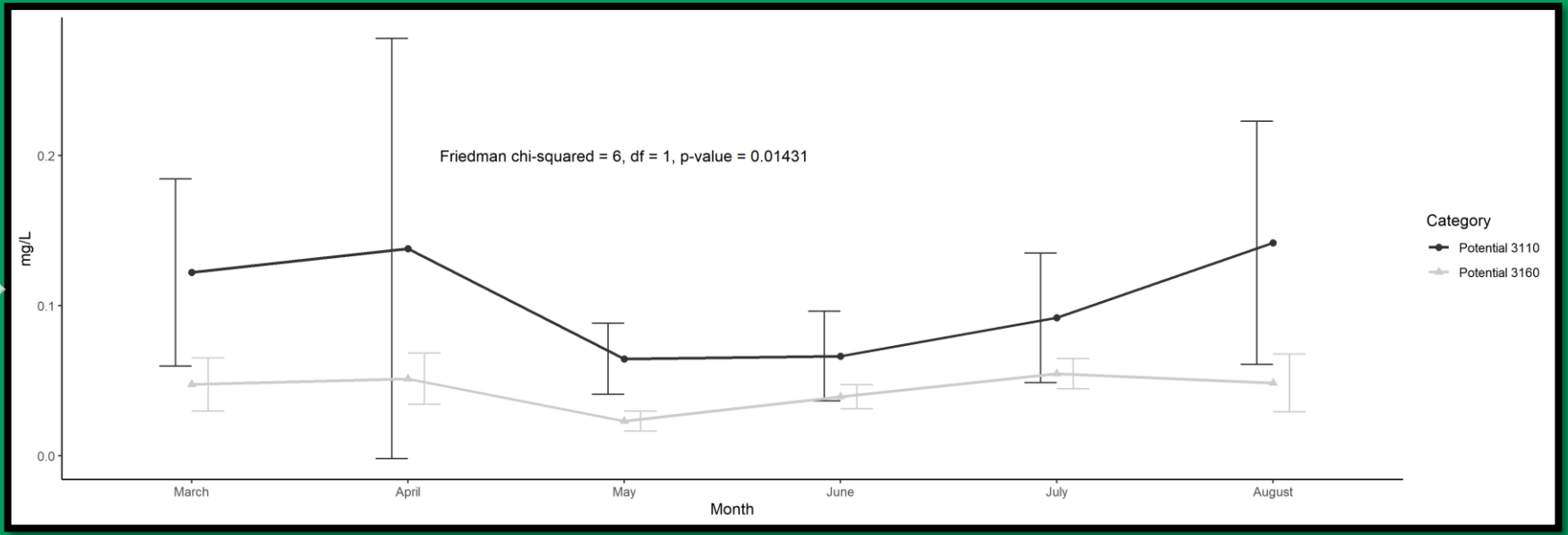
Choride

- Chloride concentratios were significantly higher in 3110 lake habitats
- Average:
  3110 = 13.38 mg/L
  3160 = 12.62 mg/L



Silica

- Very low levels of silica in both lake habitats with signifcantly higher levels found in 3110
- Average:
  3110 = 0.1 mg/L
  3160 = 0.04 mg/L

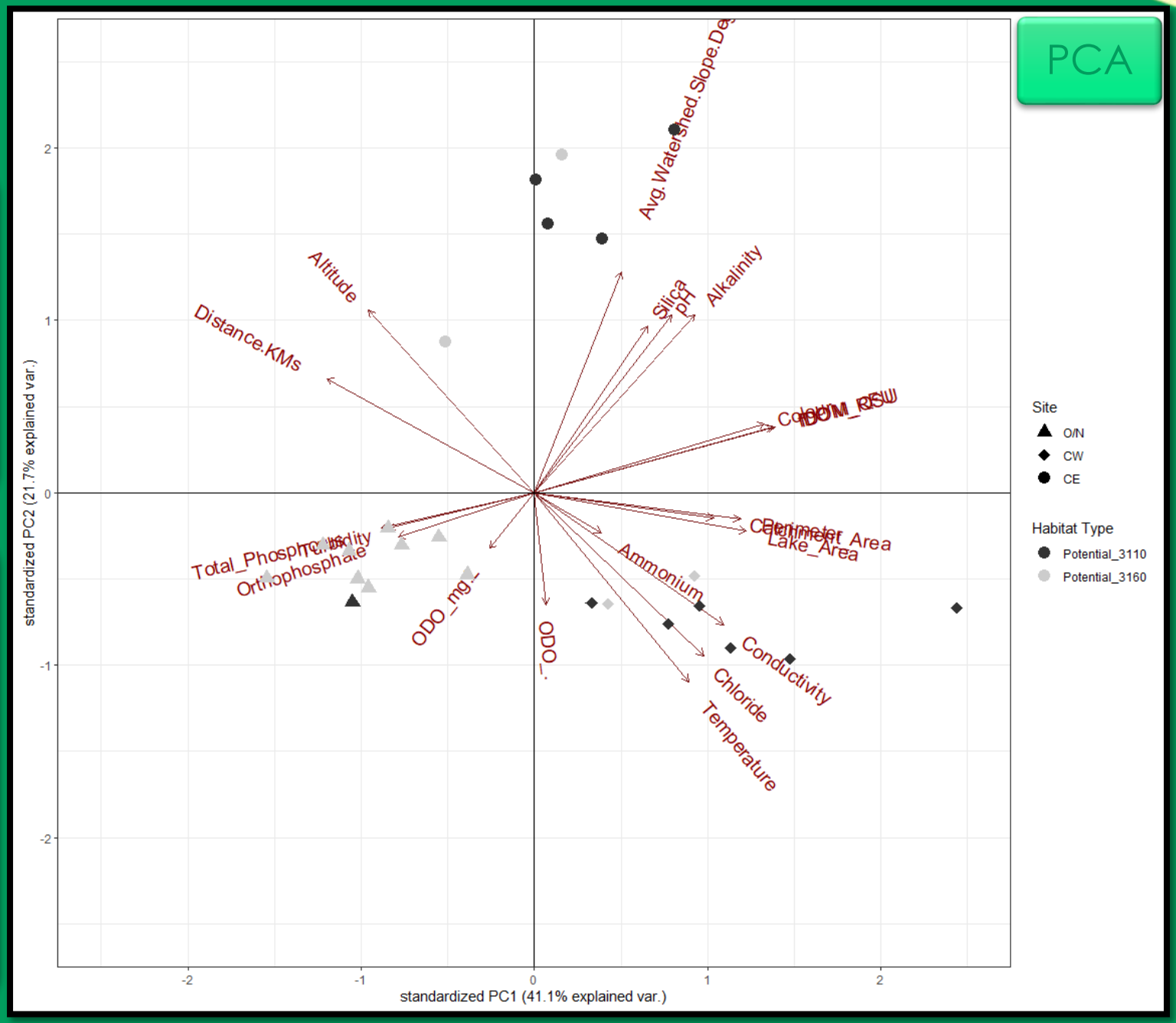


Results

Principal Component Anlaysis (PCA) highlights the importance of significant water chemistry parameters and their association with physical attributes

Most 3110 lake habitat sites scored positively on PC1 being larger with high levels of DOM, colour, pH, alkalinity and silica.

A strong regional difference is depicted by the PCA. Separating the three surveyed sites: Owenduff/Nephin (O/N), Connemara west (CW) & Connemara east (CE)

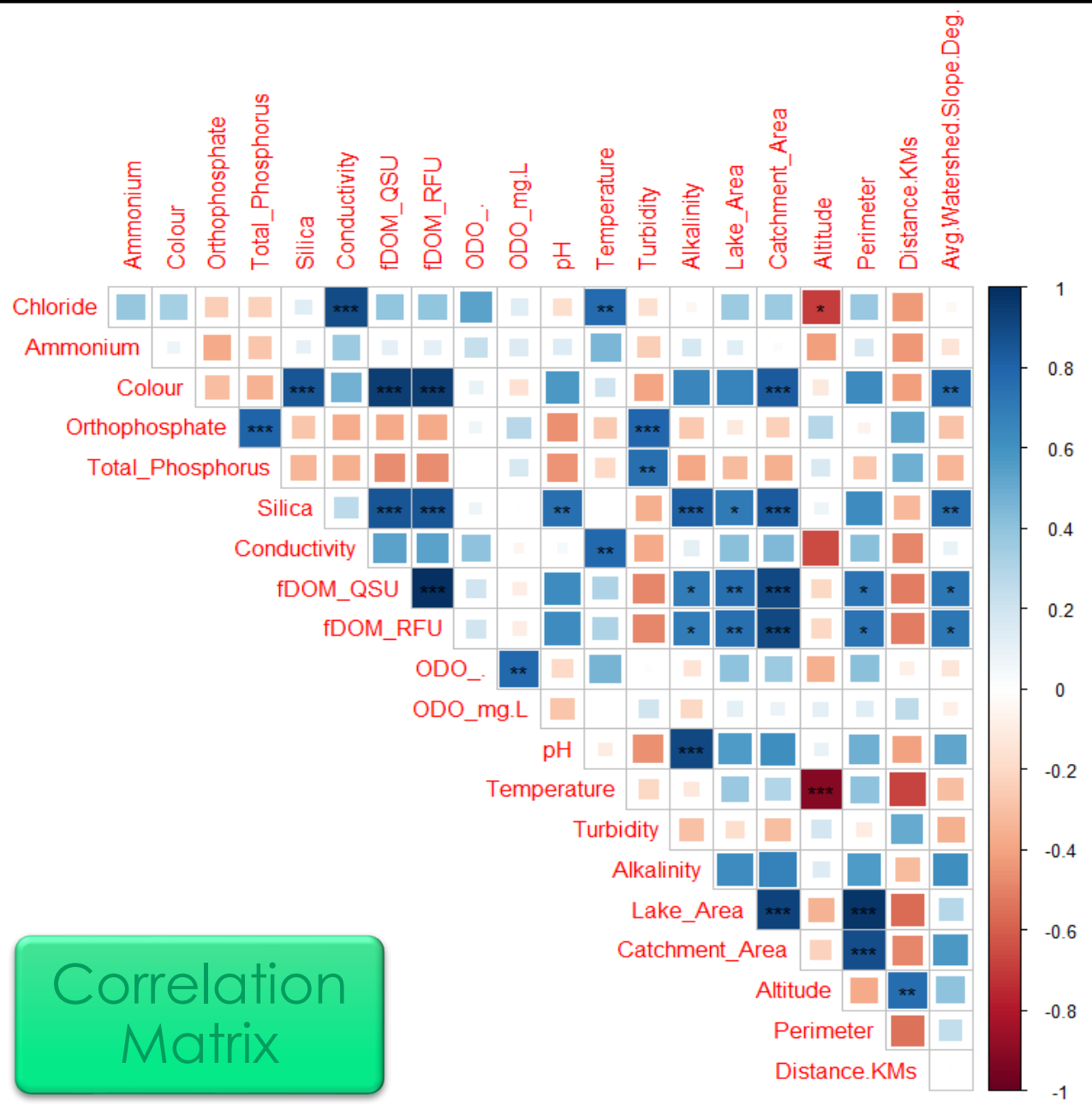


Results

The correlation matrix shows: nutrients are not correlated with any parameters but they can be predicted by the turbidity of the water

Colour, DOM and silica are positively correlated with catchment area and slope

Conductivity and chloride concentrations are negatively correlated with altitude



Correlation Matrix

Conclusions

Water chemistry suggest differences in acidity, organic matter, colour and ions between 3110 & 3160 lake habitats

The PCA confirms strong regional variability also drives separation in water chemistry, driven by local conditions, between the two lake habitat types

With the correlation matrix highlights the importance of catchment area in predicting organic matter and the influence of the sea on chloride and conductivity concentrations

Further statistical analysis is ongoing to determine which models best explain these combined correlations

Acknowledgements & Disclaimer

This project is funded under the EPA Research Programme 2021-2030 through the research project 'Framework for characterising oligotrophic lakes (3110 & 3160) using practical methods and assessment tools' (2019-W-MS-44). The EPA Research Programme is a Government of Ireland initiative funded by the Department of the Environment, Climate and Communications.

THANK YOU

Photo: *Giovanni Cappelli*

Follow PeAT Lakes Project