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Title:

Seasonal protein variability and structural responses to post-harvest drying in *Undaria pinnatifida*, *Gracilaria chilensis*, and *Ulva* spp

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Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text into it.)

Preparation of Your Abstract

1. The title should be as brief as possible but long enough to indicate clearly the nature of the study. Capitalise the first letter of the first word **ONLY** (place names excluded). No full stop at the end.

2. Abstracts should state briefly and clearly the purpose, methods, results and conclusions of the work.

Introduction: Clearly state the purpose of the abstract

Methods: Describe your selection of observations or experimental subjects clearly

Results: Present your results in a logical sequence

Discussion: Emphasize new and important aspects of the study and conclusions that are drawn from them

Seaweeds can provide a nutrient and protein dense addition to terrestrial plant and animal food sources. Earlier research found seasonal variability in proteins and nutrient content in freshly harvested seaweed tissues. However, freshly harvested seaweed decomposes fast and is difficult to store due to its high-water content (80-90%) and marine microbes and enzymes breaking down the tissue comparatively soon after harvest. One way to preserve and store seaweeds is by drying them in various ways, which possibly impacts nutrient and protein levels and cell structure. We hypothesised that seasonal factors influence the protein content and composition of wild harvested *Undaria pinnatifida*, *Gracilaria chilensis*, and *Ulva* spp. Furthermore, we hypothesised that higher post-harvest drying temperatures reduce protein content while altering tissue microstructure compared with lower-temperature or freeze-drying methods. Protein contents were determined for the three macroalgae species, sampled monthly over two years after post-harvest drying (freeze-drying, 40°C, and 90°C). Additionally, tissue structure was examined by light microscopy and dyeing using Coomassie Brilliant Blue R-250 (protein bodies) for staining. The microstructure of cells and cell content was assessed via light-microscopy to quantify any structural changes throughout post-harvest drying. Protein content varied by species and season. Overall average crude protein for each species was 33-131% higher in winter compared to summer, with the greatest winter value in *Ulva* spp. (18.1% DW) followed by *Gracilaria* sp. (17.7% DW), *Undaria pinnatifida* sporophyll (13.2% DW) and *Undaria pinnatifida* blade (13.1% DW). The macroalgae tissue structure also varied between drying treatments, with higher temperatures shifting protein bodies towards the cell wall. Our results indicate that selecting lower drying temperature or freeze-drying protocols may help to preserve proteins, and structural features.