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Evaluation of the Danish cultivated sugarkelp as possible future source of ingredients such as minerals and pigments

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The seaweed *Saccharina latissima* (sugarkelp) is cultivated near a fish and mussel farm, Hjarnø Havbrug A/S near Horsens Fjord in Denmark (Figure 1). The sugarkelp is cultivated commercially for the bioremediation (waste water management) of especially nitrogen, and the valuable biomass then sold and used for various purposes such as food or potentially as a feed supplement. Generally, seaweed is known for their nutraceutical application, but also for being able to accumulate e.g. very high iodine concentrations and unwanted heavy metals (Holdt and Kraan, 2011). In this study, the year-round minerals (incl. trace and heavy metals), pigments and vitamins (vit A and E), were analysed to evaluate the nutritional value, possible risks and harvest time of the *S. latissima* biomass for optimized value and application.

Rope cultivated sugarkelp was sampled both in close proximity to a blue mussel and fish farm (IMTA; see Figure 1) and in a reference/control site, both outside Horsens fjord in Denmark. Sugarkelp biomass was measured from 1m rope droppers (n=3) at 2 m depth in 2013-2014 (deployed in February 2013). Biomass was weighed, followed by freeze drying, homogenizing, frozen before further chemical characterization by various methods for the specific analyses of biomass composition.

Surprisingly high concentrations of potassium (K) and calcium (Ca) were found in the sugarkelp, and also the other trace metals Cr, Fe, Mn, Co, P, Na, Zn, and Se were found. The unwanted elements such as Cu, Hg, As, and inorganic arsenic were below legislative threshold values, whereas a few samples of Cd and Pb were problematic in some seasons, but not considering the recommended daily intake. The iodine was found in so high levels (up to 5 g/kg) that this will be the limiting element for the daily recommended intake of sugarkelp. The pigment profile did not change during the year, however the concentration did, and with fucoxanthin as the most interesting. Generally the year-round variations were due season, and not between the two locations (reference and IMTA), so harvest time are important for optimized use, and may be conflicting with highest yields of sugarkelp.

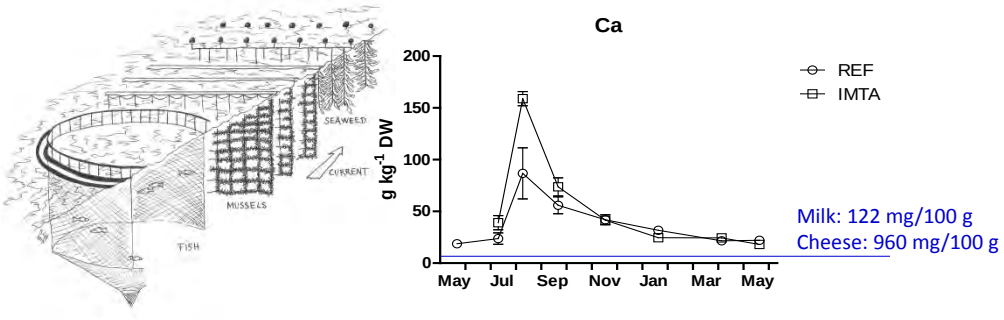

Fig. 1 Left: Integrated Multi-trophic Aquaculture with the fed organisms (fish), filtrating (mussels) and assimilating (seaweed) organisms combined. Right: Year-round calcium contentration (g/kg dry weight) of the sugarkelp. Levels of calcium from milk and cheese are inserted for comparison (source: www.foodcomp.dk).

Reference: Holdt, S.L., Kraan, S. (2011). Bioactive compounds in seaweed: functional food applications and legislation. *Journal of Applied Phycology*, 23, 543-597