Australian Seaweed Industry Blueprint Implementation Plan



AgriFutures® Emerging Industries

by Jo Kelly, Australian Seaweed Institute November 2022

Australian Seaweed Industry Blueprint Implementation Plan

A way forward to grow the Australian seaweed industry

by Jo Kelly, Australian Seaweed Institute

November 2022

AgriFutures Australia publication no. 23-010 AgriFutures Australia project no. PRJ-012802 © 2023 AgriFutures Australia All rights reserved.

ISBN 978-1-76053-351-9 ISSN 1440-6845

Australian Seaweed Industry Blueprint Implementation Plan Publication no. 23-010 Project no. PRJ-012802

The information contained in this publication is intended for general use to increase knowledge and discussion, and the long-term prosperity of Australian rural industries.

While reasonable care has been taken in preparing this publication to ensure that information is true and correct, the Commonwealth of Australia gives no assurance as to the accuracy of any information in this publication. You must not rely on any information contained in this publication without taking specialist advice relevant to your particular circumstances.

The Commonwealth of Australia, AgriFutures Australia, the authors or contributors expressly disclaim, to the maximum extent permitted by law, all responsibility and liability to any person, arising directly or indirectly from any act or omission, or for any consequences of any such act or omission, made in reliance on the contents of this publication, whether or not caused by any negligence on the part of the Commonwealth of Australia, AgriFutures Australia, the authors or contributors.

The Commonwealth of Australia does not necessarily endorse the views in this publication.

This publication is copyright. Apart from any use as permitted under the *Copyright Act 1968*, all other rights are reserved. However, wide dissemination is encouraged. Requests and inquiries concerning reproduction and rights can be made by phoning the AgriFutures Australia Communications Team on 02 6923 6900 or emailing info@agrifutures.com.au.

Author contact details

Jo Kelly Australian Seaweed Institute

0466 349 508 jo.kelly@australianseaweedinstitute.com.au

AgriFutures Australia contact details

Building 007, Tooma Way Charles Sturt University Locked Bag 588 Wagga Wagga NSW 2650

02 6923 6900 info@agrifutures.com.au www.agrifutures.com.au

In submitting this report, the author has agreed to AgriFutures Australia publishing this material in its edited form.

AgriFutures Australia is the trading name for Rural Industries Research and Development Corporation (RIRDC), a statutory authority of the Australian Government established by the *Primary Industries Research and Development Act 1989.*

Research investments made or managed by AgriFutures Australia, and publications and communication materials pertaining to those investments, are funded by industry levy payers and/or the Australian Government.

Cover image: Juvenile giant kelp (*Macrocystis pyrifera*) growing on a longline in Storm Bay, Tasmania. Photo: Cayne Layton, Institute for Marine and Antarctic Studies, University of Tasmania.

Foreword

The Australian Seaweed Industry Blueprint – A Blueprint for Growth was published in 2020, highlighting the opportunity for the Australian seaweed industry to achieve \$100 million gross value of production (GVP) by 2025. The Blueprint detailed three critical success factors: (1) industry leadership and collaboration; (2) production capability and scale; and (3) innovation for the future, and if the designated research and development activities were completed, the industry would continually grow towards this GVP target.

To progress the blueprint, an implementation plan was required. Through extensive industry consultation, this *Australian Seaweed Industry Blueprint Implementation Plan* was developed. This Implementation Plan, across two sections, details to industry how the Blueprint will be executed to advance the critical research, development and extension priorities identified.

Section 1 addresses six R&D streams of work identified in the Blueprint as being central to industry growth over the next four years:

- 1. Blueprint engagement
- 2. Blueprint delivery plan
- 3. National Hatchery Network concept design
- 4. National seaweed industry group establishment
- 5. Cluster planning framework
- 6. Space planning and policy audit seaweed ocean aquaculture.

Section 2 further details the concept design for a National Hatchery Network (NHN). The concept design pulls together principles and resources that when implemented will provide the industry with knowledge of native seaweed species and their cultivation techniques. The proposal for a centralised network aims to build capability to solve the industry's major R&D challenges relating to hatchery techniques, strain selection and disease over coming decades, and provide a forum to deliver this information to stakeholders.

This Implementation Plan has been produced as part of AgriFutures Australia's Emerging Industries Program, which focuses on new industries with high growth potential. Emerging animal, aquatic and plant industries play an important part in the Australian agricultural landscape. They contribute to the national economy and are key to meeting changing global agricultural product demands. Most of AgriFutures Australia's publications are available for viewing, free download or purchase online at www.agrifutures.com.au.

Michael Beer

General Manager, Business Development AgriFutures Australia

Contents

Foreword
Overview
Implementation Plan
National Hatchery Network
Section 1 – Implementation Plan7
Development of the Implementation Plan7
Australian seaweed industry development – one-page strategy
Industry development priorities9
Leadership and collaboration10
Production capability and scale11
Investment innovation
Estimated budget 13
Section 2 – National Hatchery Network concept design14
Section 2 – National Hatchery Network concept design
Section 2 – National Hatchery Network concept design
Section 2 – National Hatchery Network concept design
Section 2 – National Hatchery Network concept design
Section 2 – National Hatchery Network concept design
Section 2 – National Hatchery Network concept design 14 Objectives and outcomes 14 Concept design principles 15 Concept design resources 16 Facility requirements 16 People requirements 17 Key activities 17 Intellectual property requirements 18
Section 2 – National Hatchery Network concept design 14 Objectives and outcomes 14 Concept design principles 15 Concept design resources 16 Facility requirements 16 People requirements 17 Key activities 17 Intellectual property requirements 18 Implementation approach 20
Section 2 – National Hatchery Network concept design 14 Objectives and outcomes 14 Concept design principles 15 Concept design resources 16 Facility requirements 16 People requirements 17 Key activities 17 Intellectual property requirements 18 Implementation approach 20
Section 2 – National Hatchery Network concept design 14 Objectives and outcomes 14 Concept design principles 15 Concept design resources 16 Facility requirements 16 People requirements 17 Key activities 17 Intellectual property requirements 18 Implementation approach 20 Estimated timeline 21
Section 2 – National Hatchery Network concept design 14 Objectives and outcomes 14 Concept design principles 15 Concept design resources 16 Facility requirements 16 People requirements 17 Key activities 17 Intellectual property requirements 18 Implementation approach 20 Estimated timeline 21 Estimated budget 22
Section 2 – National Hatchery Network concept design 14 Objectives and outcomes 14 Concept design principles 15 Concept design resources 16 Facility requirements 16 People requirements 17 Key activities 17 Intellectual property requirements 18 Implementation approach 20 Estimated timeline 21 Estimated budget 22 Section 3 – Implementation Plan outcomes 23

Overview

Implementation Plan

The *Australian Seaweed Industry Blueprint* published in 2020 highlighted the opportunity for the Australian seaweed industry to achieve \$100 million gross value of production (GVP) by 2025. Included in the Blueprint was a Research, Development and Extension (RD&E) Plan containing activities that once completed would help the industry realise that potential. Only parts of that RD&E Plan were funded at the time, and 18 months on many initiatives on that list still require funding.

This project has extended the work done developing the Blueprint through further engagement with industry participants to define how wider industry development priorities will be implemented over the coming four years. The outcome is this Implementation Plan.

The Australian Seaweed Industry Blueprint Implementation Plan aims to leverage the biggest opportunities for the industry and address the key barriers to growth. These are:

- **Opportunities:** Large-scale marine aquaculture; cattle feed for methane reduction; and high-value bioproducts
- **Barriers:** Regulation and policy; knowledge and workforce; and R&D funding and coordination

An industry development needs analysis considered the requirements of existing businesses, future new entrants and other stakeholders (government, the general public and investors). For each of the prioritised needs, an initiative was identified and a high-level scope for each is provided. Some of these are one-off projects, others are ongoing functions that an industry peak body would perform. Based on the scope, budgets have been estimated and appropriate delivery methods and possible funding sources have been identified.

The top four priorities highlighted by industry participants are:

- Industry governance, communications, engagement and extension the formation of a peak industry body was achieved in 2021 and engagement with government stakeholders throughout 2021 has yielded very strong results. This work needs to be ramped up to continue building good federal and state government relations, and to communicate information on the seaweed industry opportunity for Australia.
- Seaweed policy reform there is a need to develop a national policy working group for seaweed aquaculture that has direct connection with all states, with the purpose to fast-track industry development.
- National Hatchery Network (NHN) this is the flagship project detailed in this Implementation Plan. The NHN would establish foundational seaweed hatchery capability (infrastructure, people and techniques) in key locations to support industry growth and accelerate industry development. A concept design for the NHN has been developed through multiple workshops with industry stakeholders.
- **RD&E investment coordination and optimisation** with increasing interest and R&D investment in seaweed, there is a need for the Australian Sustainable Seaweed Alliance (ASSA) to play a crucial role in advising and directing government seaweed investments to help ensure RD&E investment delivers commercial outcomes.

National Hatchery Network

The development of a National Hatchery Network (NHN) was identified by industry stakeholders in the *Australian Seaweed Industry Blueprint* (Kelly, 2020) as a critical path activity to industry achieving \$100 million GVP by 2025.

This key initiative would address a shared constraint to industry development – the lack of knowledge of native species and cultivation techniques. Each seaweed startup is discovering it must employ a team of seaweed scientists and work out the life cycle and cultivation techniques from scratch. This shared problem across the industry makes it extremely difficult to raise capital, as there are no seedstock sources or hatchery techniques publicly available, both of which are required for cultivation. It is estimated generating this knowledge (including constructing a hatchery facility to build this knowledge) would cost each business upwards of \$1 million, and it would be many years before any seaweed is in the water. Therefore, the NHN is critical to the development of a large-scale seaweed industry in Australia.

A national hatchery concept is not new to the aquaculture industry and many good examples exist in Australia and internationally where government investment has been directed to kickstart an entirely new industry. This was the case with the salmon industry in Tasmania – a joint venture hatchery between a Norwegian company and the Tasmania Government in 1985 kickstarted the billion-dollar salmon industry that we have today. There are other examples also across prawns, finfish and shellfish where a significant government investment in seedstock production, workforce capability and R&D expertise has played a major role in driving the establishment and growth of Australia's seafood sector.

There are a number of regions across Australia where seaweed companies are looking to establish. Primarily, these are the Eyre Peninsula in South Australia, Tasmania's east coast, Eden in southern New South Wales, between Hervey Bay and Townsville in North Queensland, and Fremantle and the Abrolhos Islands in Western Australia. Each region is progressing at a different rate depending on state government approvals for aquaculture lease areas. Therefore, a hub-and-spoke model is proposed for the NHN that can be deployed with 'the right species in the right place at the right time'. Regional hatcheries are also necessary due to biosecurity requirements that stipulate seed stock must be collected from the local, native population and not moved between regions.

This concept design has been developed through multiple workshops with industry stakeholders. The resulting NHN concept design requires a \$28.4 million investment in people, facilities and intellectual property (IP) over a four-year timeline.

The NHN now needs funding and ASSA is taking on the development of the NHN as a key initiative to unlock the seaweed industry's potential within the next five years.

Section 1 Implementation Plan

Development of the Implementation Plan

A working group consisting of project partners Australian Seaweed Institute (ASI), the University of Tasmania (UTAS), Future Feed and CH4 Global provided guidance on development of the *Australian Seaweed Industry Blueprint Implementation Plan*.

Further, 10 industry participants provided input through one-to-one discussions. Key discussion points with industry participants included:

- Key challenges and opportunities for their business
- Key initiatives the industry could implement to support their business start or grow
- Pre-competitive, collaborative initiatives versus competitive initiatives that individual businesses will pursue on their own
- RD&E priorities for industry development.

Insights from three other international industry research programs were gathered through discussions and desktop research. The most closely comparable program is the European industry's GENIALG program, which received €11 million in funding from the European Union.

Discussions with program leads at the Marine Bioproducts Cooperative Research Centre (MBCRC) were taken into account, however research priorities for this program had not been confirmed at the time of the discussions.

ASSA's 10 corporate members discussed the industry RD&E Plan and priorities at ASSA roundtables in December 2021 and October 2022, and their feedback has been incorporated.

Australian seaweed industry development – one-page strategy

Industry mission: To accelerate development of a sustainable seaweed industry in Australia Industry goals: Grow GVP, jobs and SDG outcomes

Industry vision: A high-tech, high-value and sustainable seaweed industry that supports healthy oceans and thriving coastal communities

Pillars for success

Leadership and collaboration

Provide leadership and collaboration



Production capability and scale

Enable seaweed cultivation and product manufacturing at scale



Investment in innovation

Coordinate outcomes-driven innovation to optimise investment



Industry development priorities

Leadership and collaboration

Provide leadership and collaboration



Key initiatives

- 1. Industry governance, communications, engagement and extension
- 2. Seaweed policy reform working group
- 3. Markets and products assessments
- 4. International knowledge partnerships

Production capability and scale

Enable seaweed cultivation and product manufacturing at scale



Key initiatives

- 1. National Hatchery Network
- 2. Seaweed farmers licensing toolkit
- 3. Pest, disease and biosecurity review
- 4. Cultivation technology assistance program

Investment in innovation

Coordinate outcomes-driven innovation to optimise investment



Key initiatives

- 1. RD&E investment coordination and optimisation
- 2. Development of new products, species and technology

Leadership and collaboration

Initiative	Description of need	Outline of initiative
1. Industry governance, communications, engagement and extension	Fundamental and ongoing work is needed to communicate information on this emerging industry opportunity, engage key stakeholders and respond to issues as they arise. The industry would benefit from a central and objective information and communications hub that provides researched content to help inform and respond to questions from regulators, the general public, investors and government.	 Develop a stakeholder engagement and industry communications strategy. Develop seaweed industry information and education materials. Provide industry information to government, the general public and investors. Share information on research projects and conduct extension activities, including communications, engagement and knowledge sharing. Help industry manage public relations issues and questions as they arise.
2. Seaweed policy reform – working group	Significant changes to aquaculture policies at the state and federal levels are required to support a seaweed aquaculture industry in Australia. Aquaculture policy is highly variable between states and in many cases presents a significant roadblock to commercial development, being either non-existent and therefore difficult to navigate or overly complex, with timelines for approvals spanning into years in most states.	Develop a national policy working group for seaweed aquaculture with the Australian Fisheries Management Forum's National Aquaculture Committee Seaweed Policy Working Group. Facilitate states working together to develop a realistic and risk-appropriate regulatory and policy framework that supports the sustainable development of the industry.
3. Markets and products assessments	Detailed analysis of markets and products is required by industry to help inform existing and new entrants about the market and product opportunities and risks. A recent example is the AgriFutures Australia publication <i>The algae and seaweed opportunity: An Australian</i> <i>prospective,</i> which investigated omega-3 sources from algae and seaweed. It is suggested that at least one markets and products analysis is completed each year.	 Analysis of the market, product and economic opportunities in seaweed, including: Animal feed supplements and wellness products Environmental services and markets Australian edible seaweeds Bioplastics and biofabrics
4. International knowledge partnerships	Australia's emerging seaweed industry can learn a lot from the experiences of other countries with established aquaculture sectors. There is a need for stakeholders to see examples of seaweed farms in action, and to develop opportunities for knowledge and workforce transfer to support industry growth in Australia.	Take a delegation from industry and government to a target country each year. Trips could include tours of seaweed farms, processing facilities and central research facilities, and meetings with government officials, peak body representatives and businesses. A year one trip should be to South Korea, where a \$1 billion industry has developed in recent decades.

Production capability and scale

Initiative	Description of need	Outline of initiative
1. National Hatchery Network (NHN)* * Possible funding sources include, but are not limited to, government, RDCs, CRCs and industry.	This key initiative was identified by the seaweed industry to address a shared constraint to industry development – the lack of knowledge of native species and cultivation techniques. Each seaweed startup is discovering it must employ a team of seaweed scientists and work out the life cycle and cultivation techniques from scratch. This shared problem across the industry makes it extremely difficult to raise capital, as there are no seedstock sources or hatchery techniques publicly available, both of which are required for cultivation. It is estimated generating this knowledge (including constructing a hatchery facility to build this knowledge) would cost each business upwards of \$1 million, and it would be many years before any seaweed is in the water. Therefore, the NHN is critical to the development of a large-scale seaweed industry in Australia.	Establish foundational seaweed hatchery capability (infrastructure, people and techniques) in key locations to support industry growth and accelerate industry development. Accelerate the availability of seedstock/seeded ropes and hatchery techniques for seaweed growers. Build capability to solve the industry's biggest R&D challenges relating to hatchery techniques, strain selection and disease over coming decades.
2. Seaweed farmers licensing toolkit	Numerous potential growers who are looking to enter the industry identified the need for this project. There is a regular stream of enquiries to existing industry participants for this type of information or support. This toolkit would help seaweed businesses obtain ocean lease areas and aquaculture permits.	 Develop a seaweed farmers licensing toolkit. Some great toolkits have been developed in Europe and the USA, and could be replicated in Australia. The toolkit would comprise a number of component pieces, including: State-specific guidance on navigating the permits and approvals process Location and siting guidance for seaweed aquaculture licences Seaweed aquaculture project proposal example Risk assessment template Engineering design standard drawings Economic information for business plans.

3. Pest, disease and biosecurity review	This is a gap in knowledge for Australia as there is currently no seaweed industry established here.	Complete a literature review of seaweed pests and diseases known to affect target seaweed species, including kelps, <i>Asparagopsis</i> , <i>Undaria</i> and <i>Ulva</i> . Identify and assess biosecurity risks and management actions required to manage residual risks to an acceptable level. Identify any research gaps.
4. Cultivation technology – assistance program	Purchases of seaweed cultivation equipment have been at a very small scale and cultivation is at an early stage. Support for seaweed growers to trial different types of cultivation equipment is required as it can be difficult to get equipment to Australia in small quantities.	Secure funding to employ a Cultivation Technology Program Manager to work with growers to procure and trial equipment. The program would be staged to focus on the prioritised needs of industry. Equipment would include seaweed ropes/substrate, long lines, harvesting equipment, farm management software, quality testing equipment and processing equipment.

Investment innovation

Initiative	Description of need	Outline of initiative				
1. RD&E investment coordination and optimisation	Investment is currently fragmented into small-scale projects and a lack of focus/direction on industry needs has led to missed opportunities for industry development. There is a need for specific input from industry on investment.	Secure funding to employ an RD&E Coordinator within ASSA to maintain overview of all seaweed R&D investments and undertake liaison and extension activities between programs, funders and industry participants to optimise outcomes.				
2. Development of new products, species and technologies	The Marine Bioproducts Cooperative Research Centre (MBCRC) is a not-for-profit organisation that brings together more than 70 partners from academia and industry. MBCRC is driving Australia's transition to the 'third generation' of marine production (first generation is fishing, second generation is aquaculture) through investing in research and development of new products.					
	An Australian Government grant of \$59 million and co-funding from CRC partners means there is more than \$270 million to invest over 10 years. These funds support collaborative work in four key spaces:					
	• Establishing pathways from biomarine discovery to markets in health, nutrition, agriculture, aquaculture and biomaterials.					
	Creating and expanding sustainable marine bioresource production facilities.					
	Integrating marine science and biotechnology with industries in Australia and overseas.					
	Creating industry-ready graduates focused on taking discoveries out of the lab and into the economy.					

Estimated budget

The estimated budget to implement the Australian seaweed industry's 10 key initiatives over four years is shown in Table 1.

Table 1. Estimated budget to implement the 10 key initiatives.

Initiative	Year 1	Year 2	Year 3	Year 4	Initiative totals
1. Industry governance, communications, engagement and extension	\$350,000	\$250,000	\$250,000	\$250,000	\$1,100,000
2. Seaweed policy reform – working group	\$150,000	\$150,000	\$150,000	\$150,000	\$600,000
3. Markets and products assessments	\$50,000	\$50,000	\$50,000	\$50,000	\$200,000
4. International knowledge partnerships	\$50,000	\$50,000	\$50,000	\$50,000	\$200,000
5. National Hatchery Network (NHN)*	\$4,000,000 (including facilities cost of \$1,000,000)	\$6,200,000 (including facilities cost of \$3,000,000)	\$8,200,000 (including facilities cost of \$5,000,000)	\$10,000,000 (including facilities cost of \$7,000,000)	\$28,400,000
6. Seaweed farmers licensing toolkit	\$100,000	\$150,000			\$250,000
7. Pest disease and biosecurity review	\$100,000				\$100,000
8. Cultivation technology – assistance program	\$150,000	\$150,000	\$150,000	\$150,000	\$600,000
9. RD&E investment coordination and optimisation	\$100,000	\$100,000	\$100,000	\$100,000	\$400,000
10. Development of new products, species and technologies	This is a separate investment program under the MBCRC				
Annual totals	\$5,050,000	\$7,100,000	\$8,950,000	\$10,700,000	\$ 31,800,000
Totals excluding facilities	\$4,050,000	\$4,100,000	\$3,950,000	\$3,700,000	\$ 15,800,000

* Possible funding sources include, but are not limited to, government, RDCs, CRCs and industry.

Section 2 National Hatchery Network concept design

A hatchery facility is required to build knowledge of native species, their life cycles and cultivation techniques. A working group consisting of project partners ASI, UTAS, Future Feed and CH4 Global provided input into the concept design. A series of five workshops were run with the working group covering:

- Existing examples from other industries
- The scope and objectives of the NHN
- Concept design principles and model
- Resources and costings
- The Implementation Plan.

Insights from three shared/national hatchery models used in parallel industries, e.g. salmon, prawn, shellfish, finfish industry, were gathered and considered during development of the concept design.

Further, ASSA's 10 corporate members discussed the concept design at an ASSA roundtable in December 2021 and their feedback has been incorporated.

Objectives and outcomes

The key objectives of the National Hatchery Network would be:

- Establish foundational seaweed hatchery capability (infrastructure, people and techniques) in key locations to support industry growth and accelerate industry development.
- Accelerate the availability of seedstock/seeded ropes and hatchery techniques for seaweed growers.
- Build capability to solve the industry's biggest R&D challenges relating to hatchery techniques, strain selection and disease over the coming decades.
- Attract investment to the industry to boost GVP to \$100 million by 2025.

The outputs from the National Hatchery Network would include:

- Hatchery IP (manuals and facility design standard)
- Seedstock/seeded lines for growers
- An education and skills program.

The benefits to industry from the National Hatchery Network would include:

- Increased access to hatchery knowledge and seeded ropes, which will reduce start-up costs and timeframes, and subsequently increase GVP at a faster rate
- Increased workforce skills and experience, which will reduce talent shortage risks

- Optimised investment as a result of the network model facilitating knowledge sharing
- Expanded network of seaweed experts working on industry problems
- Reduced risk and uncertainty for seaweed companies, resulting in further investment being attracted to the industry.

Concept design principles

Key design principles for the construction of the hatchery facility are:

- A hub-and-spoke model to meet regional demand, ensure development of technical knowledge, adhere to biosecurity requirements and ensure the right species is grown in the right place at the right time.
- An initial focus on two key seaweeds *Asparagopsis* and kelp based on industry demand and opportunity.
- A focus on pre-competitive industry needs to avoid company conflicts of interest.
- Transfer/licensing of existing IP where possible to leverage existing knowledge.
- Development of the central hub first in collaboration with UTAS.

A hub-and-spoke model is proposed to stage the investment and to deliver outcomes where and when they are needed by industry in each region in line with biosecurity requirements for locally sourced seedstock. The locations of the 'spokes' are indicative only as they are dependent on funding, partners and facilities available in each region.



Figure 1. Proposed locations of National Hatchery Network facilities.

Concept design resources

Facility requirements

Dedicated aquaculture facilities are required to focus and accelerate hatchery techniques for key species. It is proposed an existing indoor aquaculture facility be retrofit or sub-leased, or a new facility be built, in collaboration with a commercial party, government or university. Figure 1 shows an example design for a kelp seaweed hatchery. Figure 2 shows an example of seeded ropes produced from a seaweed hatchery.



Figure 2. Kelp hatchery design example. Image: Catriona Hurd, University of Tasmania.

Approx. scale 2 m



Figure 3. Kelp hatchery output - seeded ropes. Photo: Australian Seaweed Institute.

People requirements

A core team of 15, including seaweed phycologists, seaweed researchers and aquaculture technicians, is required for the NHN to deliver an outcomes-driven R&D program and achieve its objectives (Figure 4). A skills and training program would be developed with partner universities.



Figure 4. National Hatchery Network organisational design.

Key activities

Program planning, IP management and network management activities would include:

- Identifying knowledge holders, forming networks, conducting workshops and running knowledge-sharing events.
- Undertaking a hatchery network knowledge baseline and gap analysis for each species.
- Establishing linkages with other research programs.
- Setting up an NHN R&D program steering committee with industry partners.
- Developing an R&D plan and prioritising areas to target.
- Defining and managing IP arrangements.
- Undertaking ongoing governance and reporting to the NHN Board.
- Undertaking communications and stakeholder engagement.

The R&D program would be agreed with industry partners. It is proposed that sprint teams would be established to deliver outcomes rapidly to industry. R&D activities that would be conducted include:

- Research to close prioritised R&D gaps for key species.
- Development of a hatchery manual for each species.
- Development of standard design drawings for hatchery design.
- Development of a catalogue of cultivars.
- Development of a selective breeding program.
- Investigation into life cycle manipulation fast tracking the life-stage process.
- Design of end-use products test substrates, marine rope/infrastructure and transport to site.
- Investigation into alternative growth strategies protoplasts and tissue culture
- Development of hatchery technology 2.0 tank design, translocation equipment, harvesting equipment and light profile.

Some examples of seaweed culture manuals from the USA include Kelp Farming Manual: A Guide to the Processes, Techniques, and Equipment for Farming Kelp in New England Waters (Flavin et al., 2013) and New England Seaweed Culture Handbook: Nursery Systems (Redmond et al., 2014).



Figure 5. Example seaweed culture manuals from the USA.

Intellectual property requirements

Background IP arrangements will need to be agreed, including a licence or joint venture arrangement for existing IP, to permit transfer of background IP on kelps and *Asparagopsis* lifecycles and hatchery techniques. Ongoing discussions with ASSA members will also be essential as IP is developed.

Further, ongoing governance resources will be required to manage the agreement with industry stakeholders on what constitutes the 'pre-competitive' R&D space.

Seaweed lifecycles are complex, as shown in the kelp lifecycle example in Figure 6. The lifecycle for each species needs to be understood in detail.



Figure 6. The kelp lifecycle. Source: Redmond et al., 2014.

Implementation approach

The key steps to establish the NHN, as agreed in the workshops and outlined in the concept design approach, are:

- 1. ASSA to seek and progress funding sources for the NHN.
- 2. Establish NHN foundational team and conduct gap analysis for target species.
- 3. Agree transfer/license arrangements for background IP for existing kelp hatchery techniques from provider/s.
- 4. Agree transfer/license arrangement for background IP for existing *Asparagopsis* hatchery techniques from provider/s.
- 5. In parallel with the above, establish a Seaweed Hatchery Hub in partnership with an existing aquaculture research facility and retrofit the facility to make it suitable for a seaweed hatchery (a proposal has been developed for co-investment with UTAS at Taroona but requires funding).
- 6. Establish a focus team to develop hatchery protocols and techniques to produce commercial quantities of seeded rope.
- 7. Package these hatchery techniques and support capability to roll them out to eligible nodes under licence arrangements.

Node projects and funding arrangements for each regional hatchery node would need to be developed on a case-by-case basis, e.g. they could be run by state government, local government, the private sector, a university partner or as part of a joint venture depending on the funding and facilities available.

Estimated timeline

The estimated timeline to establish the NHN is shown in Figure 7.

2021	Year 1	Year	2	Year 3	Year 4	
NHN concept design (Blueprint implementation phase 1)	Stage Asparagop licen:	i ge 1a. NHN capability gopsis hatchery techniques, sensing and capability		Stage 1b. NHN ongoingCommercial kelp hatchery techniques, licensing and capabilityContinue Asparagopsis hatchery techniques and capability through nodesOther high-value seaweeds hatchery techniques and capabilityEducation and skills program		
	Stag EOI fo fr	e 2. Hatchery hub facili or locations to lease/acce or hatchery hub facility	ity ess			
		Stage 3a. Node development* Engage state governments, scope options, identify potential funding sources and design arrangements for each node		Stage 3b. Establish ı	nodes	

* Dependent on funding

Figure 7. Estimated timeline for implementation of the National Hatchery Network.

Estimated budget

The estimated budget to establish the NHN is shown in Table 2. The budget shows costs for each of the three establishment stages (Figure 7) over four years.

Table 2. Estimated budget to establish the National Hatchery Network.

Stage	Key activity	When/duration	Year 1	Year 2	Year 3	Year 4	Total budget
1. NHN capability	(1) Foundation team – key roles and species, consumables and background IP licences	ASAP 24 months	\$3,000,000	\$3,000,000			\$6,000,000
	(2) Ongoing team – consumables, travel, networking and ongoing IP protection	2024 24 months			\$3,000,000	\$3,000,000	\$6,000,000
2. Seaweed hatchery hub facility	Establish hatchery hub facility	ASAP 12-24 months (site dependent)	\$1,000,000	\$1,000,000			Site dependent – assume \$2,000,000 retrofit, e.g. Taroona proposal with UTAS
3. Establish node facilities and partners	(1) Node development	2023 24 months		\$180,000	\$180,000		\$360,000
	(2) Node facility delivery	From mid-2023 12-24 months (site dependent)		\$2,000,000	\$5,000,000	\$7,000,000	\$2,000,000 (retrofit) \$5,000,000 (greenfield) Assumption: Four nodes by 2025 (two retrofit, two greenfield). 2 x \$2,000,000 2 x \$5,000,000 = \$14,000,000
Totals			\$4,000,000 (inc. facilities \$1,000,000)	\$ 6,180,000 (inc. facilities \$3,000,000)	\$8,180,000 (inc. facilities \$5,000,000)	\$10,000,000 (inc. facilities \$7,000,000)	

Section 3 Implementation Plan outcomes

A program to implement the *Australian Seaweed Industry Blueprint* is estimated to cost \$32 million over four years (2022-2025). This includes:

- Investment of \$16 million (\$4 million per year to 2025) is required to fund critical industry development initiatives.
- Investment of \$16 million is required for a dedicated National Hatchery Network.

This investment will be used to:

- Build industry leadership and capability
- Build facilities and technical knowledge
- Increase stakeholder engagement and industry support
- Optimise outcomes from RD&E investment.

The expected outcomes are:

- Accelerated industry growth to achieve \$100 million GVP and 1,200 jobs by 2025.
- The foundations in place for a new sustainable \$1.5 billion industry that will have created 9,000 jobs by 2040.

References

Flavin, K., Flavin, N. and Flahive, B. (2014). *Kelp Farming Manual: A Guide to the Processes, Techniques, and Equipment for Farming Kelp in New England Waters*. Ocean Approved, Portland, ME, USA. <u>https://maineaqua.org/wp-content/uploads/2020/06/OceanApproved_KelpManualLowRez.pdf</u>

Kelly, J. (2020, September 07). *Australian Seaweed Industry Blueprint*. AgriFutures Australia. Retrieved from AgriFutures Australia: <u>https://agrifutures.com.au/product/australian-seaweed-industry-blueprint-a-blueprint-for-growth/</u>

Redmond, S., Green, L., Yarish, C., Kim, J. and Neefus, C. (2014). *New England Seaweed Culture Handbook: Nursery Systems*. Connecticut Sea Grant, Groton, CT, USA. <u>http://digitalcommons.uconn.edu/seagrant_weedcult/1</u>



Australian Seaweed Industry Blueprint Implementation Plan

by Jo Kelly, Australian Seaweed Institute November 2022

AgriFutures Australia publication no. 23-010 AgriFutures Australia project no. PRJ-012802 ISBN: 978-1-76053-351-9

AgriFutures Australia

_

Building 007 Tooma Way Charles Sturt University Locked Bag 588 Wagga Wagga NSW 2650

02 6923 6900 info@agrifutures.com.au

agrifutures.com.au

