

# Does **blue** and **red** light have an impact on the protein content of macroalgae?

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## Aim

We want to investigate methods for optimizing the protein content of the brown algae *Laminaria digitata* and the red algae *Palmaria palmata* when cultivated in Danish waters.

## Background

Fish farming is the fastest-growing sector of world food production<sup>1</sup>. Aquaculture feed is strongly dependent on fish meal and fish oil to meet the critical protein requirements. Increasing use of fish for human consumption, along with a decline in availability and increasing costs has created a need for alternative sources for protein. Macroalgae could be one of these new protein sources<sup>2,3,4,5</sup> (figure 1).

When cultivating macroalgae in Denmark, the depth at which the algae grow is crucial<sup>6</sup>. The light intensity and the spectral quality of the light are changing with depth (figure 2), and previous research has demonstrated that blue light stimulates the protein synthesis in red algae<sup>7</sup>. By improving the knowledge and insight in macroalgae response to red and blue light we may be able to optimize the protein content, and thereby make more economical, environmental friendly and sustainable feed for aquaculture.

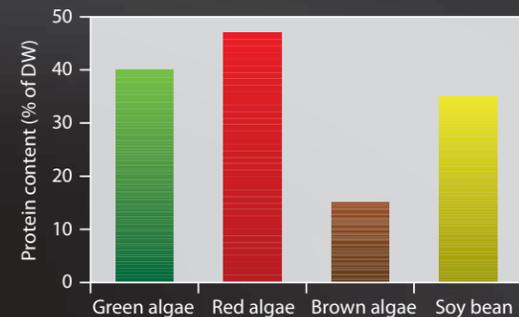


Figure 1. Comparison of maximal protein concentrations in algae and soy bean.



Figure 2. Approximate penetration of light of different wavelengths in a water column. Red light is absorbed at shallow depths whereas blue light penetrates into deeper waters.



Laila Kloster (left) & Lilli Gruwier (right) on stone reef monitoring cruise 2012, finally finding the right macroalgae: *Laminaria digitata* (bottom) and *Palmaria palmata* (top).



Sampling for analysis of *L. digitata* was carried out throughout inner Danish waters.



Experimental set-up for cultivating macroalgae under different light qualities.

## Method

- Small- and large-scale in vitro cultivation of *L. digitata* and *P. palmata* under red and blue light, analyzing effect on C:N ratio, amino acid profile and pigment concentrations.
- Investigation of the adaption to different light quantities (intensity) and qualities (blue versus red).
- Overview of the geographical differences in Denmark by compilation of time series of data on relevant parameters from inner Danish waters from the MADS database (nutrient concentration, light penetration, salinity, current velocities and temperature) with collected samples from of *L. digitata* and *P. palmata*.

## Perspectives

We hope that our work can contribute to support a Danish cultivation of macroalgae with high protein content in order to substitute soy bean as the protein in feed to ie. rainbow trout (*Oncorhynchus mykiss*) in Danish aquaculture.

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