BIM EMFAF Work Programme Project Report 2023

BENEFICIARY:	Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER:	23/KGS/STS-BG011-BR110
NAME OF PROJECT:	**Seaweed Development Services**
IMPLEMENTATION PERIOD:	1st January to 31st December 2023

Project Scope

A growing global population, the depletion of resources, environmental pressures, and the impact of climate change require a different approach to food and economic systems. For this to happen, it is essential to develop new and sustainable ways of feeding a rapidly growing global population. The EU Algae Initiative published late in 2022 aims to contribute to that by making wider use of the vast and too little used resource that is the seas and the oceans – currently the source of only up to 2% of human food, despite covering over 70% of the Earth's surface.

Despite the many possible applications algae can offer, the seaweed industry in Europe is still very much at an embryonic stage, mainly focused on the harvesting of seaweed from the wild rather than cultivation in aquaculture. With the EU Algae Initiative, the Commission wants to unlock the potential of the EU algae sector, supporting the development of upscaled regenerative algae cultivation and production. Such an industry may harness the potential of vast European seas, but also of production on land, while creating jobs for local communities also beyond coastal areas, producing healthy low-carbon products, regenerating coastal ecosystems (e.g. fixing CO2 and nutrients and generating oxygen), and providing ecosystem services.

Globally, the major use for seaweed has been for human consumption with calls for increasing consumption of seaweed as a sustainable food source and for use in the manufacture of functional foods. Secondary uses of seaweed include processed, powdered forms used in industrial processes for hydrocolloid extraction to supply the food and cosmetic industries as texturizing agents and stabilizers. Smaller but significant volumes of seaweed are also sold and processed for use in various animal and aquatic feeds, specialised fertilizers, and biotechnology applications.

Demand for high quality seaweed for use in nutraceuticals and pharmaceuticals is also increasing. This is reflected in Europe where the seaweed market is worth €840 million, compared to a global value of €8.4 billion. Seaweed aquaculture has emerged as the prime response to this increased demand, providing traceable, high quality and predictable yields, whilst at the same time avoiding any over exploitation of wild stock. Arising from a recent strategic review of the seaweed sector in Ireland there is a critical need to expand the range of species under cultivation, to drive increases in biomass output from licenced sites. This should be aligned to sector specific market analysis to profile the demand and opportunities, to provide a credible economic case for targeted sectoral development and investment which will help drive the industry forward, build confidence amongst seaweed producers, processors, and other stakeholders.

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Objectives

- The completion of a supply and value chain analysis for the Irish seaweed sector including an analysis of competitor and comparable countries (France, United Kingdom, and Norway).
- An examination of the sexual life cycle of Porphyra spp. Focus on P. umbilicalis to investigate the potential for aquaculture of this species in Ireland.
- Kelp Sporulations and maintenance (*Saccharina latissimi and Alaria esculenta).*
- Trials of three different collector string types at sea at various locations around the Atlantic coast, this objective was included at this time due to supply chain issues with the traditional Kuralon. This means that 2mm Kuralon is becoming increasingly difficult to source in China or Japan and is the most expensive string medium.

Outcomes

Value and supply chain analysis

Supply and value chain approaches are regarded as effective approaches for market analysis and development. In order for the sector to meaningfully develop, seaweed farmers and processors in Ireland need credible, current and detailed information on available market outlets for Irish species (existing and potential – including nutraceuticals, cosmetic and food), existing and potential price points in those different markets, the technical and quality/purity requirements and the extent of on-farm processing which may be required to prepare material for market, the availability of primary processing facilities, the stages of the processing chain and ultimate end users, among other supply chain questions. This project also sought opportunities for product/market differentiation (wild vs cultivated). This was aligned with an analysis of competitor and comparable countries to guide the sustainable development of the Irish sector, including a review on suitable business models utilised in other countries or food sectors for small-scale, high-quality food producers, that could benefit Irish seaweed sector. The final report of this analysis will be available for publication towards the end of Q1 2024.

Porphyra

Porphyra spp. commonly known as nori or purple laver, is a globally consumed edible red algae. Its cultivation has gained significant traction in recent years due to its high market value and environmental sustainability compared to wild harvesting. The cultivation process involves a complex life cycle that transitions between two distinct phases: the conchocelis phase and the foliose phase. The conchocelis phase, a microscopic filamentous stage, serves as the reproductive stage, producing spores called conchospores. These conchospores, upon germination, give rise to the edible foliose or thallus phase, characterised by its flattened leafy appearance. Trials in 2023 examined the intricacies of P. umbilicalis cultivation, particularly the conchocelis, conchosporangia, and conchospore stages that underpin the life cycle.

Porphyra plants, conchospores, conchosporangia and conchocelis grew well in the lab environment. We have proven that it is possible to grow *Porphyra umbilicalis* from material sourced in the wild and upscale from spores on petri dishes to plants in flasks. Arising from this work project providers are currently trialling the development and growth of plantlets on Kuralon string with the aim to put a short line at sea early January 2024. Further studies in 2024 could focus on the growth of conchocelis biomass from a few contamination-free filaments of conchocelis. Most of the biomass from 2023 will be kept dormant, so as not to trigger the development of conchosporangia and ensuring there would continually be stock available for successional ‘sowing’. A subset will be induced for conchosporangia development and subsequent release of conchospores. These could ultimately lead to the growth and harvesting of plants in tanks. The final report provides a comprehensive overview of the cultivation techniques, emphasising the critical role of optimising conchocelis growth and conchospore release, and will be available for publication towards the end of Q1 2024.

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Kelp Sporulations and Maintenance

Saccharina latissimi blades were collected in late January 2023. The blades were very ripe and there was no obvious epiphytic growth along the blades. The ripe sori were cut from twenty blades and cleaned thoroughly. The sori were then submerged in 10l of UV filtered seawater and 5mls of sodium hypochlorite for eight minutes to reduce the risk of any possible contamination. The sori were subsequently washed three times in UV filtered water, dried using lab paper and washed twice more before drying thoroughly with paper and placed in a dark incubator at 10°C for 24 hours. The next day the sori were immersed in 500ml of UV filtered water. The spore release was very fast and dense. The sporulation was stopped after 20 minutes. The spore solution was poured through 40µm filters into four 4l flasks along with the nutrients. The flasks were placed in a constant temperature room at 10°C under constant white light (20 µmol photons m-2 s -1) to allow the spores to develop into gametophytes. The temperature was gradually increased to 14°C over four days. Initially all flasks were kept under white light however three of these flasks were subsequently moved to red light following observations of slow elongation of spores. Further collections took place from February to mid-March with the final Saccharina sporulation carried out in mid-March. At this stage the distal ends of the blades were disintegrating however, the sori were very ripe.

Multiple sporulations of *Alaria esculenta* were conducted at BMRS during March and April 2023. The majority of ripe sporophylls were collected from wild populations in the Gearhies vicinity, within 500 metres of the marine station. In general, ripe sporophylls were scarce in early 2023. This coupled with stormy weather during the spring tides made it more difficult to collect ripe sori for sporulations. It was possible to find ripe sporophylls in Bantry Bay from mid-March to mid-April. By April 19th most of the sori were spent/empty in the Gearhies area. Standard sporulation protocol, cleaning and culture renewals were performed. It was still possible to source ripe sporophylls further north in Bemullet, Co. Mayo. Ripe sporophylls were delivered to the lab on 20th April 2023. These were successfully sporulated and cultured in the laboratory. This was the first time that ripe material that had travelled to the lab by post was successfully sporulated. This finding may well prove useful in future years if hatcheries wish to supply collectors seeded with spores sourced from the geographical location of the various farms around the coast.

All the sprayings worked successfully and where collectors were deployed to sea promptly the blades started growing quickly. Eight project partners received seed string. As with previous years some project partners delayed, postponed, and even cancelled participation at very short notice. Fortunately, these were generally small orders, and the problems were due to lack of funding or license approval not being finalised. The optimum time for collector deployment is four to six weeks post spraying.

String Trials

On 5th September 2023, as part of the first batch of sprayed collectors, contractors sprayed a minimum of 16 collectors each using the three different string types. These collectors were held in the laboratory for the usual four to five weeks and then distributed to four farms around the coast. The farmers included in the trial are Gerry Gallagher Mulroy Bay, Lorraine Gallagher aka Green Turtle Seaweed Mulroy Bay, Anthony Irwin Belmullet Bay and BMRS Bantry Bay.

The participating farmers were asked to put one of each of three string types along one longline to reduce the impact of site variability. Once a month between February and harvesting the farmers will be required to take three x 50cm long samples of the seaweed from each of the three string sites, so in each sampling day they should have a total of:

- 3 x 2mm string seaweed weights,
- 3 x 1.6mm string seaweed weights and,
- 3 x 1mm string seaweed weights.

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These weights will be recorded and sent to BIM for analysis of variance of the three string types. Results of this trial will be published with the final technical report in Q1/Q2 2024.

Summary of Project Spend

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Total Approved Costs	€246,000
Total Eligible Expenditure	€245,582
EMFAF Eligible Expenditure	€122,791
Exchequer	€122,791

Project Partners: Marine Institute

Report by: Joanne Gaffney

Date: February 2024

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