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Characterization of 17 elements in ten edible seaweed species from Greenland

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1 Summary

Greenland seaweeds are of interest for local and global consumption. We investigated ten species for their content of essential, trace and toxic elements: As, Ca, Cd, Cr, Cu, Fe, Hg, I, K, Mg, Mn, Na, Ni, P, Pb, Se and Zn. The elemental composition was statistically significantly different ($p < 0.05$) between species with the exception of Cr, Fe and Pb. High levels of iodine were found in certain seaweeds (all brown algae): *Alaria esculenta* (Cr and I), *Ascophyllum nodosum* (I), *Laminaria solidungula* (I), *Saccharina latissima* (I), *Saccharina longicuris* (I) and *Saccharina nigripes* (I). Through consumption of 2 g dried seaweed of these species, the upper tolerable level of iodine of 600 µg/day for adults (EFSA) is exceeded.

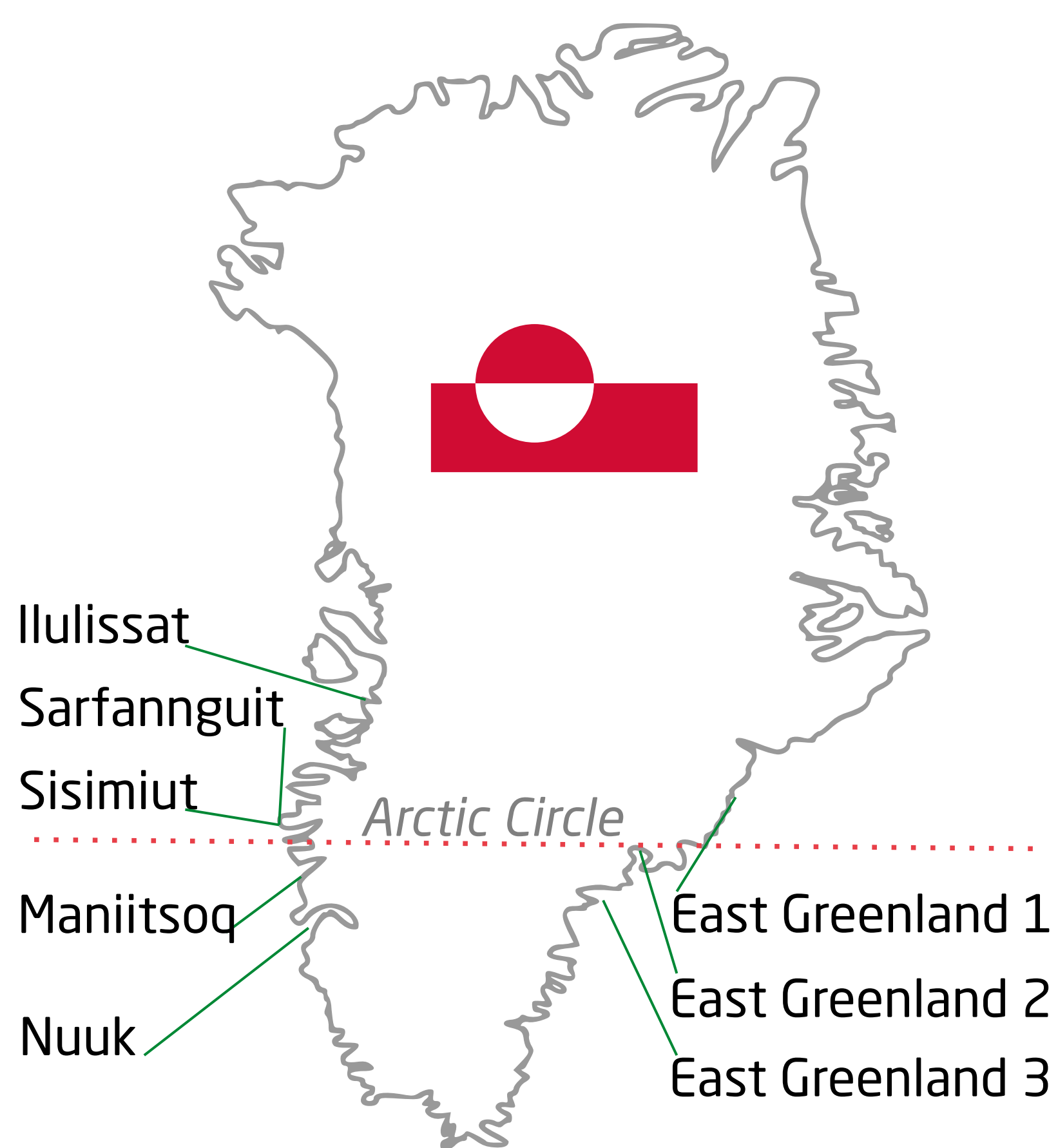


Figure 1: Sampling locations in Greenland.

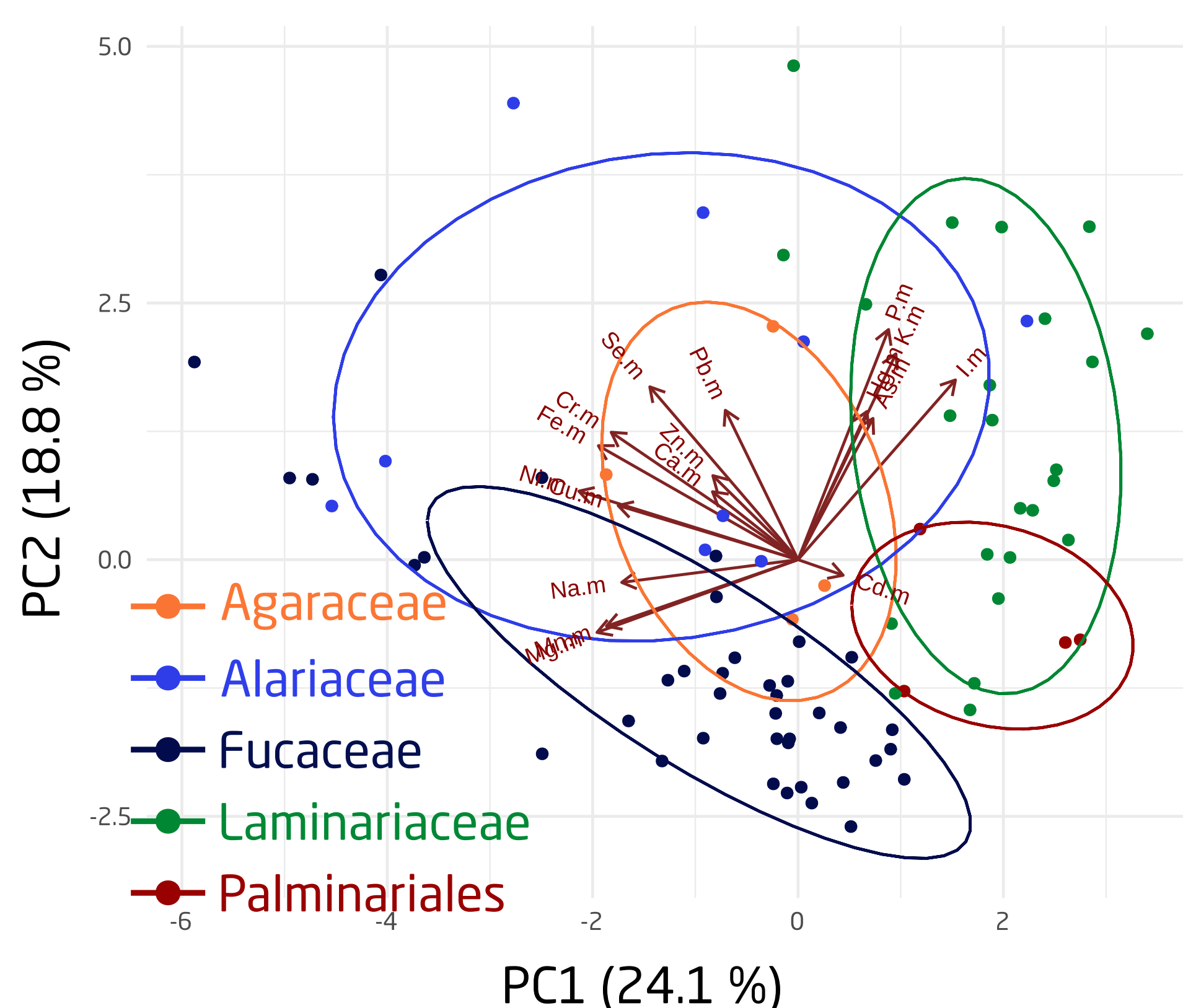


Figure 2: Principal component analysis of element content grouped by algal family. Fuaceae and Laminariaceae are well separated.

2 Methodology

Samples harvested in the field (figure 1) were freeze dried, pulverized and quantified by inductively coupled plasma mass spectrometry (ICP-MS). The quality of the analytical method was assured by simultaneous analysis of certified reference materials and adherence to European standard methods (EN 13805, EN 15763 and EN 15111).

To detect statistically significant differences between species, analysis of variance (ANOVA) and Tukey multiple comparisons of means tests were carried out. Principal component analysis (PCA) was carried out to detect patterns in the dataset.

3 Conclusion: how much is safe to eat?

| Species | 2 g serving | Why not? |
|------------------------------|-------------|----------|
| <i>Agarum clathratum</i> | | |
| <i>Alaria esculenta</i> | | I |
| <i>Ascophyllum nodosum</i> | | I |
| <i>Fucus distichus</i> | | |
| <i>Fucus vesiculosus</i> | | |
| <i>Laminaria solidungula</i> | | I |
| <i>Palmaria palmata</i> | | |
| <i>Saccharina latissima</i> | | I |
| <i>Saccharina longicuris</i> | | I |
| <i>Saccharina nigripes</i> | | I |

Figure 3: How much is safe to eat? Calculation based on dry weight of seaweed and tolerable daily intake levels set by the European Food Safety Authority (EFSA) for a 60 kg adult person.

4 PCA results

PCA reveals patterns in element content that follow the family level (figure 2).

5 Acknowledgements

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6 Sustainable development goals

