Master Project on seaweed genome size

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This master project is linked to the Research Council of Norway project NFR 280534 "Breed4Kelp2Feed" (HAVBRUK2). Today, cultivation of seaweeds is rapidly expanding worldwide, and Norway, with its extremely long coastline and well-established aquaculture industry, has a huge potential for value creation from seaweed cultivation. Breed4Kelp2Feed aims to initiate breeding of kelp (a group of marine brown seaweeds) designed for sustainable production of high yields with improved quality for multi-purpose biomass utilization.

The genome size or C-value is the amount of nuclear DNA in a cell which represents multiples of the minimum amounts of DNA corresponding to the non-replicated haploid chromosome complement. The nuclear DNA content is used in a wide range of biological fields e.g. as a predictor of phenotypic characters at cell, tissue or organism level. It also provides key information for a better understanding of the life history (as in the seaweeds), and it have been related to patterns of both invasiveness and evolution. Inducing changes in ploidy is used as a tool in crop breeding to increase yield, modify other traits or to introduce sterility and seedless fruits. Several studies have reported natural polyploidy in seaweeds, e.g. in the orders Laminariales and Fucales. Nevertheless, there is little knowledge on the genome sizes of seaweeds.

In this MSc thesis project, you will determine the nuclear DNA content of seaweeds based on image analysis of DAPI-stained specimens (microfluorometric analysis).

You will also characterize the variation of the level of intraindividual ploidy considering the wide range of cell sizes in individual thalli of brown algae, using sporophytes of sugar kelp (*Saccharina latissima*) as the model organism. And you may also investigate the variation in nuclear DNA content between the sexes of gametophytes of *S. latissima* from our culture collection. Nuclear DNA content data obtained will be incorporated into the database of plant genome sizes. Furthermore, you will do experiments to study the effect of different treatments with selected chemical compounds (e.g., colchicine and oryzalin) on the genome size of such gametophytes.

In this master thesis project, you may also take part in keeping our gametophyte collection at NMBU, giving you insights in macroalgae cultivation under controlled conditions.

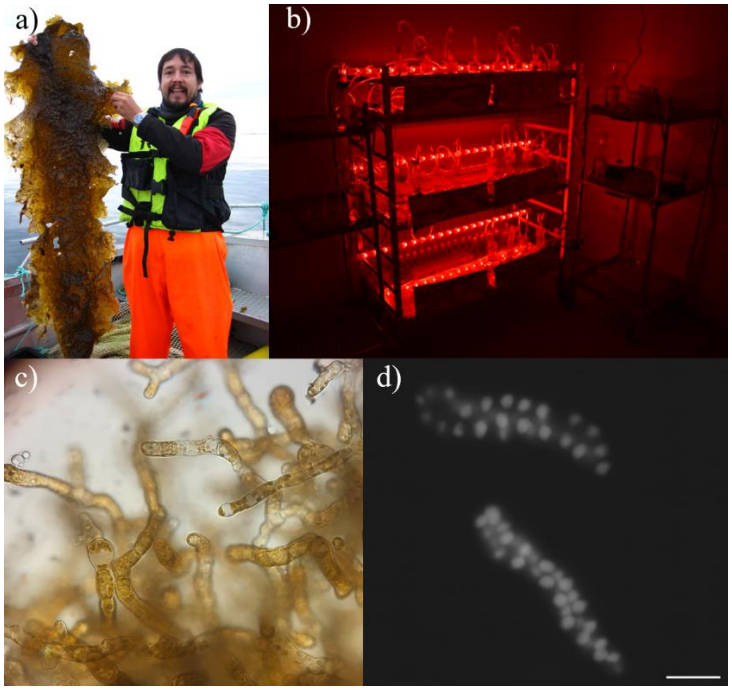

Figure 1. a) Sampling seaweeds in the fjord. **b)** Culture collection and gametophyte lab of sugar kelp (*Saccharina latissima*) at NMBU. **c)** Gametophytes of sugar kelp. **d)** Mature sporangia of giant kelp *Macrocystis pyrifera* stained with DAPI. Scale bars (1d): 5 μm (from Salvador Soler et al. 2019).

Related literature

Kapraun D.F. 2005. Nuclear DNA content estimates in multicellular eukaryotic green, red and brown algae: Phylogenetic considerations. Annals of Botany 95:7-44.

Phillips n., Kapraun D. F., Gómez Garreta A., Ribera Siguan M. A., Rull Lluch J., Salvador Soler N., Lewis R. & Kawai H. 2011. Estimates of nuclear DNA content in 98 species of brown algae (Phaeophyta). AoB Plants 11(1):1-8.

Salvador Soler N., Rull Lluch J. & Gómez Garreta A. 2019. Intraindividual variation in nuclear DNA content in *Durvillaea antarctica* (Chamisso) Hariot, *Macrocystis pyrifera* (Linnaeus) C. Agardh and *Lessonia spicata* (Suhr) Santelices (Phaeophyceae). Cryptogamie, Algologie 40(2):5-12.