

# Characterising Native DOM Super-Producers to Feed a DOM-Metal-Mixture- Bioavailability Model

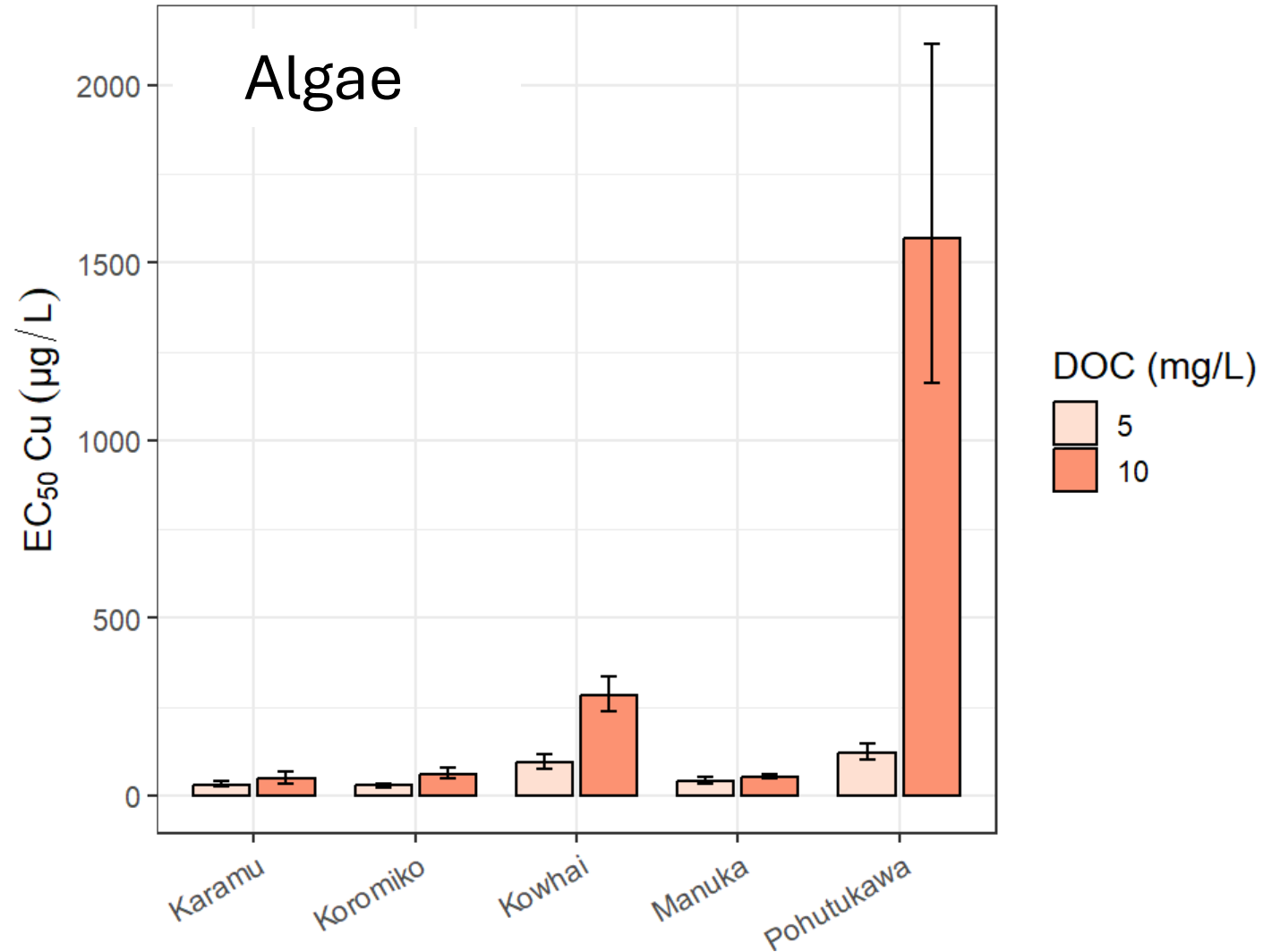
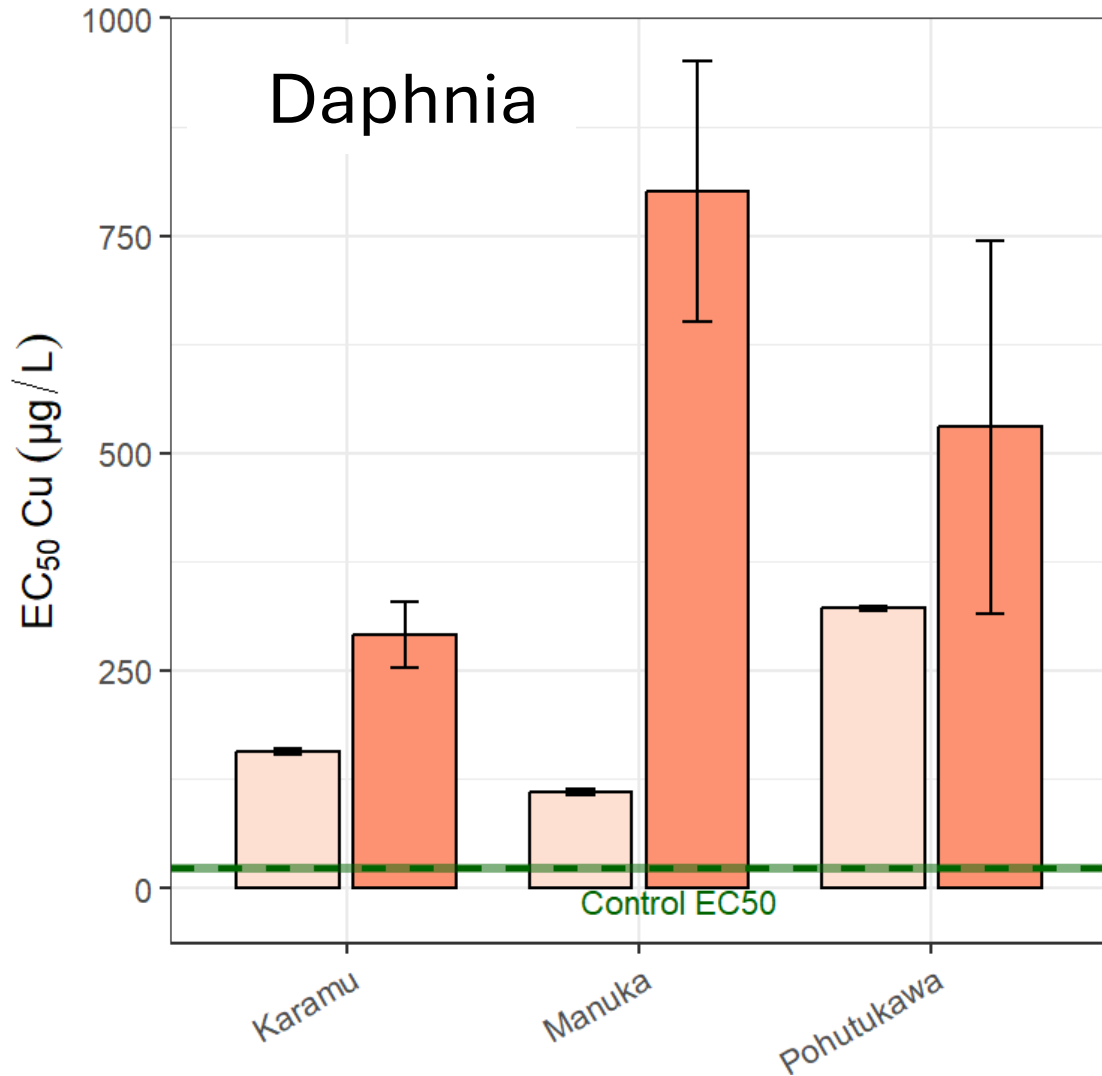
Dr Aleicia Holland<sup>1</sup>, Karen Thompson<sup>2</sup>,  
Amelia Shepherd<sup>2</sup>

<sup>1</sup>La Trobe University

<sup>2</sup>Earth Sciences New Zealand

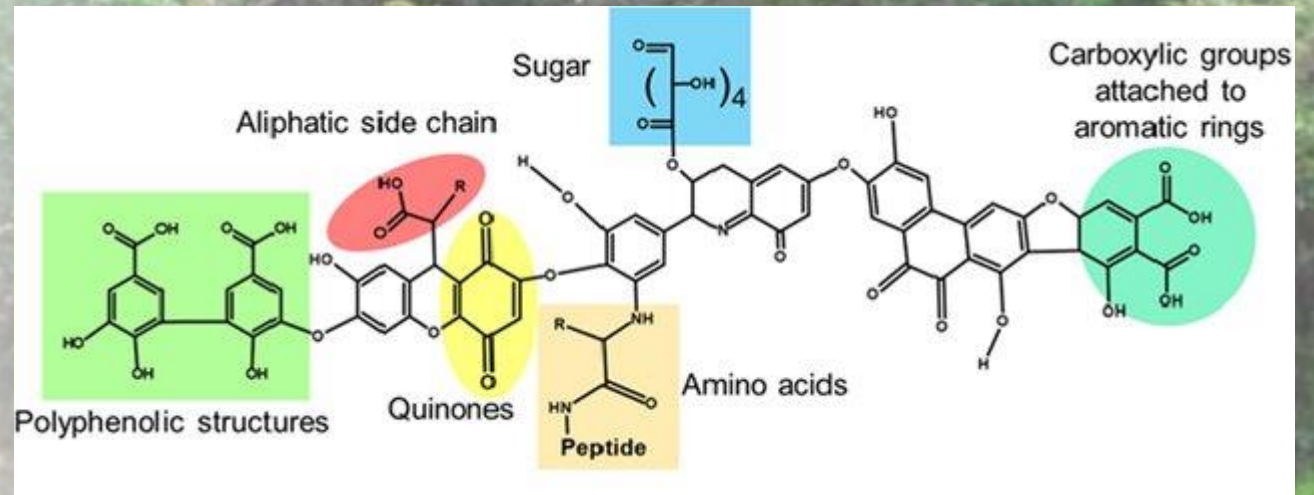


# Metal toxicity differs in presence of different plant DOM



# What is dissolved organic matter (DOM)

- Complex mixture of macromolecules consisting of humic substances (50-90%), carbohydrates, proteins, organic acids and amino acids
- Various binding groups in DOM make it able to alter the bioavailability and toxicity of metals



# Do DOM characteristics of plant leachates determine metal toxicity?

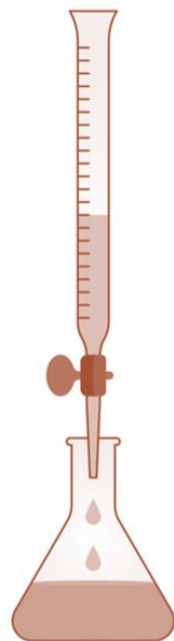


# Methods

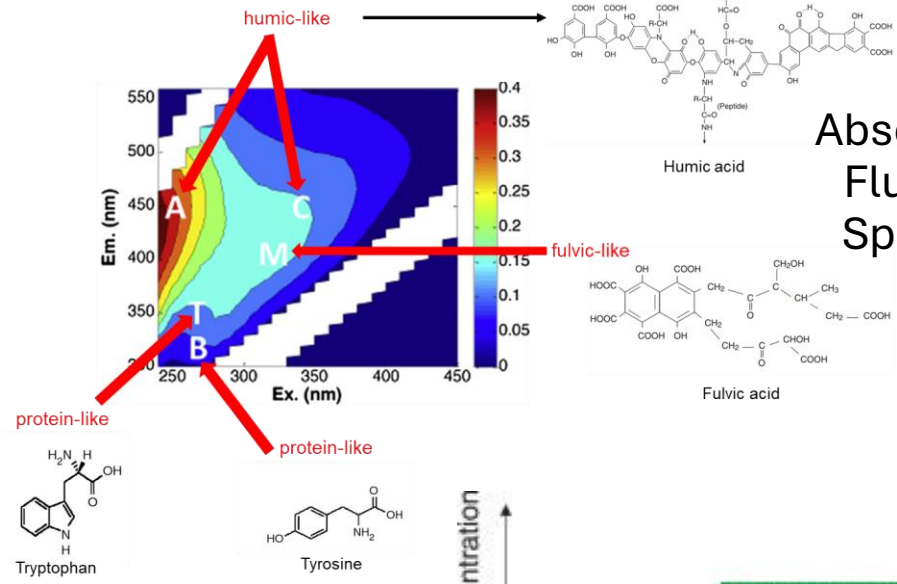
Weigh, dry and leach plant material



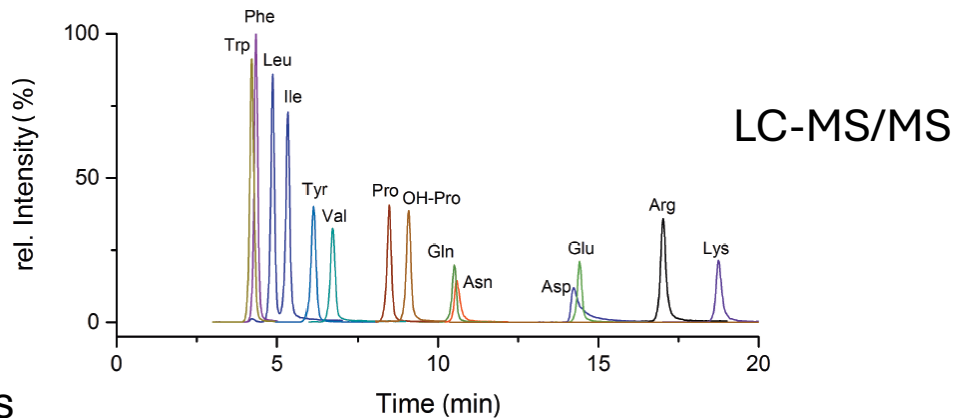
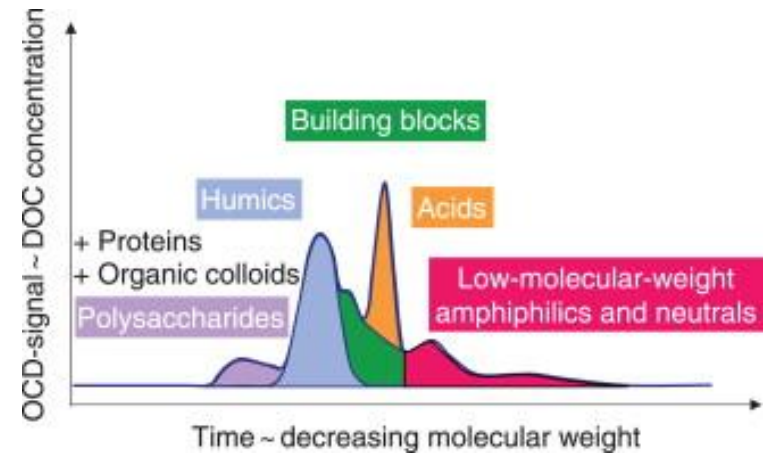
Filter DOM leachate and dilute



Acid/base titrations



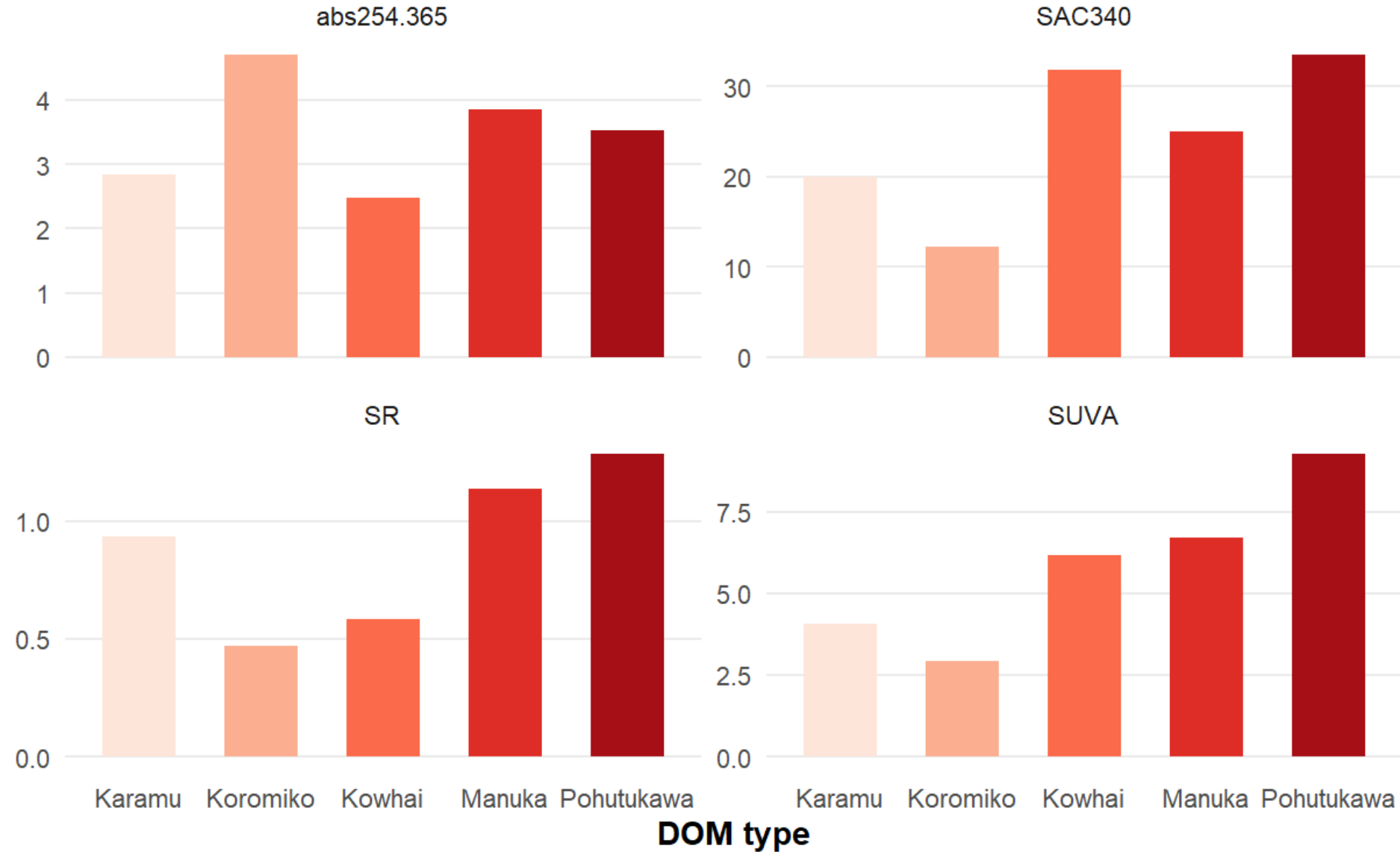
LC-OCD-OND



# Methods

Method	Key Information Provided	Cost	Expertise	Sample Prep
UV-Vis absorbance	Aromaticity, MW proxies	Low	Low	Low (filtration, dilution)
Fluorescence EEM + PARAFAC	Protein-/humic-like DOM fractions, indices: aromaticity, source, MW	Moderate	Moderate	Low (filtration, dilution, inner filter corrections, modelling)
Acid-base titrations	Functional groups (carboxylic, phenolic), site densities, pKa distributions	Moderate	High	Moderate (filter, titrator, modelling)
LC-OCD	6 DOM types, aromaticity, MW	High	High	Moderate (filtration, careful calibration)
LC-MS/MS	Molecular-level composition (specific compounds, pathways)	Very high	Very high	High (extractions, clean-up, data pipelines)

# Results: Absorbance Indices

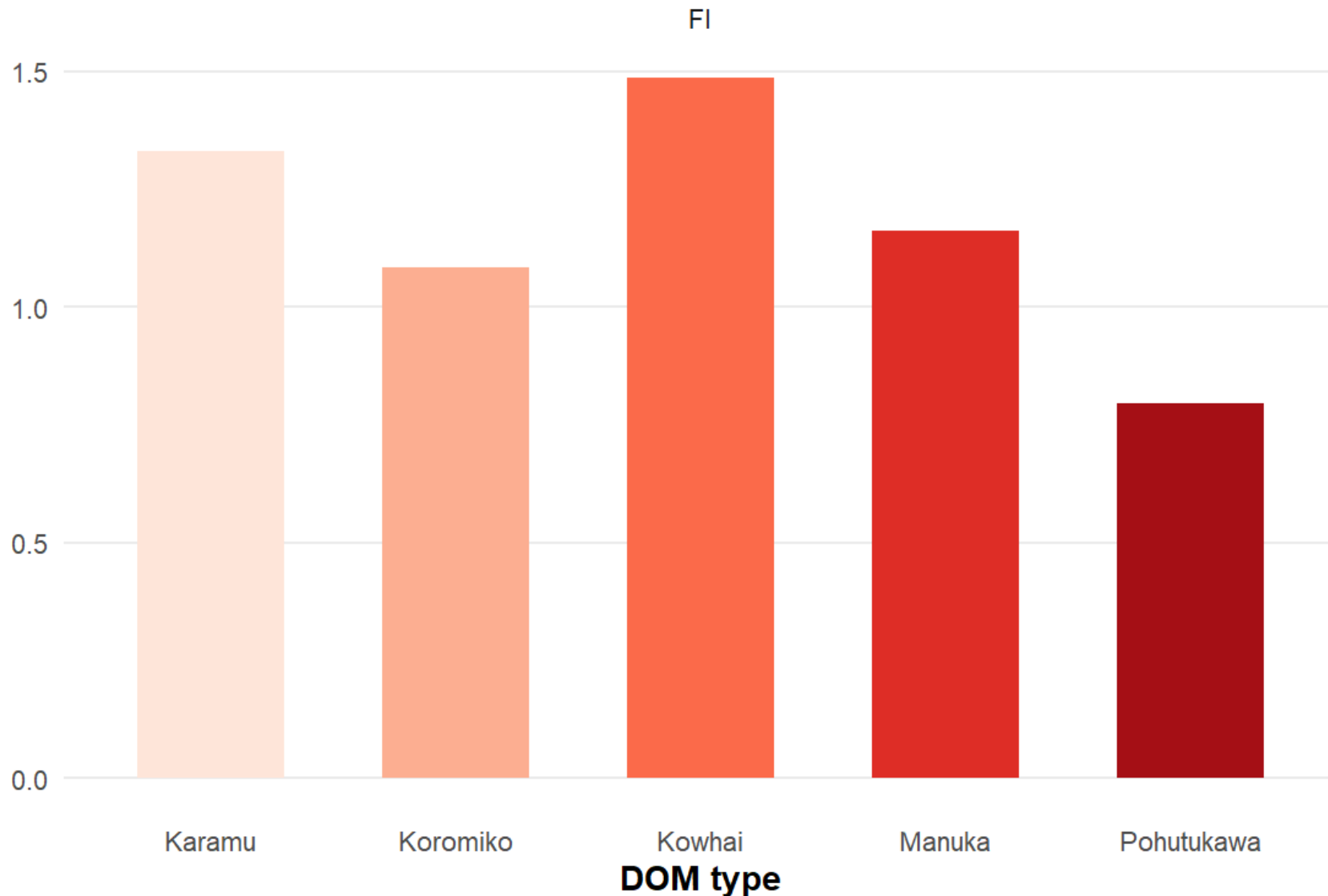


- Relative Molecular Weight Indices: abs254/365 and SR

- Relative Aromaticity indices: SUVA and SAC340

- Pohutukawa appears to be more aromatic and higher MW

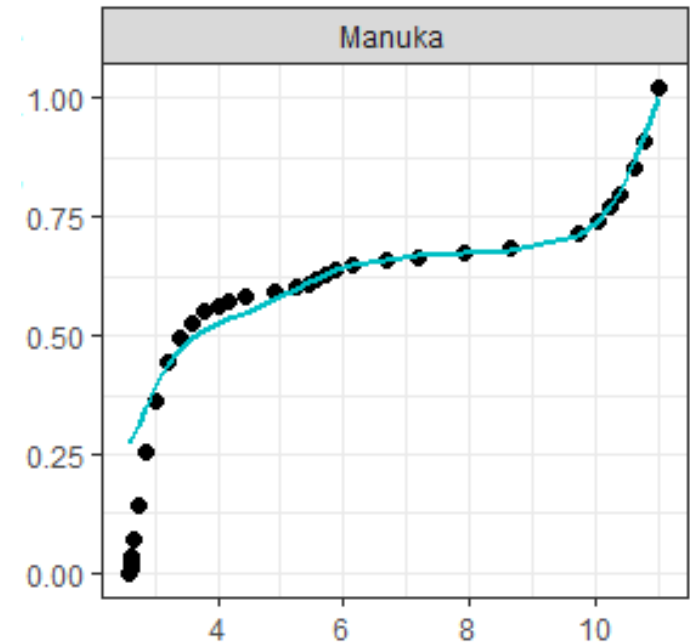
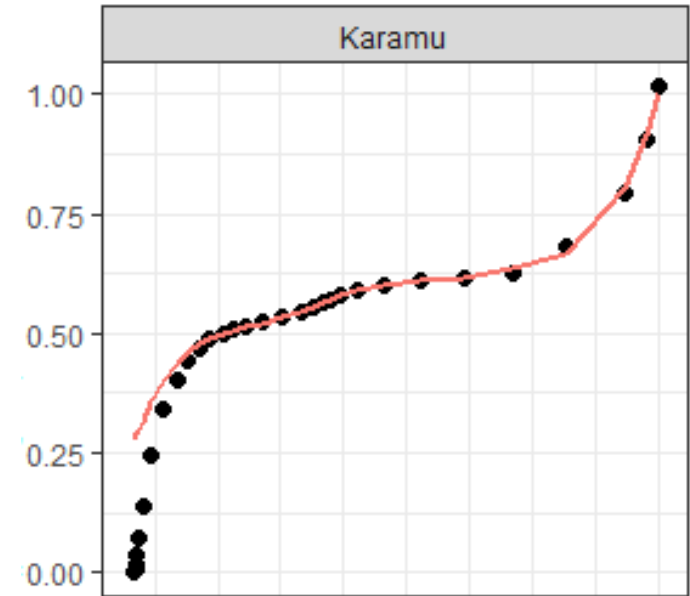
# Results: EEM and Fluorescence Indices



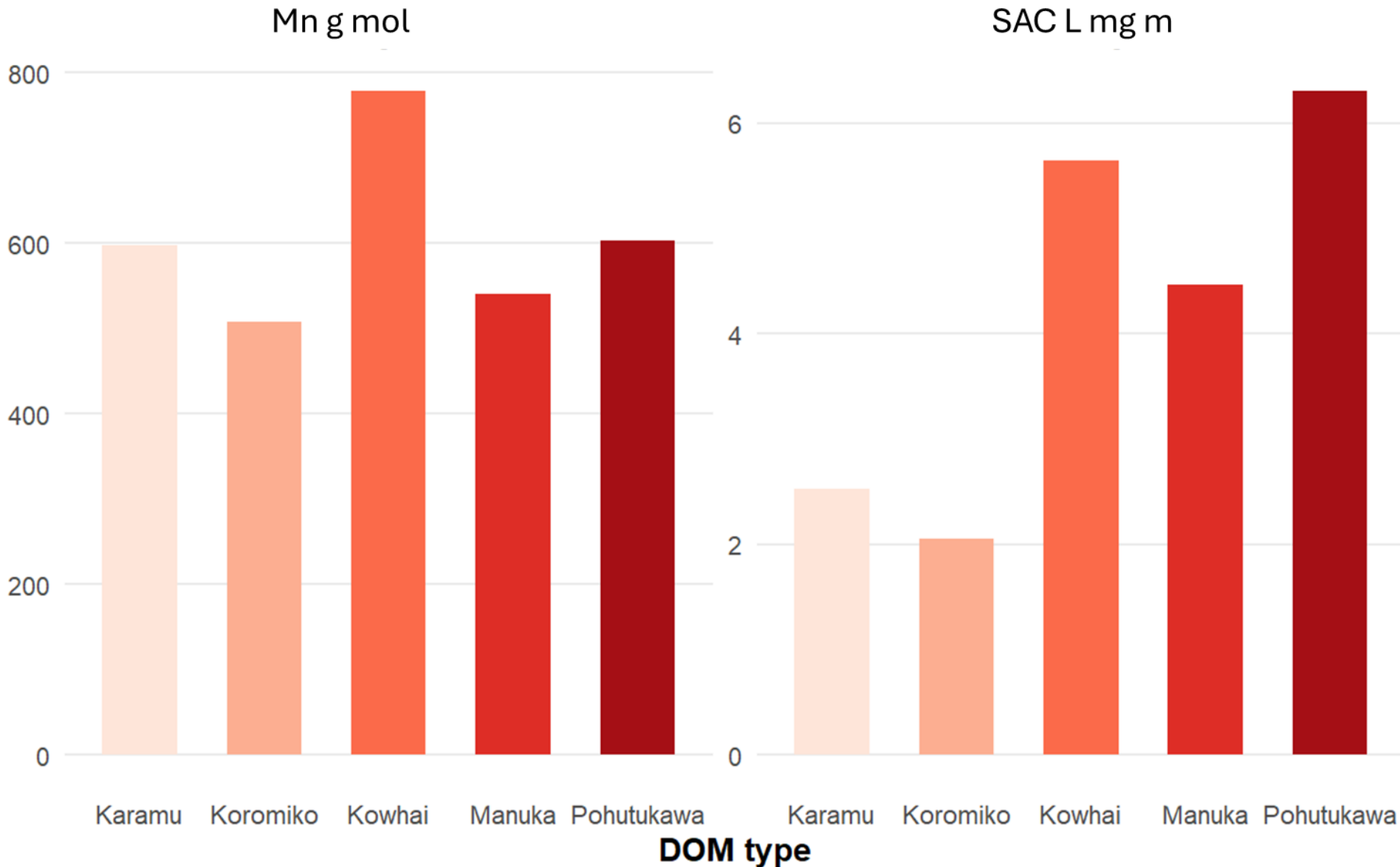
- 3 main DOM components identified: Protein, Humic and Fulvic-like components
- Differ in relative abundance between DOMs
- Fluorescence Index (FI) indicates MW lower values = higher MW

# Results: Acid/Base Titrations

DOM	Total Capacity umol per mgC	Strong acidic fraction	Intermediate umol per mgC	Proton Binding Index
Koromiko	1.38	0.39	0.10	0.20
Kowhai	1.39	0.44	0.13	0.22
Manuka	1.41	0.42	0.14	0.23
Karamu	1.43	0.41	0.14	0.15
Pohutukawa	2.66	0.23	0.16	0.13

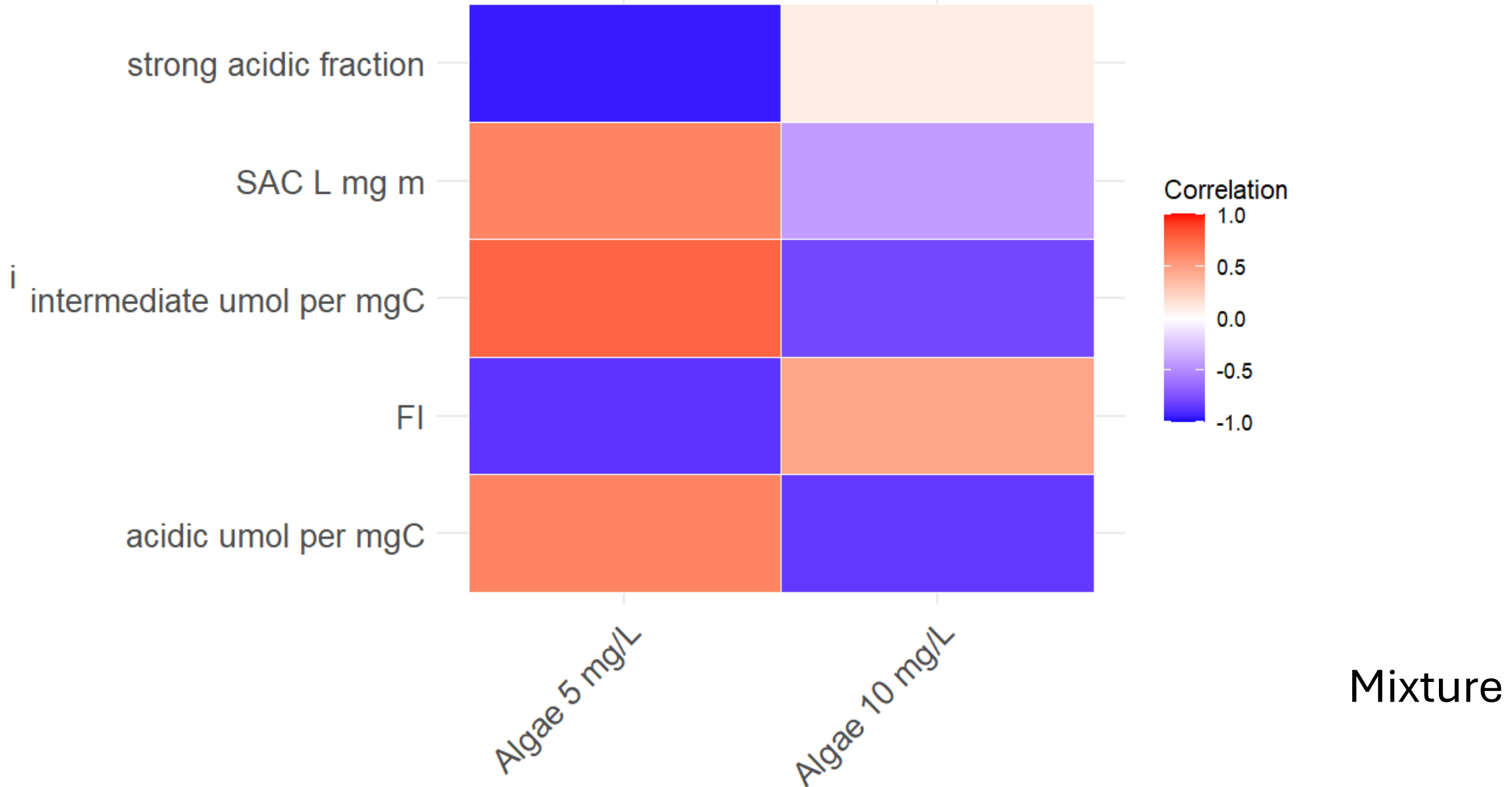


# Results: LC-OCD



- DOM composition differed between DOMs
- SAC L mg m indicates aromaticity
- Mn g mol gives the nominal MW

# Top 5 DOM characteristics linked with Toxicity



# Predictors of toxicity

DOM Characteristic	Definition	Metals Significant	Method	Cost	Expertise
<b>Intermediate umol per mgC</b>	phenolics (-OH), amides; moderate proton-donating ability	Cu, Zn, Mix	Acid–base titration	Moderate	High
<b>Strong acidic fraction</b>	carboxylic acids; dominate metal binding at neutral pH	Cu, Mix	Acid–base titration	Moderate	High
<b>FI</b>	Fluorescence Index; indicates source, molecular weight	Cu, Mix	Fluorescence spectroscopy	Low	Low
<b>SAC L mg m</b>	Specific absorbance coefficient of aromatic carbon; aromaticity	Cu, Mix	UV–Vis / LC-OCD	Low/High	Low/High
<b>SR</b>	Spectral slope ratio; indicates molecular weight	Cu, Zn	UV–Vis spectroscopy	Low	Low

# Summary

- Aromaticity, molecular weight, abundance of carboxylic and intermediate phenolic groups associated with toxicity
- DOM indices derived using optical methods and acid/base titrations may provide useful tools in screening plants for use in metal mitigation initiatives
- Standardised monitoring methods for DOM character need to be developed



# Acknowledgements

- Funded by MBIE Smart Idea - (CO1X2306) How do native super-producers of organic matter mitigate aquatic metal mixture toxicity?
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- Ewen Silvester – La Trobe University



# Questions