Seafarm Future Workshop: Summary of Findings

seafarm Makroalger för ett biobaserat samhälle

- **ECONOMIC** viability is likely to depend on the results of FA3 research, notably the value and volume of products that can be fractioned from the algae.
- There is a lot of **HYPE** surrounding algae research at the moment; it should be addressed strategically for the long-term good of the Swedish algae industry.
- Locally **ADAPTED** and genetically **DIVERSE** specimens of *S. latissima* will be the most productive and resilient to cultivate. Furthermore, new **CULTIVATION TECHNOLOGIES** are emerging that could reduce labor requirements, facilitate seeding, reduce environmental impacts and cut costs.
- The provision of **ECOSYSTEM SERVICES** should be understood and accounted for.
- **PERMITS** are likely to be a complicated obstacle for further expansion of a West coast algae industry, due to aesthetics issues and related risks of **PUBLIC AVERSION** from locals and summer residents, competition with other water uses (e.g. leisure boating) and a lack of a legal framework to certify coastal aquaculture.
- Market analysis should be conducted for the potential **PHYCO-PRODUCTS** that could be produced at the biorefinery.
- The **ALGAE POTENTIAL** of the Swedish West coast should be estimated to assess the long-term potential and sustainability of this industry.
- Perhaps most crucially, Seafarm researchers should **WORK TOGETHER** notably in FA2/FA3 to coordinate fraction stream processes as well as to avoid wasting resources by reinventing the wheel.

FA1 Cultivation of macroalgae

Unknown factors: Ice, wind, waves, storms, depth, salinity, nutrients and water pollution, temperature, precipitation, seasonal changes, fouling, emissions, effects on local biodiversity

Promising potential: Financial compensation for ecosystem-services; Economies of scale from large cultivation; Sharing infrastructure with existing wind or mussel farms; Seasonal components

Warnings: Seeded algae must be genetically diverse; Fouling is an important factor to work around; Identify disease risks; Diversify cultivated species (more than just *S. latissima*); Complex licensing process; Regional competition

Research should focus on: Cultivation potential on the West coast & scale-up of Seafarm cultivations; Effects and minimisation of fouling; Conflicts of interest and suitable locations (using GIS); Infrastructure design (visually attractive and locally adapted); Knowledge transfer from past projects; Cost-effectiveness; Information to support licensing and facilitate the development of new legislation

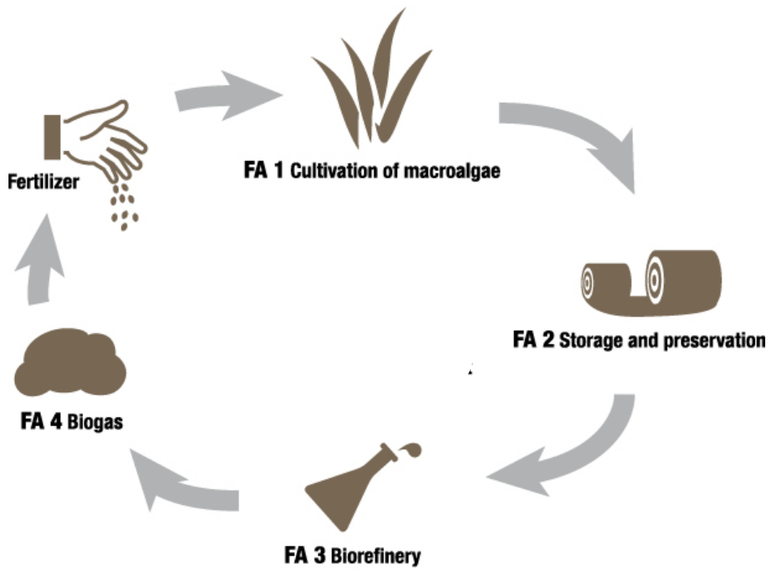
FA2 Storage and preservation

Unknown factors: how to preserve nutrients, unknown quantity of algae input and storage time, natural degradation over time, preservation/silage methods, volumes of algae, cost-benefits of transporting wet/dry biomass

Promising potential: Could reduce the size and cost of the biorefinery by providing a year-round supply of biomass rather than a large quantity immediately after seasonal harvest; Could be used as a pre-treatment stage or micro-refinery for fragile/high-value components that cannot be stored

Warnings: drying processes can destroy interesting components (lipids, etc.); Energy intensive and costly

Research should focus on: Knowledge transfer from existing large-scale algae producers (e.g. Japan); Efficiency and cost-effectiveness of drying & storage methods; Natural degradation and artificially controlled degradation time frames



FA3 Biorefinery

Unknown factors: Extraction methods of potential products (beta-glucan, omega 3, bio-plastics, nutraceuticals, phosphorus, etc.) and organise these in a linear fraction order; Low value bulk production vs. high value specialised production; Role and treatment of heavy-metals and pollutants; Extraction costs

Promising potential: This is the key to the whole system's economy; high value products with established markets (agar, carrageenan, etc.); Not much competition; Potential to substitute fossil products of existing markets; Collaboration with other biomass processing industries (wood & pulp, agriculture, etc.)

Warnings: Legislation not adapted to algae products; Heavy metals content; Limited number of parallel fractions possible; Avoid non-eco-friendly extraction substances; Potentially hazardous bi-products

Research should focus on: Extraction methods, potential high-value products and linear fractionation process; focus on a few selected products and perfect their extraction; maintain communication with other biorefinery researchers to organise the fractioning process

FA4 Biogas, feed and fertilizer

Unknown factors: Uncertain input biomass composition/volumes/water content; Optimal fermentation/digestion conditions for S. latissima (acidity, temperature, bacterial mixtures, mixed with other substrates, moisture levels, etc.); What types of nutrients, minerals and pollutants would digestate/fertiliser contain; Need for purification to higher grade biofuel

Promising potential: Biogas could supply internal demand for fuel (transport, harvest, etc.); Transforms the system waste into useful fertilisers and biofuel; Recycling of nutrients in the ocean back to agricultural land; Share existing digestion infrastructure; Combine with other digestates

Warnings: Agricultural certification required; Biogas quality unknown; Heavy metal residues need to be removed; Low value products

Research should focus on: Knowledge transfer from past algae for biogas projects (BioMara); Digestion process; Certification requirements