BLUE ECONOMY
COOPERATIVE RESEARCH CENTRE

Australian Government
Department of Industry, Science and Resources

AusIndustry
Cooperative Research Centres Program

Developing Production Systems for Offshore Kelp Mariculture

Summary

The global seaweed market is valued currently at >US$6B annually and is growing rapidly, however in Australia the seaweed industry and associated product development is nascent. Several independent analyses have identified considerable opportunities for Australia in building a modern and sophisticated industry based on seaweed production at commercial scale and developing seaweed-based bioproducts.

This project seeks to develop technologies suitable for commercial scale offshore kelp production off southeast Tasmania in particular, but which could also be deployed in offshore environments elsewhere in Australia and New Zealand.

The project will review, design and trial offshore production systems for kelp mariculture, further select for kelp genotypes to cope with ocean warming, assess the performance and potential impact of the kelp production system, and use these empirical measures to model production, environmental impacts (positive and negative) and economic viability of kelp mariculture at commercial scales.

In parallel, we will review, assess and recommend changes to policy and regulatory frameworks to ensure unambiguous guidelines to achieve industry sustainability, environmental safeguards, and social licence. Project design reflects that industry development will require careful integration and coherence across all of these elements.

Goal

This Research Project is funded by the Blue Economy CRC and the eight Project Partners, and its overall goal is to develop, test and demonstrate technologies for offshore kelp mariculture that:

- are scalable,
- are economically viable,
- achieve positive environmental outcomes,
- attract strong social licence,
- and are supported by appropriate policy and regulatory frameworks.

Project ID
2.21.005

Research Program
RP2 Seafood & Marine Products

Project Leader
Craig Johnson, University of Tasmania

Start Date
November 2022

End Date
October 2024

Duration
24 months

Partners
- University of Tasmania (Institute for Marine & Antarctic Studies, Australian Maritime College)
- Southern Ocean Carbon Company
- Huon Aquaculture
- Climate Foundation
- BMT
- CSIRO
- Department of Natural Resources & Environment (Tasmania)
- Deloitte

The Blue Economy CRC is funded in part under the Australian Government's CRC program administered by the Department of Industry, Science and Resources.

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Project Phases

The research project is designed in two phases. Phase I will focus on:

- engineering design, including modelling and testing of scale models (using facilities at AMC),
- in-water testing of a modular mariculture unit at a relatively sheltered site,
- extensive monitoring of the in-water trial,
- modelling to inform site selection for Phase II,
- analysis and development of a policy and regulatory framework to underpin seaweed mariculture in Tasmania,
- and economic analyses comprising an economic viability assessment and natural capital accounting evalution.

Phase I will be completed over two years and is funded at $3.242M.

Phase II is not yet funded since whether it is sensible to proceed with Phase II depends heavily on the results from Phase I. If Phase II does proceed, it will take place over 2.5 years and focus on in-water testing and trials at an off-shore site in SE Tasmania to be determined.

Project Elements

Engineering – Solving the 'nutrient problem'

A key challenge facing growing kelp commercially in Tasmania is that surface waters do not contain sufficient nutrient (nitrogen) to ensure sufficient growth rates for economic viability. The project will address two potential solutions, (i) growing kelp adjacent to salmon farms (which provide a source of elevated nitrogen in the form of ammonia), and (ii) utilising the elevated nitrogen (in the form of nitrate) that occurs in deeper waters (>80 m) of the continental shelf.

To access the nitrate in deeper waters, two technologies will be developed and assessed, viz. (i) using wave energy to pump water from 80-100 m depth to irrigate kelp growing at the surface, and (ii) a depth cycling system in which kelp are lowered into the deep nutrient-rich waters at night to take up nutrient, and then returned to the surface during the day for photosynthesis.

Phase I will design, model, and test these technologies as scaled models in tank facilities at AMC. Phase I will not build or deploy full scale versions of these technologies.

Engineering – farm infrastructure and systems

This element will trial use of typical aquaculture 'ring' designs for growing kelp. In-water deployment over ~18 months will enable developing and testing systems for kelp deployment, monitoring and harvesting. The deployment will involve one large aquaculture ring (53 m diam) and three small rings (18 m diam). The preferred deployment site is in the Tinderbox region south of the Blackmans Bay wastewater treatment facility. This location is relatively sheltered and thus suitable for initial testing and research, and supports elevated nutrient levels conducive to kelp growth and survival. We are aware of discussion around aquaculture rings and associated infrastructure in the Channel, and will undertake face-to-face and written consultation with stakeholders prior to deployment to explain the aims of this work

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The rings will largely support giant kelp (Macrocystis pyrifera) but wakame (Undaria pinnatifida) will be grown on one of the small rings. Both species currently occur on the low profile coastal reef adjacent to the proposed deployment site. Undaria will be harvested before it becomes reproductive. This design will enable the project to test different genetic lines, different harvest strategies, and different types of grow-out lines.

A growth trial will also be established adjacent to an existing salmon farm in the Huon / D'Entrecasteaux region in which kelp will be deployed on a line that is part of the existing farm infrastructure.

Monitoring

The project will include extensive monitoring of kelp, fish, birds, mammals, zooplankton and the kelp epiphytic microbial community at the trial sites and at appropriate control sites.

Coupled hydrodynamic/biogeochemical modelling

To identify potentially suitable areas for the location of Phase II, the project will analyse existing multi-year hindcast coupled hydrodynamic/biogeochemical model simulations of currents, waves and water quality in southeast Tasmania.

Policy Analysis & Development

Tasmania's policy and regulatory framework provides a management regime for mariculture, but until recent years this regime has only been applied to the finfish and shellfish aquaculture sectors. Thus, the project will work with NRE to assist with new policy development to design a framework that enables contemporary management of seaweed aquaculture in Tasmania. This will include (i) a systematic content analysis and process tracing of current policy documents and legislation that impact on kelp production and management; (ii) literature review and desktop analysis of regulatory arrangements for seaweed production elsewhere in the world (largely Scotland, Norway and Japan); and (iii) interviews with industry members and policy-makers on current policy and regulation and future options.

Economic Assessment

All other elements of the project will feed into economic analyses of growing kelp offshore at commercial scale. These analyses will include both a 'traditional ' economic viability assessment, and a natural capital accounting evaluation.

Permissions

Permissions for this research project will be required from the Department of Natural Resources & Environment Tasmania, and Marine & Safety Tasmania. We also see broad stakeholder acceptance of this research project as important, and will engage with a broad spectrum of stakeholders to explain our aims, the process, and answer any questions.

Contact & Further Information

Further information about this project can be obtained from the Project Leader, Professor Craig Johnson, IMAS (Craig.Johnson@utas.edu.au).

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