

Integrated multi-trophic aquaculture (combined production of fish, mussels and seaweed)

Susan L. Holdt^{*1}, Goncalo S. Marinho², Irini Angelidaki²

1: DTU Food; 2: DTU Environment

*suho@food.dtu.dk

The Danish marine aquaculture has only been slowly increasing over the last 25 years because of the imposed limits to the nitrogen (N) released to the environment, despite the huge potential. Mussels, seaweed and other species have been successfully tested as biofilters in integrated multi-trophic aquaculture (IMTA) worldwide, where waste (especially N) from e.g. fed fish production can be filtrated and assimilated into these valuable biomasses/resources (Fig. 1). This IMTA production unit and even decoupling of the biofilter organisms have been recognized by the Danish national authorities in off-shore fish farming. The bioremediation potential and yield of the new crop seaweed (sugarkelp, *Saccharina latissima*) was monitored in a commercial off-shore IMTA system year round at Hjarnø Havbrug fish farm near Horsens. Furthermore, the year-round protein, amino acid, fatty acid, mineral and vitamin content and profiles were considered to evaluate the nutritional value and harvest time of the seaweed biomass.

Sugarkelp showed to be efficient for bioremediation of nitrogen, with environmental and potentially economic benefits (e.g. waste water management and for application of biomass). Protein content varied throughout the experimental period with the highest values recorded in November (14-20%) and the lowest values recorded in May-July (2.8-6.7%). The lowest lipid content was observed in July, while the highest values were observed in November (approx. 4%), with EPA (20:5(n-3)) and DHA (22:6(n-3)) accounting for 11.3-14.4% and 2.5-4.6% of total lipids, respectively.

This “new” Danish crop may have many applications, but the harvest time should be settled around May for human consumption and September in order to achieve maximum biofiltration efficiency with harvested biomass for feed utilization. This considering both biology/life cycle, biofouling and yield, which may compromise with higher nutritional value of the produced biomass in other seasons.

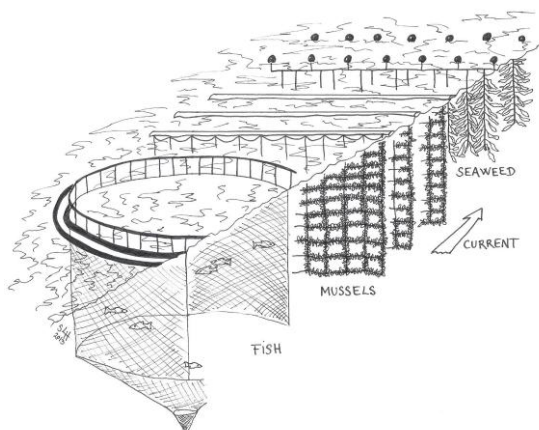


Fig. 1 Integrated Multi-trophic Aquaculture with the fed organisms (fish), filtrating (mussels) and assimilating (seaweed) organisms in a combined production unit (Holdt and Edwards, 2014).

Reference: Holdt, S.L., Edwards, M.D. (2014) Cost effective IMTA: Comparison between seaweed and mussel biofilter. *Journal of Applied Phycology*, 26, 933-945