



# Roadmap to a thriving seaweed aquaculture industry in Washington State



# AUTHORS AND CONTRIBUTORS



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**Cover photo collage:**

Harvesters pull a line of sugar kelp from the water at their farm off Lummi Island, backed by a view of the local reefnet fishery. This seasonal rotation within the same marine footprint illustrates the potential of seaweed farming as a sustainable co-use strategy, maximizing the utility of coastal marine space for overlapping sustainable industries.

Photos by Hailey Hoffman / Cascadia Daily News and Edmund Lowe

**This page:**

Harvesters pull a line of sugar kelp from the water near Lummi Island

Photo by Hailey Hoffman / Cascadia Daily News



**Vashon Kelp Forest**



## Acknowledgements

We are profoundly grateful to the wide array of seaweed industry stakeholders – including farmers, processors, advocates, researchers, tribal representatives, and policymakers – across Washington, Alaska, British Columbia, Oregon, and California, who generously contributed their time and expertise through interviews and facilitated discussions. Their

invaluable perspectives on the industry’s needs and value chain development were essential to shaping this roadmap. We also wish to express our deep appreciation to our funders, Builders Vision, whose generous support and commitment to collaborative advancement of this industry made this planning grant and the resulting Roadmap possible.



# ROADMAP TABLE OF CONTENTS

<b>AUTHORS AND CONTRIBUTORS</b> .....	<b>2</b>
Acknowledgements .....	3
<b>EXECUTIVE SUMMARY</b> .....	<b>6</b>
<b>I. BACKGROUND AND PURPOSE</b> .....	<b>13</b>
Intro to Seaweed and Seaweed Farming .....	14
Methodology and Scope .....	17
Initial Project Concept and Shifting Landscape .....	18
<b>II. CURRENT STATE OF THE INDUSTRY IN WASHINGTON STATE</b> .....	<b>19</b>
Washington Seaweed Farms and Markets .....	19
Challenges and Barriers to a Thriving Seaweed Farming Industry in Washington State .....	20
The “Chicken and the Egg” Challenge - Mismatch Between Markets and Production .....	22
The “Cart before the Horse” Challenge - Industry Growth Contingent on Risky Investments in Processing .....	24
Pervasive Knowledge Gaps Influencing All Aspects of Industry Development .....	26
<b>III. TWO KEY PATHWAYS TO A THRIVING SEAWEED FARMING INDUSTRY IN WASHINGTON STATE</b> .....	<b>29</b>
<b>Pathway 1: Supporting the Economic Viability of Small-Scale Seaweed Farms in Washington Waters</b> .....	<b>31</b>
Expand “Right-Sized” Markets .....	32
RESULTS OF CUSTOMER DISCOVERY PROCESS .....	33
Develop Co-Use Partnerships for Processing .....	34
RESULTS OF PROCESSING TECH ANALYSIS - PART 1: CO-PACKING AND SHARED USE AGREEMENTS .....	35
Build Spore Collection and Nursery Capacity .....	38
RECOMMENDATION IN ACTION: LUMMI ISLAND SEAGREENS CASE STUDY .....	39
Identify Additional Entities to Collaborate .....	43
Build an Expanded Network of Advocates .....	46
Summary of Roadmap Pathway 1 .....	49

<b>Pathway 2: Support Development and Expansion of Washington's Role in the Regional Seaweed Farming Industry</b> .....	51
Build a Broader West Coast Coalition .....	52
Explore Potential for Washington to Act as a Regional Processing Hub .....	55
RESULTS OF STATE ECONOMIC POTENTIAL ANALYSIS .....	57
RESULTS OF PROCESSING TECH ANALYSIS - PART 2: REGIONAL CASCADING BIOREFINERY .....	59
RECOMMENDATION IN ACTION: CASE STUDY: BLUE DOT KITCHEN .....	65
Exploring Transportation Channels and Logistics .....	66
Co-Developing Equitable Ownership and Benefit-Sharing Models .....	67
Summary of Roadmap Pathway 2 .....	69
 <b>IV. CONCLUSION</b> .....	 <b>71</b>
Immediate Next Steps .....	73
 <b>APPENDICES</b>	
A. List of Seaweed Industry Stakeholders Interviewed for this Roadmap .....	78
B. Discussion of Contextual Changes in Washington .....	80



Harvesting sugar kelp for Lummi Island SeaGreens in Legoe Bay.  
Photo by Mike Spranger / Lummi Island SeaGreens

# EXECUTIVE SUMMARY

## Background And Purpose

This report was led and coordinated by Washington Maritime Blue (Maritime Blue). Maritime Blue is a strategic alliance propelling the Pacific Northwest toward global leadership in sustainable maritime industries and ocean-based innovation by fostering collaboration among industry, government, academia, communities, and investors.

In late 2024, Maritime Blue received an 18-month planning grant from Builders Vision to support the collaborative advancement of Washington's emerging seaweed industry, supporting the four permitted growers

in the state as they sought to determine optimal approaches for market development, shared infrastructure, and industry growth. This Roadmap captures and organizes the outcomes of extensive facilitated discussions with these seaweed farmers (who represent all active, formerly active, and permitted seaweed farms in Washington state), as well as from a suite of supporting analyses and direct interviews with a diversity of seaweed industry stakeholders in the state and across the region. Case study discussions of one Washington seaweed farm and one Washington-based seaweed processing operation are presented to illustrate key challenges and opportunities.



Harvesting sugar kelp for Blue Dot Sea Farms in the northern part of the Hood Canal.

Photo c/o Jon Kroman / Blue Dot Sea Farms

The report is structured in three primary sections:

1. A discussion of the **current state of the seaweed industry** in Washington state, including an articulation of **key challenges, barriers and knowledge gaps** that must be addressed.
2. A set of clear recommendations to progress concurrently along **two key pathways for overcoming these obstacles** and enabling the industry to reach its full potential, with detailed case studies for illustration.
3. A **conclusion and distillation of priority next steps** for immediate action by farmers, policy makers, support agencies, academic institutions, and investors seeking to support the industry's advancement.

Taken together, this Roadmap articulates a comprehensive blueprint for the development of Washington's regenerative seaweed industry and its role in the broader region. Washington has the opportunity to play a leading role in West Coast seaweed industry growth by expanding market access and supporting secondary processing needs that anchor both

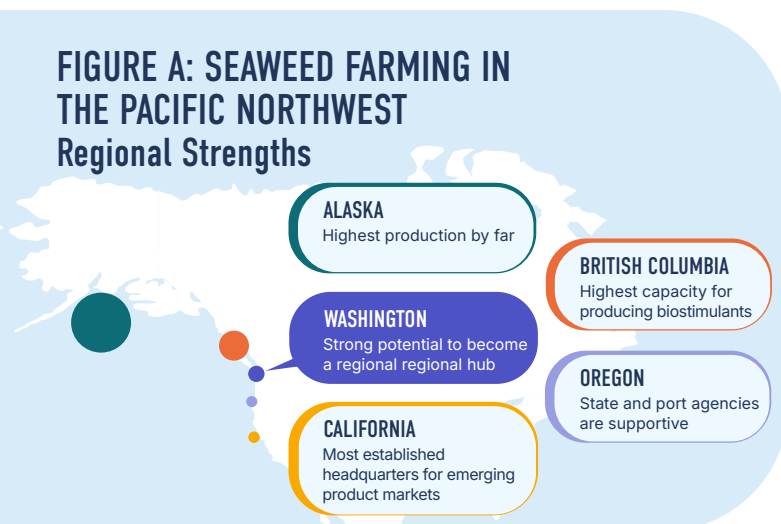
local and regional supply chains. Realizing that potential will also create more opportunities for current and future Washington-based seaweed farmers, allowing them to succeed while remaining small-scale, sustainable, community-rooted operations.

## Context and Need

Washington state currently has two active seaweed farms: **Blue Dot Sea Farms**, a 5 acre seaweed and shellfish farm located in the northern part of the Hood Canal, and **Lummi Island SeaGreens**, a 10 acre seaweed farm located off the coast of Lummi Island, on the eastern edge of the San Juan Island archipelago. Washington's seaweed farming industry has developed more slowly than its neighbors to the north, with Alaska leading that growth over the past decade, driven largely by public funding investments in production and support. The industry in British Columbia is in a phase of expansion, and is anchored by a few key players – most notably Cascadia Seaweed – and a growing number of First Nations partnerships. To the south of Washington, interest in seaweed farming and related industry has also been growing in Oregon and California, but geographical and regulatory constraints have prevented significant growth in production in either of those states.

Washington benefits from a robust marine environment, well-developed transportation networks, diverse logistics capabilities, and established processing facilities for traditional seafood and agricultural foods. These systems provide a strong foundation crucial for the growth, distribution and commercialization of seaweed products. However, seaweed aquaculture industry growth has been stalled

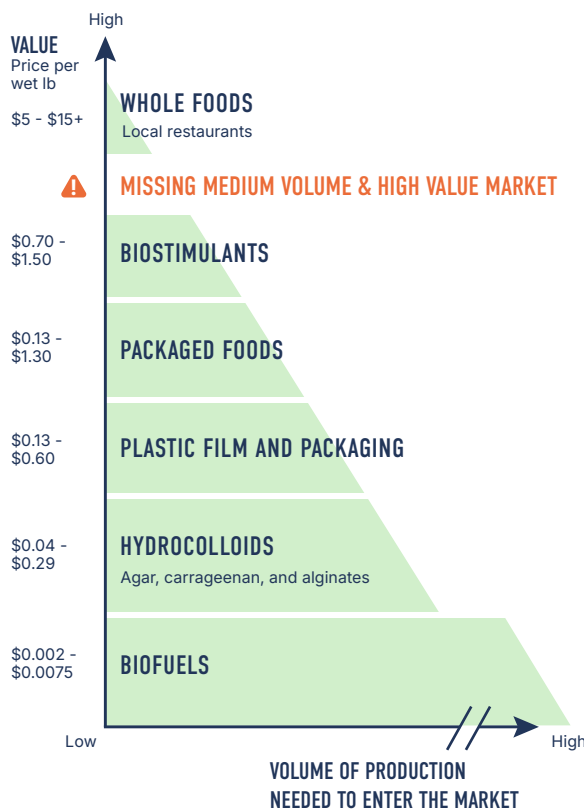
**FIGURE A: SEAWEED FARMING IN THE PACIFIC NORTHWEST**  
Regional Strengths



across the U.S., and in particular along Pacific West Coast, by the interplay of two critical logistical challenges:

- A lack of strong market demand disincentivizes growth in production, but current production volumes are insufficient to catalyze market growth (**the “chicken and the egg” challenge**).
- Insufficient processing capacity hinders growth in both markets and production, but investment in expanded processing capacity before industry scale demands it carries significant risk (**the “cart before the horse” challenge**).

**FIGURE B: PRIMARY SEAWEED MARKETS BY RELATIVE VOLUMES REQUIRED AND VALUES RETURNED TO FARMERS**



Specific barriers driving these two challenges include regulatory and spatial complexity that create high hurdles for entry; hatchery and production challenges that lead to uncertainty, instability in production, and crop failures; limited production scales that offer minimal protection against harvest variability; lack of access to established and developing markets that require higher volumes and lower price points than small farms can currently sustain; gaps in processing technology and appropriate co-packing agreements that further limit market access; and high uncertainty in return on investment that make private capital scarce.

In addition, a suite of **fundamental knowledge gaps** – in particular, around how kelp farms will interact with local species and environments and how they will interact with climate change-driven system changes – are preventing progress on all of the system challenges, creating regulatory hurdles, undermining social license, and stalling investment.

### Pathways & Recommendations to a Thriving Industry

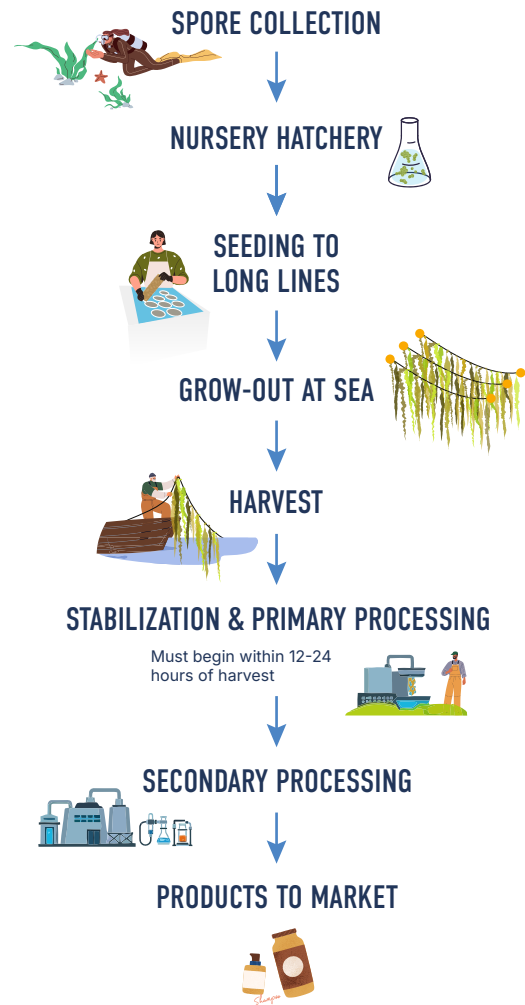
In order to achieve the goal of a thriving seaweed farming industry in Washington state and overcome these interconnected challenges, it will be necessary to **advance down two key pathways simultaneously**. These two pathways will interact with and support each other, but they require different actions and partnerships:

**Pathway 1: Supporting the economic viability of small-scale seaweed farms in Washington Waters.** Realizing a “bottom-up” industry requires addressing the high barriers to entry and viability for local producers. This

pathway focuses on stabilizing the economic foundation of farms within Washington’s waters by reducing capital expenditures through shared processing equipment, catalyzing the development of right-size markets and diversifying product streams, and reducing uncertainties driving permitting and licensing barriers. Advancing along this pathway ensures that the industry remains rooted in local communities and provides direct ecological benefits – such as nutrient removal and habitat restoration – within the Puget Sound and coastal estuaries. Success will require:

- **Expanding “right-sized” markets** through catalyzation of innovation and **supporting vertical integration and low-risk product diversification** for economic viability at small scales of production;
- **Addressing the processing bottleneck in the near term through strategic shared-use and co-packing agreements** that capitalize on existing processing capacity and infrastructure in other sectors while **moving towards a shared, modular processing hub** as production and market expansion dictate;
- **Addressing seed failures and nursery challenges** through dedicated efforts to expand skilled spore collection and nursery capacity in the state;
- **Identifying additional entities to collaborate** on processing, marketing, and innovation, potentially including seaweed farmers in southern B.C. or shellfish growers seeking to valorize nuisance *Ulva* or to expand into the subtidal zone;

**FIGURE C: SEAWEED FARMING LIFECYCLE**



- **Building an expanded network of industry advocates** across sectors and **launching a coordinated regional research initiative** to advance critical research, in particular exploring the potential for kelp farming to support or augment kelp restoration efforts and increase system-wide climate resilience.

**Pathway 2: Supporting development and expansion of Washington’s role in the regional seaweed farming industry.** While local production will remain small-scale, Washington is uniquely positioned to serve as the critical secondary processing and distribution hub for the entire West Coast. By leveraging Washington’s established maritime infrastructure, transportation networks, and food-processing density, and supporting equitable benefit sharing and region-wide collaboration through the formation of a West Coast Coalition, this pathway ensures Washington can capture significant economic value, while providing synergistic support to neighboring regions like Alaska and British Columbia. Success entails:

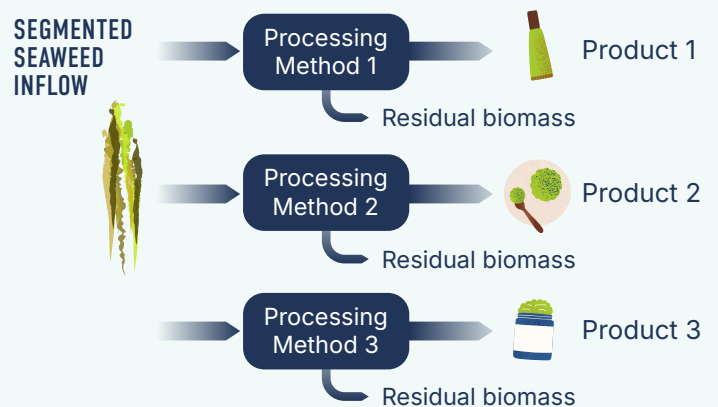
- **Creating and funding a non-regulatory West Coast Seaweed Industry Coalition** to cultivate relationships and identify opportunities for synergy and collective action across the region.
- **Implementing a phased approach to develop Washington’s capacity to act as a regional secondary processing hub**, with emphasis on **high-value, medium-volume product streams** that complement other developments across the region.
- **Investing in modular and/or cascading processing technologies** that allow for the segmented or sequential production of multiple product formats and extraction of multiple compounds to maximize value and minimize waste.
- **Improving the “Alaska-Washington kelp pipeline”** through development of aggregation hubs, expansion of low-cost

pathways for transportation of stabilized kelp from rural areas, and exploration of opportunities for regulatory streamlining.

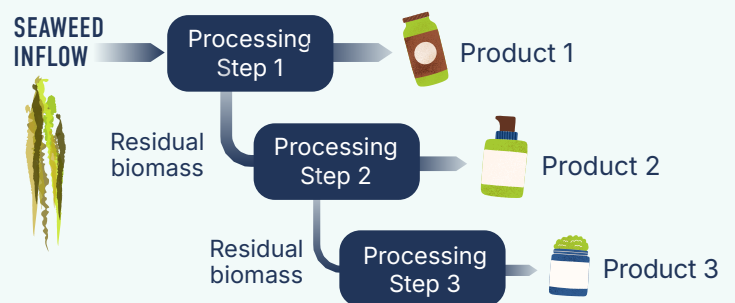
- **Developing and implementing participatory ownership models** (such as federated cooperatives) to ensure that industry benefits flow equitably across the region.
- **Creating a blended finance mechanism**, where a mix of public, philanthropic, and private funding are used to establish revolving loan funds that de-risk early-stage investments for growers and processors.

**FIGURE D: MODULAR VS. CASCADING PROCESSING STRATEGIES**

**Modular Processing**



**Cascading Processing**



# WASHINGTON SEAWEED FARMING INDUSTRY ROADMAP

## Figure E: Two Interdependent Pathways to a Thriving Seaweed Industry

### THE INTERCONNECTED CHALLENGES IN THE SEAWEED INDUSTRY

⚠️ **MARKETS ↔ PRODUCTION (CHICKEN OR THE EGG)**

⚠️ **PROCESSING ↔ PRODUCTION (CART BEFORE THE HORSE)**

⚠️ **PRIORITY KNOWLEDGE GAPS**

#### PATHWAY 1

### Support Small-Scale Viability for Washington Farms

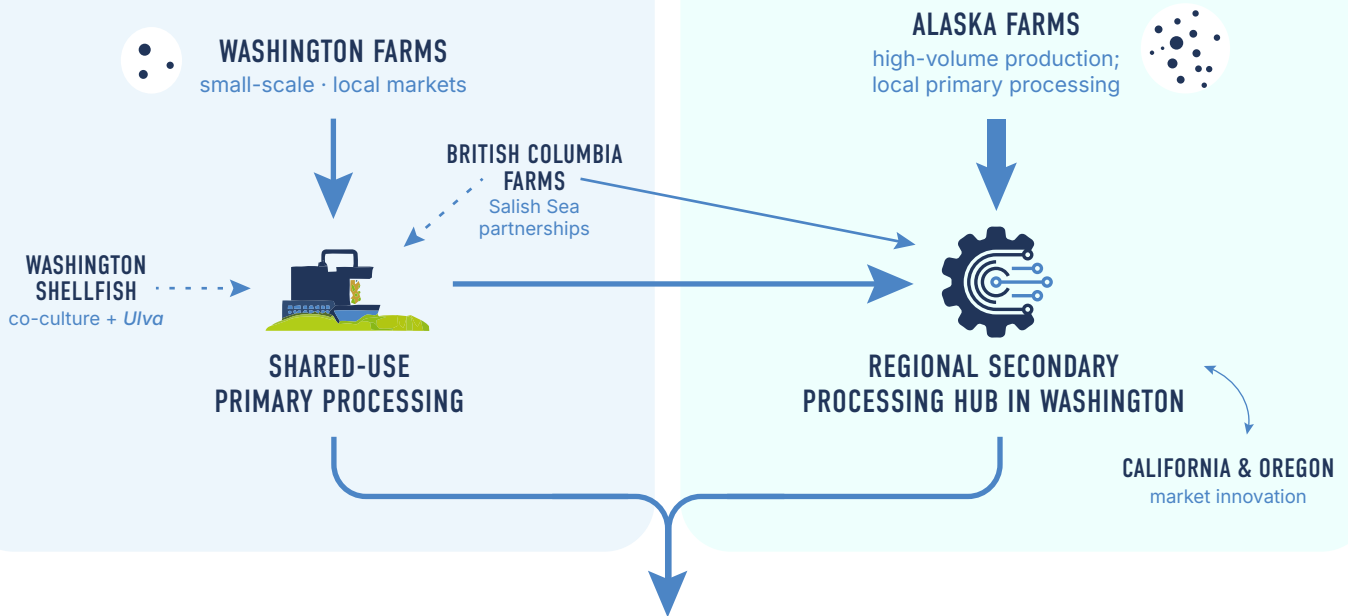
- Expand right-sized, high-value markets
- Address seed failures & nursery gaps
- Build shared-use agreements to address the processing bottleneck
- Explore collaborations and partnerships across sectors and regions
- Launch coordinated research initiative to address uncertainties driving regulatory hurdles

#### PATHWAY 2

### Establish Washington as Regional Processing Hub

- Build a West Coast Seaweed Industry Coalition
- Invest in shared, regional secondary processing capacity
- Advance modular or cascading processing platforms to preserve market flexibility
- Optimize Alaska–Washington kelp pipeline
- Ensure equitable ownership and benefit-sharing

### REGIONAL SEAWEED INDUSTRY FROM PRODUCTION THROUGH PROCESSING VIA THE TWO PATHWAYS



### A THRIVING, EQUITABLE, REGENERATIVE SEAWEED ECONOMY

**ECONOMIC VIABILITY**  
JOBS · REVENUE · TAX BASE

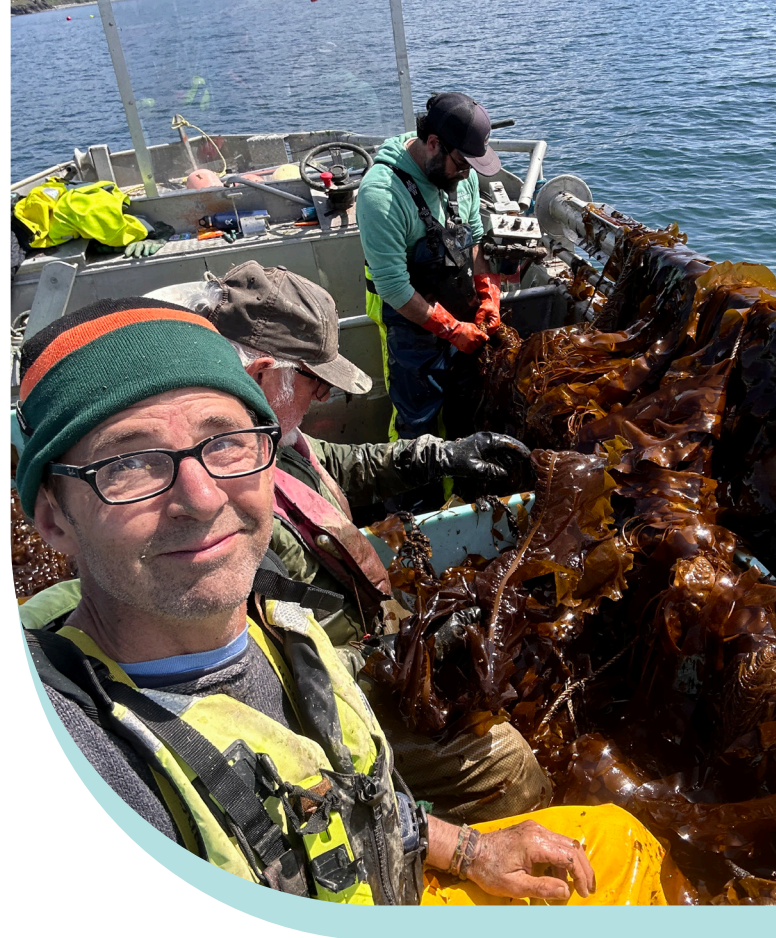
**ECOLOGICAL HEALTH**  
HABITAT · WATER QUALITY · RESILIENCE

**SOCIAL EQUITY**  
SMALL-SCALE FARMS · LOCAL BENEFITS

**REGIONAL COLLABORATION**  
WEST COAST COALITION · INNOVATION

By collectively advancing these two pathways concurrently, Washington’s seaweed industry has the potential to evolve from its nascent stage into a cornerstone of the Pacific Northwest’s blue economy. With the confluence of a profound cultural heritage tied to the coast, a large base of environmentally-aware consumers, and an experienced workforce in the seafood and agricultural processing sectors, **Washington seaweed farms could reverse broader industry trends and serve as a “bright spot” case study for successful small-scale seaweed farming with global relevance.** Additionally, the state possesses a unique combination of established port infrastructure, a skilled maritime workforce, and strategic geographic positioning with respect to both shipping and ground transportation lines that allows it to serve as a high-value anchor for the entire West Coast industry. **Washington can leverage these assets to become a regional hub for secondary processing, distribution, and innovation of seaweed products.** Achieving this vision will generate meaningful economic opportunities, provide sustainable food and material resources, and significantly bolster the health and resilience of our marine ecosystems.

While navigating the sector’s current regulatory, logistical, and market hurdles



Kelp harvest for Lummi Island SeaGreens.  
Photo by Mike Spranger of Lummi Island SeaGreens

requires persistent effort, this Roadmap provides the strategic blueprint necessary to move from planning to implementation. By fostering collaboration across the West Coast, prioritizing equitable benefit-sharing, and investing in both the viability of our local growers and the state’s regional processing infrastructure, Washington can transform its seaweed sector into a globally competitive model of regenerative ocean innovation.

# BACKGROUND AND PURPOSE

In late 2024, Maritime Blue received an 18-month planning grant from Builders Vision to support the collaborative advancement of Washington's emerging seaweed industry, supporting the four permitted growers in the state as they sought to determine optimal approaches for market development, shared infrastructure, and industry growth. In partnership with these growers, as well as through regular consultation with an extensive group of industry, government, research, and regional stakeholders, Maritime Blue has

identified a set of priority activities to ensure Washington's seaweed industry can reach its full potential. This Roadmap articulates critical challenges facing the industry in Washington state, captures the lessons, experiences, and perspectives of key industry experts, and lays out informed pathways for achieving this shared goal. It is intended to serve as a comprehensive document for regulators, policy makers, agencies, nonprofits, academic institutions, funders, and investors seeking to support the industry's advancement.

## FIGURE 1: ECOSYSTEM BENEFITS OF KELP FARMING



### WATER QUALITY

Removes excess nutrients, including nitrogen and phosphorus



### OCEAN ACIDIFICATION

May locally buffer pH



### HABITAT CREATION

Creates habitat structure for many fish and invertebrates



### ECOSYSTEM RESILIENCE

Healthier ecosystems are more resilient to climate change and other impacts

Seaweed farming is uniquely sustainable, using:



**NO FRESH WATER**



**NO FERTILIZERS / PESTICIDES**



**NO ARABLE LAND**

### HOW SEAWEED ABSORBS NUTRIENTS

Unlike plants, seaweed has no roots or vascular system — it absorbs nutrients and CO<sub>2</sub> directly through its entire surface, clinging to substrate via a "holdfast."



Kelp holdfasts gripping rocks on a beach.

Photo by Willow Battista

A Great Blue Heron hunting on a bunch of bull kelp off Orcas Island.

Photo by TMI

## Intro to Seaweed and Seaweed Farming

Seaweeds are a subset of the algae family (termed “macroalgae”), meaning that these marine (salt water) organisms are not plants, having no roots or vascular systems for transmission of nutrients up from soil or energy and carbon dioxide down from leaves. Instead, seaweeds absorb nutrients and photosynthesize directly from the water around them through their entire surface area, and utilize a structure called a “holdfast” to cling to rocks or other substrates [1]. Seaweed reproduction begins when a mature seaweed releases microscopic spores into the water which settle onto rocks and other substrate surfaces where they then develop into baby seaweeds. Seaweeds play an important role in coastal and marine ecosystems, providing numerous ecosystem services such as nutrient cycling, habitat provisioning, and coastal protection [2], [3]. Seaweeds have also been consumed by many people across cultures and throughout time, and are very good sources of a variety of important nutrients including fiber, essential minerals (especially iodine, calcium, and iron), and key vitamins [4].

Seaweed aquaculture (herein referring to the farming of seaweed at sea, as opposed to in tanks) represents a sustainable and environmentally beneficial form of aquaculture with significant potential for growth. The seaweed aquaculture process begins with collecting spore material directly from native parent seaweeds and cultivating them on lines

in a nursery. These lines are then outplanted to a farm site in subtidal waters, usually fairly near shore, where they are secured by anchors to the sea floor and suspended by buoys to float near the surface where they can receive sufficient sunlight to grow to maturity for harvest by boat.

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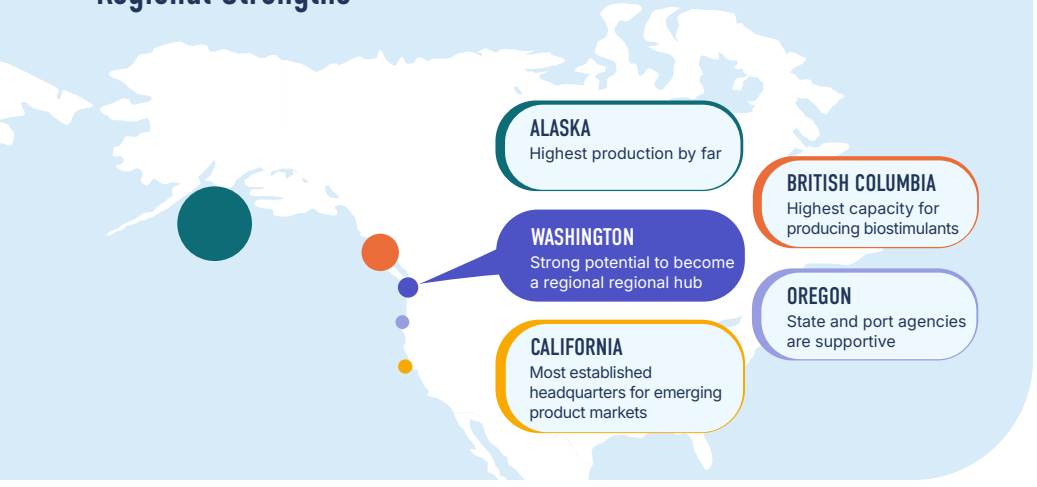
**Unlike traditional agriculture, seaweed cultivation requires no fresh water, arable land, fertilizers, or pesticides, making it an exceptionally eco-friendly production method for food and other resources.**

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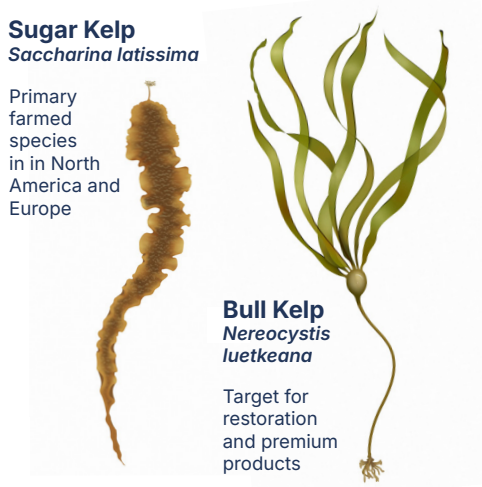
Beyond its minimal input requirements, seaweed aquaculture can support the overall health of marine ecosystems by removing excess nutrients to improve local water quality, reducing acidification to support climate resilience, and directly providing important habitats that support diverse marine life.

Seaweeds are categorized into three groups: reds, browns, and greens. “Kelp” refers to a subset of the brown seaweed group which thrive in cold, nutrient-rich waters (like the waters along the Pacific coast of North America), and which form complex, highly productive, and diverse underwater habitats often referred to as “kelp forests.”

**FIGURE 2: SEAWEED FARMING IN THE PACIFIC NORTHWEST**  
Regional Strengths



**FIGURE 3: KEY SPECIES**



Globally, there are over 10,000 identified species of seaweed, including over 100 species of kelp, however only 9 seaweed species groups (including 2 species of kelp) make up nearly 98% of global aquaculture production [5].

The waters off the coast of Washington state boast a large abundance of wild, native seaweed species, including a number that are commonly wild-harvested for consumption or other uses, such as sugar kelp (*Saccharina latissima*), bull kelp (*Nereocystis luetkeana*), nori (*Porphyra spp.*), sea lettuce (*Ulva spp.*), and rockweed/bladderwrack (*Fucus distichus*) [6].

Seaweed aquaculture on the West Coast has expanded rapidly over the past decade (Figure 2). This expansion has been driven largely largely by investments in production, especially

through the U.S. Economic Development Agency Build Back Better grant funding in Alaska. Leading these developments, Alaska has moved beyond the “proof-of-concept” phase, with harvest volumes growing by more than 4000% between 2017 and the industry’s peak in 2022 [7], [8]. However, production volumes declined significantly in 2023 and 2024, and although they recovered somewhat in 2025 after improvements were made at seed hatcheries across the state, market demand has significantly lagged behind growth in production, and some Alaskan farmers have had to scale back to mitigate losses. The seaweed farming industry in British Columbia is currently in a phase of expanding production. While a precise number of active farm licenses is not publicly available, B.C.’s industry is anchored by a few key players — most notably Cascadia Seaweed, which operates five active farm sites — and a growing number

of First Nations partnerships (including the Kwiakah, Tsawout, and Metlakatla) that are integrating traditional ecological knowledge with modern aquaculture. Currently, about 30 hectares of B.C.'s coastline are under cultivation, and this is projected to scale up to as much as 500 hectares in the coming years [9].

Globally, seaweed product market focus has shifted from direct human consumption toward ingredient and material uses, including as biostimulants and methane-reducing livestock feed, compostable bioplastics, and cosmetics and nutraceuticals [10]. However, significant challenges in alignment of production costs with economically-viable ingredient price points in each of these markets have limited market access, especially for small-scale seaweed farmers. Regulatory hurdles have also slowed industry growth across the West Coast. The recent exploration of federal Aquaculture Opportunity Areas (AOAs) in Alaska should support production by streamlining site selection in that state [11], [12], but other West Coast regions have yet to implement this tool.

In addition to underdeveloped markets, the industry faces a critical processing gap. Seaweed begins to degrade within 12-24 hours from harvest, making immediate stabilization (e.g., by drying, freezing, addition of citric acid or fermentation catalysts) critical. Additional primary (e.g., chopping, flaking, etc.) and secondary (e.g., extraction of active ingredients, creation of spice mix, etc.) processing

steps may also be necessary depending on the intended final product. Current infrastructure for stabilizing and processing kelp is insufficient to meet the volumes being harvested, creating a bottleneck that limits the ability of small-scale farmers to reach global markets [13]. Regulatory hurdles present an additional bottleneck; the uncertainty, delay, and high cost of necessary approvals present a significant barrier to entry for farmers as well as to development of new products. To achieve long-term viability, recent strategic reports emphasize the need for “active intervention” through public-private partnerships to build regional processing hubs and move toward “pre-permitted” aquaculture zones that reduce the financial risk for new entrants [13], [14].



Harvesting sugar kelp for Blue Dot Sea Farms.  
Photo c/o Jon Kroman / Blue Dot Sea Farms

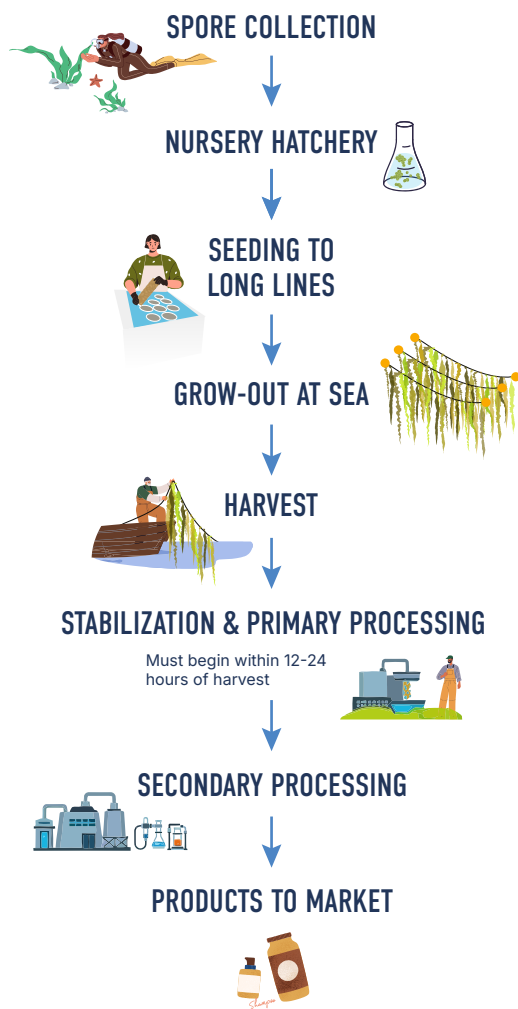
## Methodology and Scope

This Roadmap captures and organizes the outcomes of extensive facilitated discussions with active and prospective seaweed farmers in Washington, as well as of interviews with a diversity of seaweed industry stakeholders (listed in [Appendix A](#)) in the state and across the region. In addition to these conversations, a series of analyses were conducted or commissioned in support of this work. These include: a targeted Customer Discovery interview process (conducted by GreenWave), a State Economic Potential Analysis (conducted by Confluence Environmental Co. and Greene Economics), an Optimal Processing

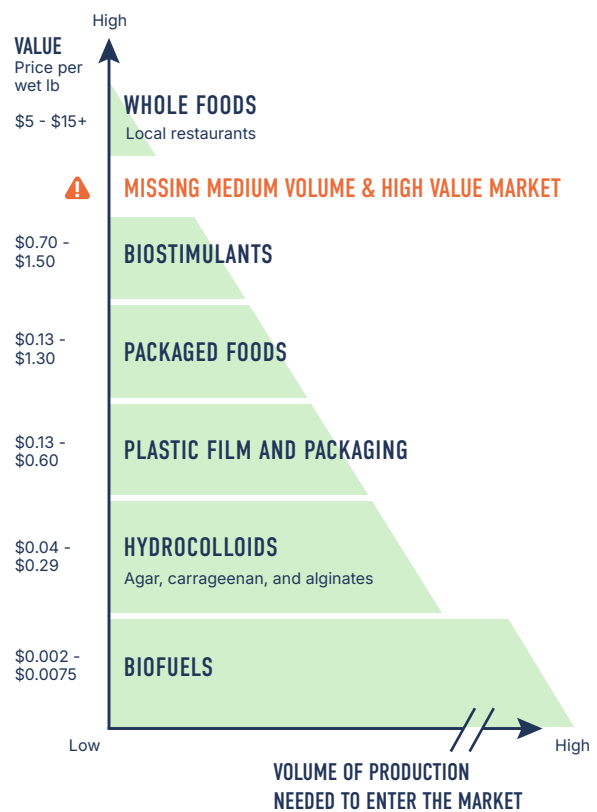
Technology Analysis (conducted by Hatch Blue), an analysis of Transportation Corridors and Equitable Ownership Models conducted by Charlotte McGoldrick as part of University of California, Berkeley’s Master of Development Practice program’s capstone requirement, and a report on the findings gathered through the One Ocean Week Seattle West Coast Seaweed Aquaculture Roundtable (led and compiled by Maritime Blue in partnership with the Alaska Fisheries Development Foundation [AFDF]).

Building on the results of these analyses and discussions, this Roadmap articulates priority next steps to support the industry, identifies

**FIGURE 4: SEAWEED FARMING LIFECYCLE**



**FIGURE 5: PRIMARY SEAWEED MARKETS BY RELATIVE VOLUMES REQUIRED AND VALUES RETURNED TO FARMERS**



key knowledge gaps, and underscores the need for broader regional collaboration. Crucially, accelerating this regional collaboration could allow Washington to establish itself as a central secondary-processing hub, enabling local small-scale farms to thrive at a sustainable, community-rooted scale while supporting farms producing larger harvest volumes from across the West Coast.

Nothing in this report commits any of its contributors to taking any actions or working to advance key recommendations.

### **Initial Project Concept and Shifting Landscape:**

At the launch of this planning grant in January 2025, the state of the industry consisted of three active farms and one pending lease approval, all of which were (1) growing at least some sugar kelp; (2) actively seeking or open to viable new markets for their harvests;

and (3) willing to explore whether processing infrastructure to support accessing those new markets could be shared on some basis (see next section for details on these four farms). Over the course of the grant, all three of those contextual conditions have changed (see [Appendix B](#)), limiting the ability for the farmers to enter into a formal collaborative agreement such as a processing cooperative.

Nonetheless, the work done collectively over the past 18 months — both the direct knowledge-sharing facilitated through ongoing farmer-farmer conversations, as well as the targeted analyses commissioned to support their decisionmaking — has allowed for the identification of key challenges and barriers to progress, created conditions for the farmers to partner informally and/or through bi-lateral agreements, to address those barriers, and created valuable relationships between farmers and other stakeholders, both within Washington and across the West Coast region.



Harvesting sugar kelp for Blue Dot Sea Farms.

Photo c/o Jon Kroman / Blue Dot Sea Farms

# CURRENT STATE OF THE INDUSTRY IN WASHINGTON STATE

Washington benefits from a robust marine environment (inclusive of the Puget Sound, Salish Sea, and Pacific Ocean), well-developed transportation networks, diverse logistics capabilities, and established processing facilities for traditional seafood and agricultural foods. These systems provide a strong foundation for industry growth. The state currently has two<sup>a</sup> active seaweed farms, but barriers in access to permits (including leases from the Washington Department of Natural Resources), processing technology, and reliable markets have essentially prevented any growth in farm production and the state's role and position within the broader regional seaweed market remain unclear. These barriers must be addressed for the industry to reach its full potential.

## Washington Seaweed Farms and Markets

### Lummi Island SeaGreens (LISG)

Lummi Island SeaGreens is a 10 acre farm located off the coast of Lummi Island, on the eastern edge of the San Juan island

archipelago. LISG grows sugar kelp on long lines, which are fully removed from the water between seasons. Harvests typically occur in April and May. Their first commercial season was planted in the fall of 2023 and harvested in spring 2024, coming in at roughly 10,000 wet pounds. The footprint of their lease should allow for harvests between 30,000 and 40,000 wet pounds, depending on various farming and harvesting decisions, but thus far market gaps and challenges with spore viability has prevented them from approaching this theoretical maximum production.

LISG operates a vertically integrated business model through which they produce and sell their own seaweed products, including various fresh and packaged food products as well as personal care products (more information below).

### Blue Dot Sea Farms (BDSF)<sup>b</sup>

Blue Dot Sea Farms is a 5 acre seaweed and shellfish farm located in the northern part of the Hood Canal. BDSF first outplanted sugar kelp commercially in 2017. Their current 4-year authorization to grow seaweed for commercial

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<sup>a</sup> Originally, the project aimed to assist four permitted farms in seeking new markets, considering shared processing technology, and exploring collaborative governance for shared processing. For a variety of reasons (see [Appendix B: Discussion of Contextual Changes in Washington](#)), these contextual conditions have changed, and there are now only two active farms - Lummi Island SeaGreens and Blue Dot Sea Farms.

<sup>b</sup> Blue Dot Kitchen, referred to at other parts of this report, is focused on creating value added food products from seaweed and is a separate but affiliate company of Blue Dot Sea Farms.



Lummi Island SeaGreens farm as viewed from the water.  
Photo by Larry Mellum, Lummi Island SeaGreens

purposes took effect in 2024. In 2025, BDSF donated its harvested sugar kelp production to terrestrial farmers in its area, exploring the use of seaweed for agricultural applications. BDSF is currently focused on producing only small crops primarily to support research efforts, and expects to donate its (likely smaller) harvests to terrestrial farmers again in 2026 and 2027.

### **Pacific Sea Farms (PSF)**

Pacific Sea Farms was a 10 acre commercial sugar kelp farm located in Colvos Passage off the coast of Vashon Island, Washington. PSF received its commercial lease to grow sugar kelp, oysters, and mussels in 2024.

However, the business faced an unexpected setback shortly thereafter when a catastrophic gear failure caused the farm to violate its strict lease guidelines, ultimately resulting in the revocation of that lease and all farming gear being removed from the water in 2025. Operations are on indefinite hold until a new lease can be secured.

### **Vashon Kelp Forest (VKF)**

Vashon Kelp Forest has obtained the necessary permits to operate from the Army Corps of Engineers, but is still awaiting a finalized lease from WA Department of Natural Resources (DNR), and is thus not yet an active farm. The Vashon Kelp Forest conservation project aims to create a regenerative seaweed farm in Puyallup waters off the coast of Vashon Island. In the face of the massive decline of bull kelp in Puget Sound, the VKF project will work to regrow this critical species. The goal of the VKF project is to build a start-up company that can be financially sustainable through the sale of kelp as well as help the environment and Vashon community.

## **Challenges and Barriers to a Thriving Seaweed Farming Industry in Washington State**

A complex, interwoven set of challenges and barriers are slowing progress across Washington's seaweed farming industry. These challenges are organized here into two overarching categories designed to highlight their inter-connected nature.

Colloquial terms that are commonly used by industry stakeholders are used to highlight the frustration around the inability to overcome one hurdle because of another – making clear the need to advance solutions synchronously for systemic progress:

- **The “chicken and the egg” challenge:** The current scale of market demand is too small to drive an increase in production, but the current scale of production is too small to support new or expanded market demand.
- **The “cart before the horse” challenge:** Investing in processing capacity before markets and production expand is risky and illogical, but insufficient processing capacity hinders industry growth.

These challenge categories are summarized here at a high level, and the diversity of barriers within each one are presented briefly in [Table 2](#) below.

In addition to these industry-specific challenges, a set of **fundamental knowledge gaps** — in particular, around how kelp farms will interact with local species and environments as well as how kelp farms will be impacted by, and/or interact with, climate changes — are preventing progress on all of the other challenges and barriers facing the industry, creating regulatory hurdles, undermining social license, and stalling investment. These critical knowledge gaps are discussed below, with a priority list of key research questions for collaborative exploration captured in [Table 3](#).

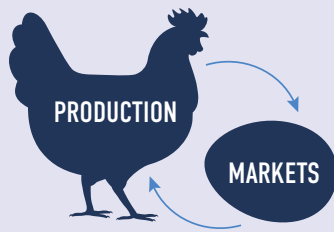


## The “Chicken and the Egg” Challenge

### MISMATCH BETWEEN MARKETS AND PRODUCTION

#### FIGURE 6: THE “CHICKEN AND THE EGG” CHALLENGE

You can’t have markets without production, you can’t have production without markets, and it’s very hard to know where to start.



The first challenge to industry growth is essentially that there isn’t strong enough market demand to drive expanded seaweed production, and there isn’t enough seaweed production to support the development or expansion of markets. This is a problem facing seaweed farmers across the U.S., but it is exacerbated by the very small-scale of production happening here in Washington state.

Most established (or establishing) seaweed markets globally tend to be for high-volume, low-value products (e.g., bioplastics, biofuels), and/or require advanced, sophisticated, and expensive-to-develop processing facilities to extract specific compounds from the kelp (e.g., biostimulants, cosmetics) (see [Table 1](#)). Meanwhile, the small-scale production capacity of the Washington state farms means they must find low-volume, high-value markets that can grow with them into medium-volume markets if they are to become economically viable. Thus far farmers here have been able to access

only extremely low-volume buyers that even at very high values, cannot sustain these farm businesses into the future.

An additional challenge to development of new markets is the significant uncertainty around harvest volumes and quality each season, which is worsened by a lack of reliable seed supply and nursery capacity and expertise in the state. Farmers have experienced seed failures and complete crop losses due to spore contamination and other factors, and a lack of technical expertise on nursery teams in Washington has made it challenging to gather spores during critical seasonal windows. Spores must be gathered from at least 50 wild kelp “parent” plants found within 50 kilometers of a farm’s footprint, a regulation colloquially referred to as the “50 by 50 rule.” This strict regulatory requirement adds operational burden that makes it difficult for small-scale nurseries to remain viable or provide high-quality, consistent spores to growers.

There have been some advances in the development of medium-volume, higher-value products around the U.S. (particularly regionally-targeted cosmetics and biostimulants), and there are a small number of companies engaged in creating seaweed-based products (including foods, biostimulants, cosmetics, and bio-materials) here in Washington and elsewhere on the West Coast. However, Washington farms have not been able to access even these developing markets because of insufficient and unpredictable seaweed supply, a lack of processing capacity (discussed further in the subsequent challenge

**TABLE 1: Market scale ranges with average farm gate price per pound.<sup>a</sup>**

Global Demand (Wet Pounds/Year)	Qualitative Volume Category	Individual Farm Production Volume Necessary to Access the Market (Wet Pounds/Year)	Target Markets	Qualitative Value Category	Average Price (USD/ Wet Pound at Farm Gate) <sup>b</sup>
>2B (theoretical)	Ultra High	>500,000	Biofuels	Ultra Low	\$0.002 - \$0.0075 <sup>[15]</sup>
>1B	High	>100,000	Seaweed-derived hydrocolloids (agar, carrageenan, and alginates) as ingredient to processed foods or cosmetics	Low	\$0.04 - \$0.29 <sup>[16]</sup>
>1B (theoretical)	Medium High	100,000 - 200,000	Plastic film/ packaging	Medium Low	\$0.13 - \$0.60
1.5B - 2B	Medium Low	50,000 - 100,000	Packaged foods	Medium	\$0.13 - \$1.30 <sup>[16]</sup>
>500,000,000 <sup>[17]</sup>	Low	10,000 - 50,000	Biostimulants	Medium High	\$0.70 - \$1.50
N/A	Tiny	<2,000	Local whole foods (e.g., sold to local restaurants)	Ultra High	\$5.00 - \$15.00+

<sup>a</sup> Except where otherwise noted with a direct citation, the numbers presented in this table are rough estimates of volumes and values gathered through interviews with industry experts and aggregation of market research at the time of report drafting. They are provided for illustrative purposes only, and are not intended to set or suggest prices for any specific products or customers, or to detail costs of production at any specific farm or company.

<sup>b</sup> The prices in this chart reflect wet weight. Because seaweed is roughly 85-90% water, the dry weight price is typically 10x higher. If a market offers \$5.00/lb for dried flakes, that is equivalent to roughly \$0.50/lb for the wet harvest.

category), and price points that are still too low to support their businesses. Additional market innovation and development has also been hindered by a lack of financing, particularly blended and patient capital that can absorb a high level of risk.

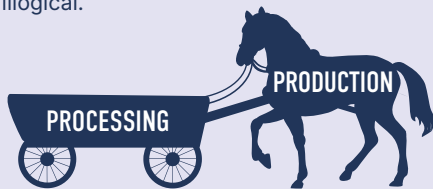
In essence, Washington state seaweed farms have no market for their harvests (the “egg”), but markets that fit their needs won’t develop without expanded production and processing capacity (the “chicken”). The specific drivers in this challenge category are further broken down in [Table 2](#) below.

## The “Cart before the Horse” Challenge

### INDUSTRY GROWTH CONTINGENT ON RISKY INVESTMENTS IN PROCESSING

#### FIGURE 7: THE “CART BEFORE THE HORSE” CHALLENGE

Lack of processing stalls development of markets, which stalls growth of production, but investing in processing before the industry expands is risky and illogical.



The second challenge category dives more deeply into the production and processing bottlenecks that are specific to Washington state. As explained above, there are only two active seaweed farms in state waters, and both are limited to relatively small footprints, meaning even at their maximum production capacity they will each remain solidly within the realm of “small-scale farms.” Geographical distance and significant differences between their priorities and goals have limited their ability to collaborate, while regulatory and financing barriers, among other factors, have hindered the development of additional farms in

the state. What’s more, production from these two farms has proven to be highly variable and unpredictable from year to year. All of this makes it extremely difficult for processors and product developers to depend on Washington harvests for their production systems.

The resulting lack of processing capacity in Washington — both primary processing/stabilization, as well as secondary processing to create higher-value products — has been a major obstacle to scaling the industry. Individual farms are essentially on their own in securing expensive equipment to process their harvests. In the case of Lummi Island SeaGreens, creative co-packing agreements with local agricultural processing facilities have been helpful, but won’t be sufficient as production grows, which it must do if farmers are to access established markets for seaweed (discussed above), or if new markets are to develop.

So, in short, there isn’t enough processing capacity (the “cart”) to support access to existing markets or development of new ones, but investment in processing capacity before markets and production scale (the “horse”) is risky and unappealing to investors. [Table 2](#) presents the specific barriers and factors contributing to this challenge in greater detail.

**TABLE 2: Primary barriers driving the “Chicken and the Egg” and “Cart before the Horse” challenges facing the seaweed farming industry in Washington state, categorized.**

Barrier Category	Primary Contributing Factors
<b>Regulatory &amp; Spatial</b>	<ul style="list-style-type: none"> <li>• <b>Permitting &amp; Leasing:</b> High hurdles for entry; complex and uncertain regulatory landscapes; duplicative requirements across agencies.</li> <li>• <b>Spatial Constraints:</b> Regulatory challenges, including lack of clarity on requirements, and a crowded coastal/ marine space limit current and potential farm footprints.</li> <li>• <b>Siting Conflicts:</b> Difficulty identifying locations accepted by all stakeholders that support long-term growth.</li> </ul>
<b>Hatchery &amp; Production</b>	<ul style="list-style-type: none"> <li>• <b>Seed Instability:</b> Challenges in spore harvest, spawning timing, and nursery management lead to uncertainty, instability in production, and crop failures.</li> <li>• <b>Expertise Gaps:</b> Critical need for technical skills in seaweed spawning to prevent business-threatening seed failures.</li> <li>• <b>Species Diversity:</b> Need to expand expertise around growing additional species of seaweed which may have stronger market potential.</li> </ul>
<b>Operational Risk</b>	<ul style="list-style-type: none"> <li>• <b>Small-Scale Vulnerability:</b> Low margins for harvest variability; high risk for small businesses.</li> <li>• <b>Challenging Environment:</b> Marine environment inherently harsh and challenging; operation and response plans must assess and mitigate risks.</li> <li>• <b>Collaboration Barriers:</b> Distance between farms limits opportunities for shared infrastructure and crop aggregation.</li> </ul>
<b>Market Access &amp; Economics</b>	<ul style="list-style-type: none"> <li>• <b>Price Disconnect:</b> Established and developing markets require higher volumes and lower price points than small farms can currently sustain.</li> <li>• <b>Product Fit:</b> Limited North American consumer demand for seaweed as food, challenges with scaling and economic viability.</li> <li>• <b>Competition:</b> Pressure from low-cost foreign imports, wild harvested seaweeds, and synthetic alternatives.</li> <li>• <b>Vertical Integration:</b> Existing companies often keep supply chains internal, excluding independent small farms; vertical integration can be challenging for small-scale farms with limited staff capacity.</li> </ul>

Barrier Category	Primary Contributing Factors
<b>Financing &amp; Investment</b>	<ul style="list-style-type: none"> <li>• <b>Investor Hesitation:</b> High uncertainty in return on investment (ROI) and market demand makes private capital to support both production and processing scarce.</li> <li>• <b>Capital Gaps:</b> Traditional lending and grant structures do not accommodate the high uncertainty and unique seasonal and biological cycles of seaweed farming. There is a need for blended and “patient” capital – funding models that can support higher-risk and longer return on investment timelines, catalytic investment, and better coordination of funding.</li> </ul>
<b>Logistics &amp; Processing</b>	<ul style="list-style-type: none"> <li>• <b>Primary Processing:</b> Seaweed degrades within 24 hours; farms lack nearby stabilization infrastructure.</li> <li>• <b>Secondary Processing:</b> Gaps in processing technology and appropriate co-packing agreements limit market entry.</li> <li>• <b>Geographic Isolation:</b> Farms are often too far apart to share processing facilities effectively.</li> </ul>

### Pervasive Knowledge Gaps Influencing All Aspects of Industry Development

Seaweed farming in Washington State requires clear and effective public engagement, particularly around the siting of new farms. Public push back has created challenges for two newly-permitted farm sites near Vashon Island despite significant efforts on the part of the farm teams to engage the local community and develop buy-in. One challenge stems from a lack of public familiarity with seaweed aquaculture and how it differs from finfish aquaculture. The finfish aquaculture industry carries a significant negative public perception in Washington after a catastrophic gear failure at an Atlantic salmon net pen farm in the early 2000s led to a major escape of Atlantic salmon

into the Puget Sound, theoretically threatening to outcompete or breed with Washington’s valuable and vulnerable salmon species.

In addition, although there is strong global evidence that the impacts of seaweed farming on surrounding ecosystems can be beneficial via improved water quality, habitat creation, and by augmenting wild seaweed populations [5], local, in situ studies are lacking in Washington state. Regulatory agencies in Washington have voiced concerns around potential negative impacts of kelp farming, such as the risk of genetic influence from farmed kelp to wild populations via the spread of spores, and the risk of marine mammal entanglement in the floating lines or in lost gear.

Thus, the existing perception challenges are further complicated by key knowledge gaps that prevent definitive risk assessment. When scientific understanding is incomplete, regulatory frameworks (at least in Washington) often default to worst-case scenarios and precautionary actions. Concerns about genetic impacts of farmed seaweeds on wild populations could be ameliorated if regulators had a better understanding of the actual genetic makeup of wild seaweeds in Washington waters, or of the dispersal patterns of spores from farms under different current conditions. Similarly, concerns around entanglement could be reduced through fine-scale analysis of potential farm locations in relation to marine mammal territories. But addressing each of these research needs / knowledge gaps requires financial and staffing resources that neither farmers nor regulatory agencies have available. This lack of definitive

information forces regulators to err on the side of caution, resulting in more stringent, time-consuming, and costly regulatory requirements that disproportionately affect the nascent seaweed industry, hindering its ability to scale and realize its economic and environmental potential within the state.

**Key Knowledge Gaps**

Through convenings, workshops, and interviews over the past 18 months, a number of additional critical knowledge gaps have been identified (**Table 3**), which are slowing industry growth across the region. These unknowns drive and exacerbate all of the other challenges listed above. Addressing them through coordinated scientific research, industry analysis, and scenario testing is therefore critical to advancing this industry, in Washington and across the region.

**TABLE 3: Priority Knowledge Gaps for Collaborative Research**

Category	Priority Research Questions & Knowledge Gaps
<b>Ecological Interactions</b>	<p>Quantifying the benefits of kelp farms for wild kelp restoration (e.g., through spore dispersal) and local biodiversity (e.g., through habitat creation or nutrient moderation), particularly understanding farm siting, design, and operational specifications that lead to stronger restoration outcomes (e.g., when should spores be collected?; should lines and holdfasts be left in the water year round?).</p> <p>Understanding dispersal patterns of spores as well as the actual genetic makeup of wild seaweed populations to address concerns of genetic pollution of wild kelp populations.</p> <p>Regionally-specific Life Cycle Assessments (LCAs) to validate/prove the carbon-reduction and ecosystem service provisioning potential of seaweed-based products developed in the region.</p>

Category	Priority Research Questions & Knowledge Gaps
<b>Climate Change</b>	<p>Understanding the likely impacts of sea-level rise, extreme weather events and “heat domes” on existing and prospective farms and local ecosystems.</p> <p>Identifying and understanding how to grow more heat-resistant strains of seaweed for farm resilience, as well as potentially to support wild populations’ ability to withstand climate change (Note: there is a critical tension between this goal and the goal of avoiding genetic influence from cultured strains on wild populations.)</p> <p>Exploring the potential for kelp farms to be sited to act as “habitat refugia” for native species and communities seeking to relocate (poleward and/or deeper) to track preferred ocean temperatures and conditions; and/or to support resilience for coastal communities (e.g., by tempering storm surges or reducing erosion).</p>
<b>Social &amp; Cultural</b>	<p>Better quantifying and monetizing the social and cultural value of kelp (e.g., spawning or nursery habitat for culturally significant species like salmon and herring; culturally important uses for Indigenous and/or immigrant communities) to help farms capture this value.</p> <p>Better understanding of what seaweed species are wild-harvested in Washington, as well as what those species are used for; how farming interacts with subsistence use (e.g., will it help remove pressure from commercial wild harvest or will it increase regulatory barriers to subsistence use?).</p>
<b>Siting &amp; Engineering</b>	<p>Understanding whether and to what extent farm designs will be affected by the potential for severe weather events and other impacts, including those that will worsen with climate change.</p> <p>Identifying “Aquaculture Opportunity Areas” (AOAs) with high-resolution mapping data for better site selection (beyond those recently identified in Alaska).</p> <p>Understanding how farm siting decisions impact interactions with local ecosystems and species (including differential potential for entanglement in different areas) and potential for farms to augment restoration efforts.</p>
<b>Logistical &amp; Developmental</b>	<p>Identifying opportunities to improve efficiency and lower costs, including as operations scale (e.g., simplifying outplanting, reducing processing costs).</p> <p>Identifying the most efficient sea, air, and land routes for transporting raw kelp and intermediate products from Pacific Northwest harvesting sites (Alaska, British Columbia, etc.) to a centralized regional processing hub. Assess capacity constraints at key transit points.</p> <p>Assessment of varying state, federal, and international regulations, including import/export rules, food safety requirements, permitting, and quality control, that impact product flow across the region.</p>

# TWO KEY PATHWAYS TO A THRIVING SEAWEED FARMING INDUSTRY IN WASHINGTON STATE

In order to achieve the goal of a thriving seaweed farming industry in Washington state and overcome the interconnected challenges and dynamic nature of the sector articulated above, it will be necessary to **advance down two key pathways simultaneously**. These two pathways will interact with and support each other, but they require different actions and partnerships. Through their collective advancement, the seaweed farming industry can support Washington's economy, provide jobs, produce sustainable food and other resources, and support the health of local ecosystems. These two pathways are:

- **Pathway 1: Supporting the economic viability of small-scale seaweed farms in Washington waters**, individually or collectively, through **expansion of right-sized markets** for small-scale harvests, potentially **identifying additional entities** to share processing costs and aggregate harvests with existing farms, and **building an expanded network of advocates** who can collaboratively address priority knowledge gaps and advance towards shared goals.

- **Pathway 2: Supporting the development and expansion of Washington's role in the industry across the broader West Coast region**. This includes expanding processing, transportation, and distribution infrastructure that will allow **Washington state to act as a processing hub** for the seaweed farming industry across the region, as well as building more general connectivity and collaborative structures to **support knowledge sharing and coordination** across the region. Importantly, it will be critical to ensuring new cross-regional systems are developed in a participatory and equitable way.

The subsequent sections of this Roadmap will dive more deeply into these two pathways, summarizing the outcomes of the work done over the past 18 months to identify and advance each of them, and laying out the necessary next steps to support the seaweed aquaculture industry in Washington state in reaching its full potential.

# WASHINGTON SEAWEED FARMING INDUSTRY ROADMAP

## Figure 8: Two Interdependent Pathways to a Thriving Seaweed Industry

### THE INTERCONNECTED CHALLENGES IN THE SEAWEED INDUSTRY

⚠️ **MARKETS ↔ PRODUCTION (CHICKEN OR THE EGG)**

⚠️ **PROCESSING ↔ PRODUCTION (CART BEFORE THE HORSE)**

⚠️ **PRIORITY KNOWLEDGE GAPS**

#### PATHWAY 1

### Support Small-Scale Viability for Washington Farms

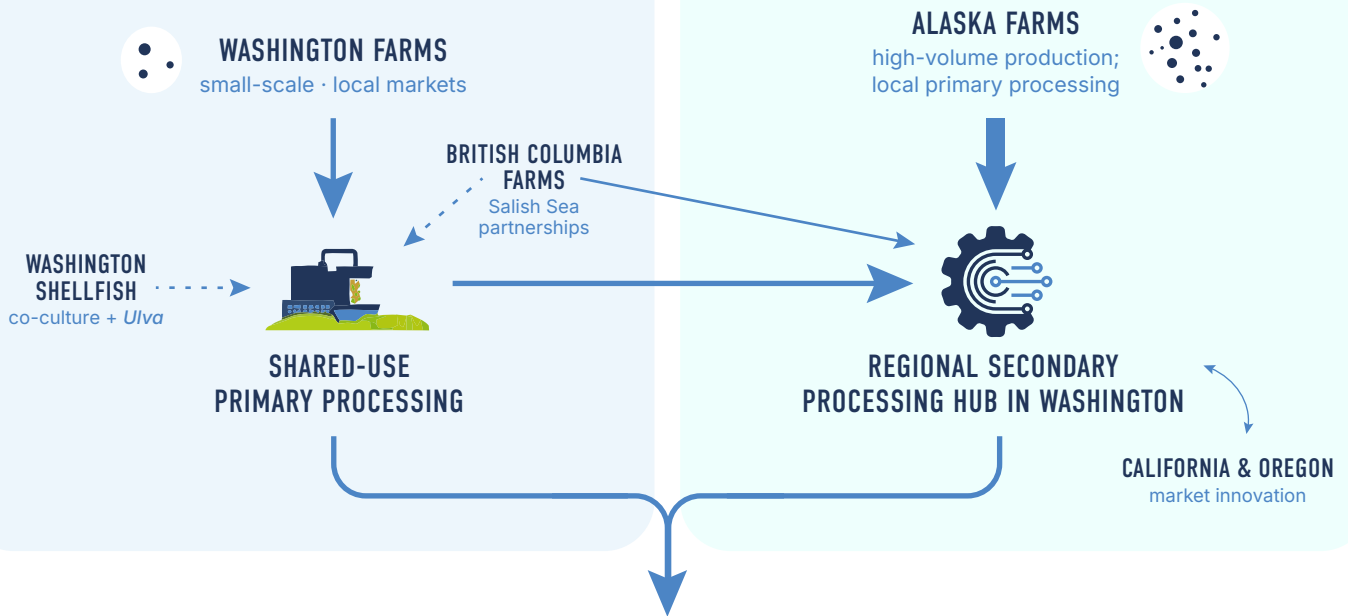
- Expand right-sized, high-value markets
- Address seed failures & nursery gaps
- Build shared-use agreements to address the processing bottleneck
- Explore collaborations and partnerships across sectors and regions
- Launch coordinated research initiative to address uncertainties driving regulatory hurdles

#### PATHWAY 2

### Establish Washington as Regional Processing Hub

- Build a West Coast Seaweed Industry Coalition
- Invest in shared, regional secondary processing capacity
- Advance modular or cascading processing platforms to preserve market flexibility
- Optimize Alaska–Washington kelp pipeline
- Ensure equitable ownership and benefit-sharing

### REGIONAL SEAWEED INDUSTRY FROM PRODUCTION THROUGH PROCESSING VIA THE TWO PATHWAYS



### A THRIVING, EQUITABLE, REGENERATIVE SEAWEED ECONOMY

**ECONOMIC VIABILITY**  
JOBS · REVENUE · TAX BASE

**ECOLOGICAL HEALTH**  
HABITAT · WATER QUALITY · RESILIENCE

**SOCIAL EQUITY**  
SMALL-SCALE FARMS · LOCAL BENEFITS

**REGIONAL COLLABORATION**  
WEST COAST COALITION · INNOVATION

## PATHWAY 1: SUPPORTING THE ECONOMIC VIABILITY OF SMALL-SCALE SEAWEED FARMS IN WASHINGTON WATERS

Seaweed farms in Washington are currently, and will almost surely continue to be, small-scale operations with limited potential to physically expand. This is due to geographical constraints, precautionary regulatory agencies and public opinion, and a subtidal zone that's crowded with other marine uses. Small-scale seaweed farms, similarly to their terrestrial counterparts, may actually be more ecologically sustainable and more likely to benefit local communities than large-scale operations. Small-scale terrestrial farms have been shown to be less likely to disrupt or damage local ecosystems than large-scale monocultures, more adaptable to local conditions, and more likely to be community-owned and thus to support local sovereignty and economic stability [18], [19], and these same patterns are reflected in the aquaculture industry.

Prevailing trends across the industry have been pushing farms to scale up and/or aggregate harvests in order to access larger-volume markets. It has even been suggested that seaweed farming simply cannot be an economically viable industry unless it happens at very large scales (see earlier discussion of the mismatch between the current scale of production and existing or emerging markets for seaweed products). However, while it has undeniably been more difficult than expected to develop higher-value, lower-volume markets than was initially expected when seaweed farming began to take off on this coast a



Kelp harvest for Lummi Island SeaGreens.  
Photo by Mike Spranger / Pacific Sea Farms

decade ago, there is no reason to believe that it will be impossible to do so eventually. In fact, as larger-scale and more established farms elsewhere on the West Coast work through bottlenecks and barriers that have held the industry back, it may become more feasible to successfully operate a small-scale seaweed farm at a profit by tapping into more developed infrastructure and consumer awareness.

Through this lens, seaweed farms in Washington are poised to play a critical role in the advancement of the industry. With the confluence of a profound cultural heritage tied to the coast, a large base of environmentally-aware consumers, highly developed marine and logistical infrastructure and distribution networks, and an experienced workforce in the agricultural and seafood processing sectors, there is every reason to believe that **Washington seaweed farms have the potential to reverse broader industry trends and serve as a “bright spot” case study for successful small-scale seaweed farming with global relevance.** The following recommendations, identified and distilled through the collaborative

discussions and cross-sector interviews conducted through this project, capture the critical actions and essential first steps required to achieve this goal.

### **Expand “Right-Sized” Markets**

The most significant challenge facing small-scale seaweed farm viability in Washington right now is the mismatch between the scale of seaweed production and the scale of markets for seaweed products. As mentioned above, even at maximum potential production

amounts help farming in Washington will remain “small-scale” in relation to the quantities of kelp needed to access emerging markets, such as bioplastics, biostimulants, and biofuels. And due to high production costs in the US, small-scale kelp farms cannot compete with Asian producers to access higher-value established international markets for kelp as food. Thus, for small-scale seaweed farmers to succeed, they need to find small- to medium-scale markets that offer a relatively high value per unit of harvest.



Harvesting sugar kelp for Lummi Island SeaGreens in Legoe Bay.  
Photo by Hailey Hoffman / Cascadia Daily News

To provide a general sense of the existing local market and inform new product development, Maritime Blue contracted with GreenWave to conduct a series of “customer discovery” interviews to better understand potential customer interests and priorities in two market sectors that were prioritized by the growers: packaged foods and personal care products targeted to the hospitality sector.

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**Washington seaweed farms have the potential to reverse broader industry trends and serve as a “bright spot” case study for successful small-scale seaweed farming with global relevance.**

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## RESULTS OF GREENWAVE’S CUSTOMER DISCOVERY PROCESS

Customer discovery is the systematic process of understanding potential customers’ needs, pain points, and behaviors. It is typically conducted before positioning a product and pursuing a sales strategy. GreenWave conducted a series of 30-minute interviews with potential kelp customers in the Pacific Northwest to support Washington kelp farmers in deciding which market sectors to pursue via secondary processing and product development. After reaching out to more than 80 potential interviewees, GreenWave spoke with six potential customers in the consumer packaged foods (CPF) and foodservice sectors, as well as three potential customers in the hospitality sector, using lists of questions tailored to these two sectors. Their key findings and resulting guidance are summarized here.

### **Market Opportunities and Customer Needs**

In the food sector, potential customers show interest in dried, milled, or flaked kelp with shelf stability, requiring consistent quality, food safety documentation, and year-round supply. Fresh kelp is also of interest for use in restaurants and for fermented products. Customers prefer minimal packaging and value organic certification, traceability, and sustainability information. Volume needs for testing range from small samples (500g-5 lbs) to larger batches (10-50 lbs), with an emphasis on consistent flavor and availability. These findings challenge the prominent idea that there will never be any market for seaweed as food in North America, and support the conclusion that selling Washington-grown

seaweed to local and regional restaurants and packaged food producers could prove to be an important part of a viable business strategy for small-scale seaweed farmers in the region. However, these markets — especially the direct-to-consumer path — will remain quite small, and farmers will likely need to diversify their buyers, with lower quality seaweed going to a higher volume, non-food markets, to see a reasonable profit.

In the hospitality sector, kelp-based bath products with coastal identity and sustainability credentials are promising, especially if priced competitively and offered in waste-free formats through existing channels. Hospitality properties (e.g., hotels) seek products that deliver functional benefits, with quick, easy ordering and inventory readiness being critical. These findings underscore the importance of having a clear understanding of end product specifications and logistics to drive processing plans and technology investment decisions further up the value chain.

## **Operational and Market Insights**

For farmers, accessing existing markets and selling to existing businesses will depend on developing processing infrastructure — drying, milling, and packaging — to meet specific quality and safety standards dictated by these buyers, and establishing inventory and distribution systems for consistent supply. Direct relationships with small to medium customers are preferred for the Washington context, with sampling and long-term development cycles emphasized. Pricing strategies should emphasize the quality, consistency, and “local story” of the product. Volume discounts can be used to incentivize larger purchases. In specialty and low volume markets (where kelp represents less than 10% of the ingredient composition), price sensitivity is expected to remain low (meaning these markets can bear higher fluctuations in ingredient pricing). Hospitality applications, even targeting boutique hotels, will require partnerships with established brands for formulation and packaging, as well as sufficient inventory to prevent supply gaps.

## **Develop Co-Use Partnerships for Processing**

As the Customer Discovery process made clear, in order to access and expand right-size markets, Washington farms will need to utilize the right processing technologies and facilities for sample creation and pilot-scale product runs, and to do so without taking on excessive

capital investment risks. To better understand which processing technologies, platforms, and infrastructure will be necessary and appropriate to support the developing seaweed aquaculture industry in Washington state, as well as what constraints must be addressed to expand this capacity, Maritime Blue contracted with Hatch Blue.

# RESULTS OF PROCESSING TECH ANALYSIS - PART 1: CO-PACKING AND SHARED USE AGREEMENTS

Hatch Blue conducted an extensive analysis of the technologies and infrastructure necessary to support the production of the two product categories prioritized by the Washington kelp farmers to receive their highest-quality harvest: packaged food products and personal care items for the hospitality market, as well as a third product category able to receive lower-quality (non-food grade) biomass: agricultural soil inputs.

The Hatch Blue team conducted a comprehensive infrastructure audit across the seafood, agricultural, and fermentation sectors to evaluate “shareable” processing capacity in 13 different Washington locations. The analysis reinforced the recommendation of a phased approach, finding that Washington seaweed farmers have a significant opportunity to seasonally utilize existing infrastructure and co-packing agreements to stabilize and process kelp, reducing initial capital expenditure (CAPEX). However, once market demand expands to require continual, year-round production, dedicated processing capacity in an existing permitted facility will be necessary to allow them to scale up without prohibitive investment costs.

In particular, the assessment identified a variety of potential opportunities for pilot scale processing operations in the **Bellingham / Whatcom County / Skagit corridor** due to its high density of potential partners: 20+ potential co-packing / shared-use partners were identified across seafood processors,

feed mills, and fermentation facilities, and the April-June kelp harvest window aligns well with off-peak capacity. In addition, the region boasts a strong workforce capacity at a lower wage point than the Seattle metro area, R&D access through Western Washington University and the Shannon Point Marine Center, Port investment in, and local prioritization of, maritime economic development with the Whatcom Working Waterfront initiative, and the unique connection to the Alaska Marine Highway (creating potential for secondary processing of seaweed from Southeast Alaska in addition to seaweed grown in Washington).

The primary risk to investing in processing infrastructure in the Bellingham area is that there is limited availability of industrial zoned real estate available, limiting the potential for scaling as seaweed production and/or importing increases. Within this same Whatcom County region however, **Ferndale**, which is 10 miles north of Bellingham on the I-5 corridor, offers much more flexible and abundant industrial vacancy space and lower industrial rent than Bellingham, thereby making it both a strong fallback option for pilot-scale processing and a leading contender for scaling up, with the caveat that it relies on Bellingham for port access.

The assessment also explored the technical capacity and feasibility for seaweed to be processed through the technologies and infrastructure currently utilized in co-located sectors (agriculture, seafood, and



An operation manager at Sauk Farm feeds dried kelp into a grinder.  
Photo by Hailey Hoffman / Cascadia Daily News

fermentation). Twenty five possible processing steps were evaluated across primary and secondary processing and rated for shareability: whether an existing Washington partner has the equipment, capacity, and regulatory standing to perform that step under a shared-use arrangement. Specific recommendations for stabilization and primary processing through available facilities include:

- **Agricultural and Feed Integration:** Existing feed mills and agricultural dehydrators were identified as high-potential partners for stabilizing seaweed into agricultural inputs, biostimulants, and soil amendments.

- **Seafood Processing:** Utilizing the off-peak capacity of seafood processors (particularly during the spring kelp harvest window of April–June) was recommended for drying, freezing, or primary stabilization.
- **Fermentation:** Facilities such as breweries or kombucha production sites (e.g., Kombucha Town) were noted to offer vessel capacity for liquid-state fermentation.

However, the report notes that only 11 of the assessed processing steps are “highly shareable” with existing equipment and infrastructure, and food-grade validation is a bottleneck. Currently, no Washington facility is fully validated for seaweed food processing, and cross-contamination / allergen risks (i.e., risk of shellfish contamination from seaweed<sup>a</sup> into other seafoods) remain a primary hurdle for shared-use agreements. The agricultural product pathways avoid this challenge, as drying, milling, and pelletizing can be performed in a single facility without the requirement of food-grade certifications.

Additionally, the analysis underscores that different end products require different numbers of processing steps, which translates to different numbers of processing partnerships to navigate through the shared-use pathway. Each additional partnership relationship increases the complexity and burden, each requiring its own MOU, regulatory compliance verification, scheduling

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<sup>a</sup> Seaweed is not shellfish, but it may be harvested with small crustaceans attached:

<https://allergenbureau.net/allergen-management-critical-as-seaweed-market-accelerates/>

coordination, etc. The majority of currently-viable products require just 1-2 partners. For example, the production of animal feed supplement requires: seaweed farm → feed mill for drying, milling, and pelletizing (1 partnership); whereas production of kelp seasoning requires: seaweed farm → dryer → food co-packer for milling and blending (2 partnerships); and similarly, production of liquid biostimulant requires: seaweed farm biostimulant farm → juice press → fertilizer blender for concentration and bottling (2 partnerships). However, some of the higher-potential-value products (e.g., alginate and fucoidan extraction) will require a third partnership if/when such an extraction facility is developed in Washington.

Furthermore, the analysis reveals that the personal care market may be viable, but will require additional development. The transformation of seaweed into finished soaps, lotions, etc. that meet relevant safety, quality, and labeling requirements is thus far untested at any Washington facility, and although the analysis points to some potential partners for exploration, the nascency of this product pathway will require the engagement of experienced contract manufacturers to bring these products to market.

Ultimately, the assessment revealed six theoretically viable product pathways for Washington state farmers at this stage of industry development (at lower CAPEX investment and biomass availability), all which rely on basic processing steps only (e.g., air drying, milling, fermentation), and all which produce shelf-stable products with established

market demand. These include: dried whole leaf, salted or preserved kelp, fermented kelp, kelp condiments, fermented seaweed slurry (for agricultural use), and soil amendments with integration of *Ulva*. These can all be processed using shared or cross-sector equipment without dedicated facility investment. Additionally, the report recommends that Washington stakeholders consider creating or subsidizing a shared food innovation and wet-processing space of approximately 3,000-10,000 sq. ft. to retain innovators and reduce early-stage development costs.

However, this comes with an important caveat: different primary processing decisions can limit final product possibilities if the chemistry of the seaweed is altered (e.g., through fermentation). A key recommendation is thus to select primary processing technologies and pathways that don't alter the chemistry significantly unless final stage product plans are certain.



## Build Spore Collection and Nursery Capacity

Beyond the lack of market access and processing capacity, the kelp farming industry in Washington is hampered by a lack of reliable seed supply and skilled nursery technicians, with only one commercial nursery currently operating in the state. Farmers face significant risks of seed failure, and although Blue Dot Sea Farms has had success each year of their lease thus far, Lummi Island SeaGreens experienced catastrophic seed failures in both their second and third years of operation. This is a common challenge for the early stages of this industry's development;

both the Alaskan and British Columbian seaweed aquaculture industries struggled with seed supply and quality challenges in their early years, and Washington is still a few years behind those regions in building nursery capacity and expertise. Implementing strict spore collection and standardized nursery protocols, such as those outlined in GreenWaves [Kelp Nursery Operations Manual](#), as well as upgrading technologies to improve water purification and filtration, have been key to addressing this challenge in other regions, and Washington stakeholders are now pursuing similar improvements.



A line of sugar kelp is pulled from the water for viewing mid-season.  
Photo by Willow Battista

# RECOMMENDATION IN ACTION: LUMMI ISLAND SEAGREENS CASE STUDY

The LISG team has been working to implement many of the recommendations contained within Pathway 1 of this Roadmap, and to directly address the key barriers facing their industry in Washington state. Their efforts are presented here as a case study to illustrate the results of ongoing and completed activities, as well as critical next steps.

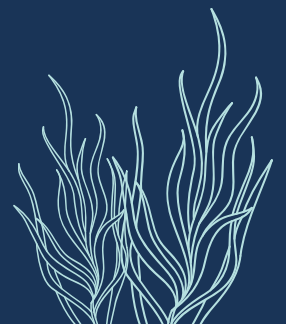
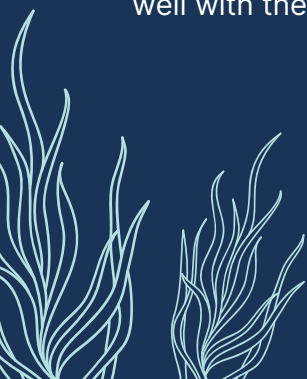
Lummi Island SeaGreens was Washington's first fully permitted commercial seaweed farm, harvesting its first commercial crop in 2024. Located in Legoe Bay, just south of Vancouver, B.C. near the U.S./Canadian border, the farm operates on the ancestral homelands of the Coast Salish People. Their business model focuses on the cultivation of high-quality Sugar Kelp (*Saccharina latissima*), stabilized into fresh, frozen, and dried products.

Founded by Riley Starks, a lifelong fisherman and restaurateur, the farm was initially intended to provide additional income to augment the traditional reefnet salmon fishery in Legoe Bay. Reefnet fishing, a highly sustainable fishing method, originated centuries ago with the Indigenous Coast Salish People, and they still practice today in Legoe Bay at one of only 11 such fisheries currently in existence. In the Salish Sea, the salmon reefnet fishery season runs only from August or September to early November, aligning well with the sugar kelp farming season which

generally runs from November through April. In collaboration with Larry Mellum, a Seattle restaurateur, Mr. Starks applied for a permit and lease to farm kelp within the bounds of the existing reefnet fishing permit, assuming that they would be able to sustain the kelp farm through direct sales to chefs and restaurateurs around the state.

## **Co-Packing Agreements for Low-Cost Processing**

One of the first challenges the LISG team had to address in their first year of production was that of stabilizing and processing their raw wet kelp for market. Without strong market demand signals, the team decided to create three stabilized formats to preserve the diversity of potential markets they could access. Rather than invest in expensive and energy intensive equipment at this early stage, however, the team capitalized on their strong existing relationships with terrestrial farmers and seafood producers in and around their community. They identified an opportunity to enter into a co-packing agreement with a local orchard, whose commercial-grade dryer has the capacity to handle the liquid content of the fresh sugar kelp, and was not in use during the critical kelp harvest season. They also contracted with a seafood producer to chop some of the kelp before drying, making it easier to transform into end products like spice mixes and bath soaks, however the timing was less-well aligned with this partner



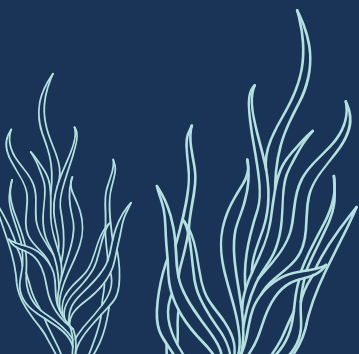
and the LISG team ended up renting a chopper and screw press from a vendor in Florida to process the last of their kelp in-house. LISG has thus solved the processing challenge in the near term. However, to grow and scale they will need to invest in a higher-capacity dedicated processing equipment/ facility that can enable them to produce multiple products in higher quantities and all year round.

**KEY DECISION POINT:** The Lummi Island SeaGreens team has addressed near-term processing needs through co-packing agreements with a local agricultural processor and a local spice manufacturer. Co-packing or shared use agreements with existing agricultural, seafood, or other processing facilities can allow for stabilization and primary processing of small-scale harvests at a fraction of the cost of investing in a new facility. This can be a stepping stone to business growth. Many processors exist throughout Washington, in the seafood, agriculture, and specialty foods sectors, which could theoretically handle processing of kelp based on technologies and seasonality of use, although concerns around allergen cross-contamination and other food safety considerations may need to be addressed. However, such agreements will not be able to support the industry long-term, as year-round processing needs develop.

## Product Diversification for Value Maximization

Unfortunately, as many other seaweed farmers have discovered, the current direct-to-restaurant seaweed market is quite small. For example, one restaurant only needed ~5lbs of frozen kelp to sustain an entire year of operations. Although the LISG team was able to facilitate a number of purchase agreements with various restaurants around the region, they found that they had soon reached the limits of this demand. After their first official harvest season, the team was left sitting on 900 pounds of dried, 800 pounds of frozen, and 140 liters of liquified kelp with no clear market for these products.

Based on extensive discussions with GreenWave experts throughout the Customer Discovery process, as well as with the other seaweed farmers participating in this collaborative, the LISG team decided to shift their focus from the extremely-small-scale “direct-to-consumer” food market to the **packaged foods** market, where their dried kelp can be tested as ingredients in a variety of existing product streams. In addition, considering their existing relationships and expertise, they decided to target **personal care products**, in particular for the hospitality industry (i.e., local or regional hotel chains), as their secondary market for lower quality harvest portions. They hope that by diversifying the type of markets they target with each harvest, they will be able to increase profit margins and reduce risk.



**KEY DECISION POINT:** The Lummi Island SeaGreens team decided to target a “principal” market for a high-value, low-volume product with the highest-quality portion of each harvest, while simultaneously developing a “subsidiary” market for a lower-value, higher-volume market for their lower-quality harvest portions. Targeting a mix of markets with different quality and volume requirements can help to diversify income streams and reduce grower risk, as it prevents total financial loss if a single market fails or demand for one product declines. However it may also necessitate diversifying processing technologies if different formats are required as input to the different markets, as well as the management of multiple fulfillment relationships and logistics.

### Vertical Integration for Market Development and De-Risking

Despite following a number of promising leads that stemmed from the GreenWave Customer Discovery process, the LISG team continued to struggle to find an established buyer willing to purchase their kelp at their current modest scale of production, and at a price point sufficient to sustain their operations. This market gap forced a strategic reassessment. Rather than continuing to search for a wholesale buyer, the Lummi team decided on a path of vertical integration. This pivotal decision led to the formation of their own seaweed product company, which they officially launched in late 2025 under the name

### FIGURE 9: VERTICAL INTEGRATION: THE LUMMI ISLAND APPROACH

Vertical integration brings multiple value chain steps under one roof, reducing reliance on underdeveloped markets and capturing more value — while increasing individual farm risk and complexity.



#### KELP NURSERY

Spore collection · hatchery · seeding  
Considering bringing in-house



#### OCEAN FARM

Legoe Bay · 10 acres · sugar kelp



#### PRIMARY PROCESSING

Drying · freezing · liquid extract  
Co-pack: local orchard dryer



#### PRODUCT DEVELOPMENT AND SECONDARY PROCESSING

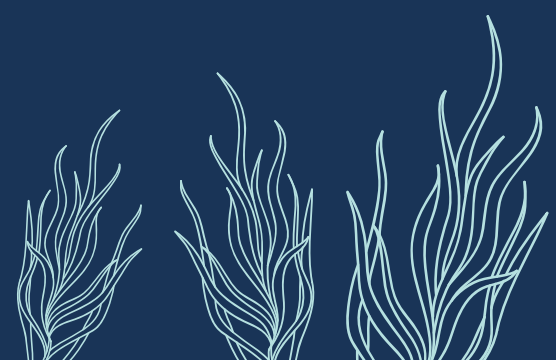
Formed “Bounty of the Salish Sea” brand  
Direct-to-consumer and packaged foods  
Personal care products



#### DIRECT-TO-CONSUMER MARKET

Opening Pike Place Market shop  
Shelf-stable regional products  
In-store kelp experiences

**Bounty of the Salish Sea.** Additionally, building on their past experience and expertise, the team decided to go a vertical step further, pursuing a lease on a physical shop location in the famous Pike Place Market in downtown Seattle. Once open, this shop will sell both shelf-stable kelp products from across the Salish Sea (including from other regional farms and companies), and provide customers with



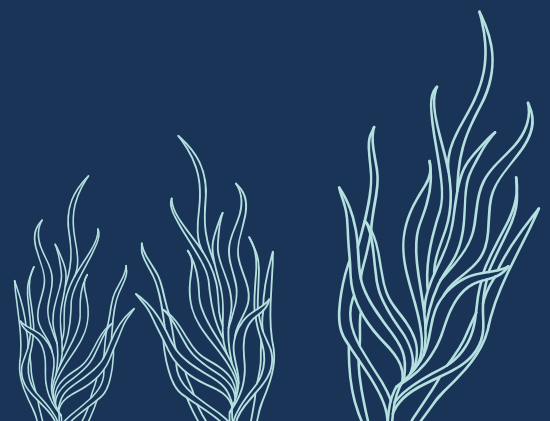
in-store kelp experiences including “kelp foot baths” and kelp-based soups for purchase. This new venture allows them to not only grow the raw material but also process, package, market, and sell consumer-ready products, thereby capturing more value from their operation and ensuring a viable market for their harvest.

Additionally, in response to the critical seed failures that the LISG team experienced in their second and third years of operations, the team recently made the decision to further expand their vertical integration by building and operating their own kelp nursery. To inform the LISG team’s planning, Maritime Blue facilitated direct advising from GreenWave’s nursery experts, and supported Mr. Starks and Mr. Mellum’s attendance of the recent Mariculture Conference of Alaska, held in Anchorage in March 2025, where they were able to consult with various experts who have contributed to the advances the industry has made in that state, which appear to have solved this challenge for Alaskan farmers. Bilateral seed sourcing agreements with the Blue Dot Sea Farms nursery have also been discussed to address near-term sourcing needs.

**KEY DECISION POINT:** The Lummi Island SeaGreens team decided to vertically integrate - developing their own products, opening their own consumer-facing market, and working to open their own nursery. Vertical integration (where one entity is responsible for multiple steps in the value chain, e.g., farming, processing, and distribution) can be an important pathway for early-adopter seaweed farms that lack potential upstream and/or downstream partners within reasonable geographic proximity. By internalizing these steps, farmers reduce reliance on underdeveloped markets, capture a larger share of the value, and accelerate the development of specialized products, thereby securing their own market viability. However, vertical integration also increases the individual farm’s risk, logistical complexity, and investment costs, as each step in the value chain is essentially a separate business with its own margins and challenges.



Photo by Larry Mellum/ Lummi Island SeaGreens



## Additional Recommendations

Beyond the key recommendations reflected in the Lummi Island SeaGreens case study, it is clear that additional actions are needed to ensure the LISG farm, and any potential future small-scale seaweed farms in Washington state, can reach economic viability. These additional recommendations are detailed below.

## Identify Additional Entities to Collaborate

Although, as explained above, a key premise of this Roadmap is that it is both feasible and valuable to support LISG and other small-scale seaweed farms in becoming economically viable on their own, the fact remains that there are many significant challenges facing small businesses in any sector that can be at least partially alleviated through collaboration with additional businesses and with shared goals. Collaboration and cooperation can help small businesses overcome challenges related to scale and market access. Aggregation of harvests, for example, would allow individual farms to meet larger-volume orders that would be impossible for a single small producer, thereby unlocking access to new and more lucrative markets such as wholesale food distribution or industrial ingredient buyers [20]. Furthermore, pooling resources – such as investment in shared use of specialized processing equipment, joint marketing efforts, or collective procurement of supplies – can reduce individual operational costs and allow small businesses to benefit from economies of scale [21]. Such collaborative structures can also foster shared learning and innovation, improving best practices across the sector and enhancing the collective resilience of the participants [21].

This was the premise behind the original grant supporting this project, which sought to support formal collaboration between the existing seaweed farmers in Washington. Although contextual changes have meant that there aren't currently enough of these Washington seaweed farmers to achieve this goal, the group has discussed a variety of other entities with whom collaboration might still be feasible, and indeed synergistic.

## Seaweed Farms in Southern British Columbia

LISG's location near the southern border of British Columbia opens the possibility that seaweed farms along the southern B.C. coastline might actually be closer geographically to the Lummi Island farm than Blue Dot Sea Farms, which is a significant distance south in the Hood Canal. Furthermore, Lummi Island is situated squarely within the



A line of sugar kelp being held out of the water.  
Photo c/o Jon Kroman / Blue Dot Sea Farms

Salish Sea, a body of water that Washington shares with British Columbia. There is thus potential to capitalize on the reputation of the Salish Sea — known for being pristine and highly productive — when marketing seaweed products grown in these waters across this national border.

Facilitating collaboration and coordination between the “Salish Sea Seaweed Farmers” in southern B.C. and off Lummi Island could lead to the identification of synergistic pathways for advancing the industry, potentially including co-investment in a secondary processing facility, such as a biorefinery, that would be well-sited to support all of these entities (although cross-border complexities, such as tariffs and import regulations, would need to be considered). This joint infrastructure would support both Salish Sea entities and provide a pathway to accessing long-term, larger markets.

### **Shellfish Farms in Washington State**

Washington state is the largest producer of cultured shellfish in the United States. As of early 2026, the sector comprises more

than 300 active licensed operations, ranging from small family-run tidelands to industry leaders like Taylor Shellfish Farms [22]. The state’s nutrient-rich intertidal zones are fertile grounds for Pacific and Kumamoto oysters, Manila clams, Mediterranean mussels, and the high-value geoduck clam, but the historically robust industry currently faces many significant challenges. Climate change-induced ocean acidification and warming threaten shellfish development and increase the risk of toxins, while nutrient pollution from upland agricultural runoff drives annual blooms of nuisance algae that reduce farm productivity. Despite these pressures, the industry remains a cultural and economic cornerstone of Washington’s sustainable blue economy, and an important source of climate-smart food for a growing population.

Shellfish farming in Washington is overwhelmingly done in subtidal settings, where co-culture with seaweed isn’t feasible. However, interest in subtidal shellfish cultivation, as implemented by Blue Dot Sea Farms, has grown recently and as climate



Blue Dot Sea Farms team pulls a line of sugar kelp from the water for harvest.

Photo c/o Jon Kroman / Blue Dot Sea Farms

change-driven shifts in water conditions impact subtidal zones, this interest is expected to expand further. This trend is evidenced by Taylor Shellfish securing a substantial subtidal lease in 2025. There are two primary avenues through which the interests of shellfish farmers operating in subtidal settings might overlap with those of kelp farmers in Washington State.

### ***Co-Culturing Benefits for Shellfish Production***

First, by incorporating kelp into their operations — either as a “curtain” around existing cages, or through migration or expansion into the subtidal water column — shellfish growers can leverage kelp’s potential benefits, such as the capacity to mitigate ocean acidification, reduce nutrient pollution, and improve ecosystem health. This symbiotic relationship between kelp and shellfish could lead to more resilient and productive aquaculture systems, providing environmental benefits and economic advantages [23], including possibly counting as habitat restoration activities for shellfish farmers from a regulatory/permitting standpoint. Blue Dot Sea Farms, with support from Builders Vision, is presently experimenting with the co-culture of shellfish and sugar kelp to assess whether and to what extent shellfish can benefit from seaweed in close proximity.

### ***Shellfish Farms Dealing with Nuisance Ulva Blooms***

The second area where there might be overlap between the interests of shellfish growers and those of kelp farmers is in the management of nuisance *Ulva* blooms. *Ulva*, a green macroalga commonly known as “sea lettuce,” blooms on Washington state shellfish farms most years in the spring and summer, with blooms becoming more common and



Baywater Shellfish oyster cages covered in *Ulva* at low tide.  
Photo by Willow Battista

more intense as waters warm (Pacific Shellfish Institute, 2025). *Ulva* forms thick, heavy mats that physically smother bivalve beds, creating a “sludge” that prevents essential water circulation and causes localized anoxia (oxygen depletion) at the sediment level [24]. Industry leaders have reported significant shellfish mortality directly linked to these “*Ulva* piles,” and their management is a massive economic burden, requiring teams of workers to manually scoop thousands of pounds of seaweed off the shellfish cages. Currently it is common practice to leave this removed *Ulva* in the water adjacent to pens and farms, as its actual removal from the water is quite labor intensive. Recent efforts, including an ongoing partnership between the Puget Sound

Restoration Fund, Baywater Shellfish, the University of Washington, and Washington Sea Grant, are working to valorize this nuisance by turning the harvested *Ulva* into organic soil amendments for terrestrial agriculture. These efforts have proven quite effective at the pilot scale, but scaling up to match the scale of the *Ulva* bloom challenge in shellfish farms across the state will require investments and advances in processing technologies that can handle 10s or 100s of thousands of pounds of wet seaweed, and that can add sufficient value to the raw resource to make its removal economically viable [25].

This need for primary and secondary processing capacity is shared by the dedicated kelp growers in Washington, and bringing these groups of stakeholders together could help both sectors to overcome barriers to growth.

In addition to potentially sharing investment in a processing facility or other resources, kelp could theoretically be mixed with the *Ulva*, potentially creating an even more nutrient-dense agricultural input. Although the value per unit of kelp from the agricultural market is not likely to be high enough to sustain small-scale seaweed farmers as a principal product, it could be a valuable secondary income stream if made from the trimmings and waste streams of a higher-value product.

### **Build an Expanded Network of Advocates and Address Priority Knowledge Gaps**

To address the knowledge gap challenge that slows progress to address all other barriers to seaweed farming in Washington waters it will be critical to expand the number and type of voices that are collaborating and coordinating efforts to tackle key questions. A series of interviews with representatives from key



The M.V. Kelp, a floating vessel for primary processing of both kelp and shellfish at Blue Dot Sea Farms.

Photo c/o Jon Kroman / Blue Dot Sea Farms



Freshly harvested sugar kelp.  
Photo by Tatum

stakeholder groups whose interests intersect with the industry has illuminated their unique perspectives on seaweed aquaculture in Washington and highlighted their top priorities for research and analysis. These priorities are summarized here, and these interviews inform the entirety of this Roadmap:

**Regulators:** Agencies like the Washington Department of Natural Resources (DNR) and Department of Fish and Wildlife (WDFW) are focused on habitat stewardship and have a mandate to balance provisioning of economic benefits with preservation of ecological wellbeing. Their current approach is often precautionary due to key knowledge gaps

(see [Knowledge Gaps section](#) above) and a desire to avoid repeating past aquaculture industry failures.

**Restoration Community:** There is a strong potential for synergy between kelp and broader ecosystem restoration goals and the development of kelp aquaculture. Both sectors face the same existential threats from warming waters and pollution in Puget Sound, and many of the same techniques used in seaweed aquaculture are also used to support restoration efforts. In addition, a significant and growing body of research points to the ecosystem restoration benefits that kelp farms provide, including through the amelioration of nutrient pollution, the mitigation of ocean acidification, and the creation of habitat structures that support local biodiversity [11], [26]. However, there are a number of outstanding questions surrounding whether, to what degree, and under what conditions kelp farming can actually augment or support restoration efforts, and regulators currently view the industry through a traditional lens of potential for ecosystem impact (see [Knowledge Gaps section](#) above).

The Washington Seaweed Collaborative, an inclusive, cross-sector community coordinated by Washington Sea Grant, in partnership with The Nature Conservancy and Puget Sound Restoration Fund, was formed in 2020 in part to support the two-way flow of high-quality, evidence-based information between the seaweed restoration and cultivation sectors in Washington state [27]. However, the group's funding is sunseting later in 2026 and this

line of direct connection between these two communities will be lost. It's notable that a primary goal of the Vashon Kelp Forest project was to advance research to help address some of these questions with respect to bull kelp in the Puget Sound, but other key knowledge gaps and barriers have stalled attainment of their lease.

**Shellfish Growers:** The historically robust shellfish industry is watching the kelp sector carefully. As summarized above, there are two pathways through shellfish growers' interests could directly overlap with those of kelp farmers around processing technology needs: (1) the integration of kelp culturing into existing shellfish farms (which could theoretically deliver benefits like ocean acidification mitigation and nutrient removal); and (2) the valorization of nuisance *Ulva* that blooms on the shellfish farms each year. However, interest in kelp farming in the Puget Sound has increased public and regulatory scrutiny of aquaculture operations in the region in general, and shellfish growers are wary that development of this new industry will increase their own regulatory burdens or otherwise make things more challenging for their sector.

**Tribes:** Tribes interviewed primarily voiced an interest in kelp restoration, as opposed to cultivation, although historically some local Tribes have harvested and used seaweed — as agricultural input as well as food — for centuries. In general, the focus of the Tribes spoken with has been on the linkages between kelp cultivation and the wild kelp habitats which are critical to the health of salmon and



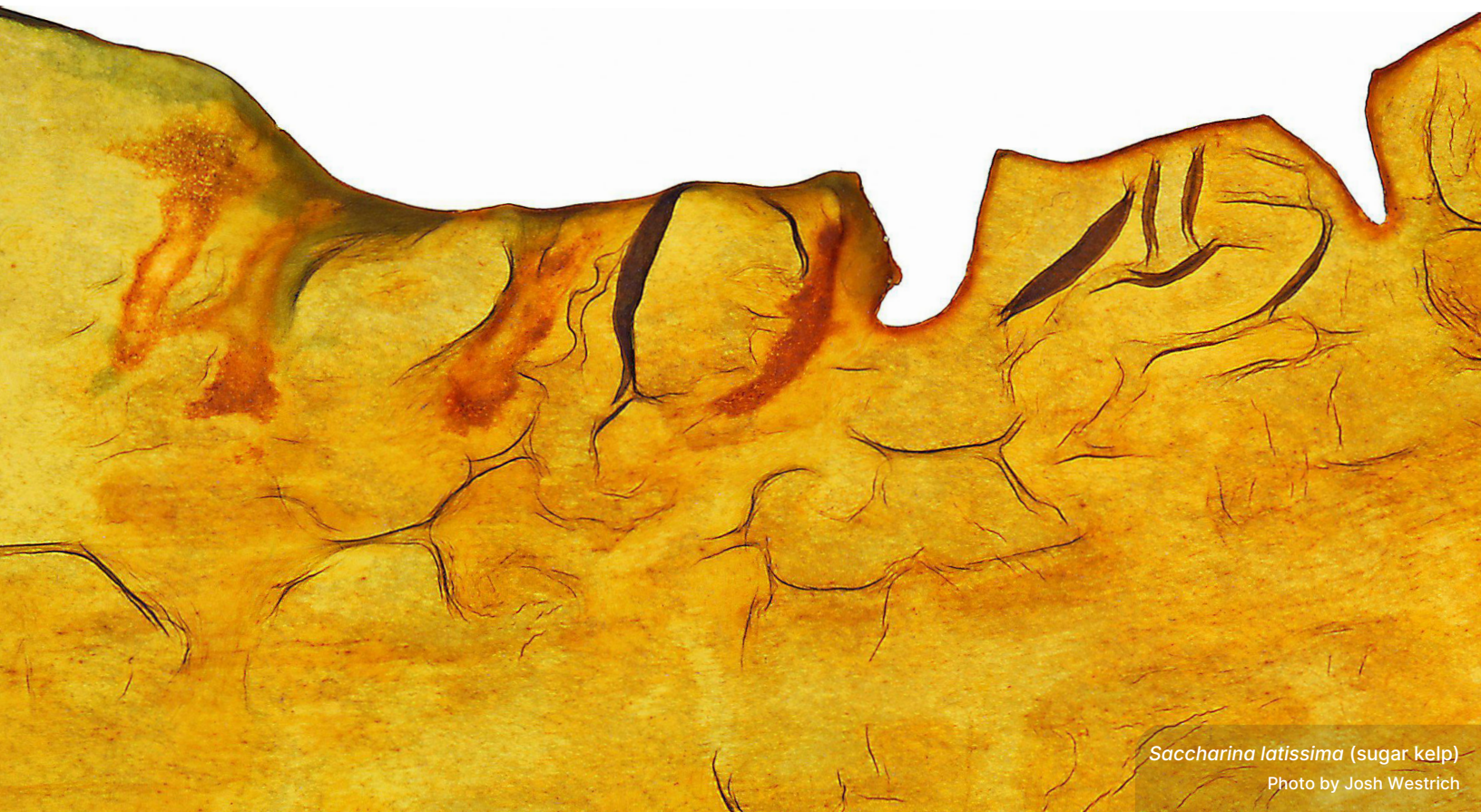
Geoduck tubes overgrown with *Ulva* at Baywater Shellfish  
Photo by Willow Battista

other fishery target populations of cultural and economic importance. Some of the Tribal representatives voiced that commercial kelp farming could be of greater interest if/when markets are stronger, while others remain more cautious about floating aquaculture due to concerns about gear entanglement with fishing activities. However, many Tribal representatives have noted that they are watching the industry's evolution with interest.

## Summary of Roadmap Pathway 1

Supporting the economic viability of small-scale seaweed farms in Washington state is a crucial pathway, recognizing that production will remain small due to geographic and regulatory constraints. Success hinges on overcoming the “Chicken and the Egg” challenge by shifting focus to developing small- to medium-scale, high-value markets (like specialty foods and personal care products) that can grow with the farms. Doing so will require addressing the “Cart before the Horse” challenge: removing the processing bottleneck through creative solutions like co-packing agreements in the short term, and ultimately, investment in dedicated processing capacity. This latter need will make the most sense through collaboration with kelp farm industry actors across the broader West Coast region, which is discussed below. Collaboration with regional entities, such as

Southern British Columbia seaweed farms and Washington’s robust shellfish industry (especially those managing nuisance *Ulva*), can provide shared resources for processing and marketing, economies of scale, and political advocacy. Finally, building a broader chorus of supporters, including regulators, the restoration community, and Tribes, can create opportunities to collaboratively tackle critical knowledge gaps, and reduce the “Perception Gap” that currently hinders social license and prevents regulatory streamlining.



*Saccharina latissima* (sugar kelp)

Photo by Josh Westrich

## KEY NEXT STEPS FOR PATHWAY 1

### *For seaweed farmers:*

- 1. Create standardized pitch materials** including composition details and food safety documentation, highlighting your sourcing story and environmental benefits; invest in year-round inventory to ensure samples are always available for prospective customers.
- 2. Target and Diversify Markets:** Focus on small- to medium-scale, high-value markets (e.g., packaged foods, personal care products for hospitality) that align with Washington's modest production scale.
- 3. Consider Vertical Integration:** Weigh the benefits of vertical integration — increased control and the ability to capture more value from products — with the added complexities and potential investment costs.
- 4. Build Industry Alignment:** Cultivate relationships and align interests with seaweed farms in southern BC as well as with the shellfish farming industry in Washington to explore potential for shared processing solutions, and to increase collective advocacy capacity.

### *For regulators, investors, and support agencies:*

- 1. Support Shared-Use Processing:** Support small-scale seaweed farmers in exploring and identifying appropriate/feasible opportunities for co-packing and shared-use agreements with existing processing facilities, reducing the investment burden for individual growers.
- 2. Support Shared Product Innovation Capacity:** Create or subsidize a shared seaweed product development and processing space in Washington to retain innovators and reduce early-stage development costs.
- 3. Collaboratively Address Knowledge Gaps:** Regulators, researchers, and support agencies should work collaboratively with seaweed farmers to tackle priority research questions in order to validate the benefits of seaweed farming and streamline permitting processes.

Giant kelp forest in the sunlight  
Photo: Adobe Stock

## PATHWAY 2: SUPPORT DEVELOPMENT AND EXPANSION OF WASHINGTON'S ROLE IN THE REGIONAL SEAWEED FARMING INDUSTRY

The second key pathway to support a thriving seaweed farming industry in Washington state is to build Washington's role in the broader west coast regional industry. Research conducted during this grant identifies a critical need for enhanced coordination among seaweed farmers and other industry stakeholders across the West Coast, where different segments of the region face unique challenges and offer distinct opportunities for growth. Furthermore, the West Coast landscape differs significantly from more established industries on the East Coast and abroad, and thus regionally-specific learning and innovation is critical for local success. The state of Washington, in particular, stands to gain significantly from establishing a cross-regional coalition. Expanded partnerships would allow the local sector to integrate best practices from the more mature industries in British Columbia and Alaska, while also maximizing Washington's own commercial potential through the advancement of regional support infrastructure and activities.

Additionally, while local production will likely remain small-scale, as discussed above, the state possesses a unique combination of established port infrastructure, a skilled maritime workforce,



Aerial view of kelp farm off the coast of Kodiak Island, Alaska.  
Photo by Willow Battista

ample existing seafood and agricultural processing capacity, and strategic geographic positioning with respect to both shipping and ground transportation lines that allows it to serve as a high-value anchor for the entire West Coast industry. **Washington can leverage these assets to become the regional hub for processing, distribution, and innovation of seaweed products.** Washington and its small-scale farms would directly benefit from these investments, as well as from broader industry advancements that this much-needed processing capacity can enable.

The sections below lays out the results of the activities and analyses that Maritime Blue conducted or commissioned which demonstrate the need for this regional seaweed strategy pathway. These include the **State Economic Potential Analysis** (by Confluence Environmental Co. and Greene Economics), “part two” of the aforementioned **Processing Technology Analysis** (by Hatch Blue), and findings gathered through the **One Ocean Week Seattle (OOWS) West Coast**

**Roundtable** (led and compiled by Maritime Blue in partnership with the Alaska Fisheries Development Foundation [AFDF]). These results, as well as conversations with diverse stakeholder groups across the region, also point to key next steps to ensure a sustainable and just future for the industry.

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**Washington can leverage its established infrastructure, workforce, and distribution channels to become the regional hub for processing, distribution, and innovation of seaweed products.**

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### **Build a Broader West Coast Coalition**

In October 2025, Maritime Blue and the Alaska Fisheries Development Foundation (AFDF) coordinated a Roundtable on West Coast Kelp Farming Challenges and Opportunities at One Ocean Week Seattle (OOWS), bringing together seaweed farmers, processors, policymakers, and researchers from Alaska, British Columbia, Washington, Oregon, and California. This effort, along with extensive stakeholder interviews across the West Coast, highlighted a critical need for increased knowledge sharing and collaboration to address systemic “pinch points” hindering the regional industry. These priority challenges and the collaborative solution pathways developed during the workshop are summarized here.

#### **Shared Regional Challenges**

Roundtable discussions underscored the shared belief that the emerging seaweed farming industry offers significant potential for economic development, coastal resilience,



Participants from across the region collaborate during the Roundtable on West Coast Kelp Farming at One Ocean Week Seattle.

Photo by Willow Battista

and sustainable food systems along the West Coast. However, participants agreed that it will be crucial to ensure that this growth (1) is economically sustainable and aligned with long-term market demand; (2) benefits all communities equitably, both across geographical boundaries, and with respect to Indigenous peoples, small-scale farmers, and those with deep ties to the marine environment.

The roundtable identified three priority challenge categories shared across the West Coast, all of which are discussed above in the **Challenges and Barriers** section as they manifest in the Washington-specific context. The cross-regional nature of these challenges is explored here, along with the added complexities within each category when viewed through the region-wide lens:

- **Market Development and Processing**

**Challenges:** Participants across the region described feeling the pressure to scale up for increased market access, but lacking mid-sized processing infrastructure and markets. Both primary and secondary processing facilities are insufficient or inaccessible in all sub-regions. Additional regional bottlenecks include high shipping costs (especially from Alaska and BC to the “lower 48”), transboundary and international trade regulations, and regulatory complexities that limit opportunities to utilize existing shipping and transportation systems.

- **Regulatory and Permitting Challenges:**

Complex, piecemeal, or non-existent permitting processes across local, state, and federal jurisdictions present a major barrier to kelp aquaculture expansion at a regional

scale. Key regionally-relevant challenges include the lack of: standardized regulatory pathways between states and provinces for specific seaweed products (especially regarding seaweed processing and heavy metal testing for food market-bound products, as well as ingredient labeling regulations for biostimulants and cosmetics); effective spatial and logistical planning across remote farm areas to support multi-farm coordinated harvests and processing; and collaborative science to address ecological knowledge gaps – especially with respect to climate change-driven ecosystem shifts (e.g., shifting ranges of kelps and dependent species), which contribute to regulatory complexity.

- **Financing and Investment Challenges:**

Upfront investment in specialized equipment and technology is a significant barrier for small operators across the region, but differences in energy costs, availability and cost of industrial-zoned space, accessibility of a skilled workforce, and infrastructure readiness add additional layers of complexity along the coast. Centralized secondary processing hubs could help address processing challenges for actors across the region, but funding for development of such hubs is stalled by cross-state / nation regulatory complexity and misalignment, i.e., permitting uncertainty in one state deters capital for expanded processing and production in another.



Harvesting sugar kelp for Blue Dot Sea Farms.  
Photo c/o Jon Kroman / Blue Dot Sea Farms

### **Proposed Solution Pathways**

To transition from conceptual alignment to practical implementation, the roundtable participants developed a key set of high-priority strategic activities for region-scale action:

**Transportation Infrastructure Mapping:** To support centralized high-volume processing capacity for the region, including the potential for such capacity to be developed in Washington, mapping transportation corridors and understanding regulations is critical.

Needs include:

- **Logistics Corridors:** Identify efficient sea, air, and land routes from harvesting sites (i.e. farms) in Alaska, B.C., and the broader Pacific Northwest to Washington, and assess Washington ports' capacity to manage influx of traffic, product, and distribution.
- **Regulatory Analysis:** Assess varying state, federal, and international rules (import/export, food safety, permitting, quality control, etc.) to identify and potentially harmonize regulatory barriers.
- **Small-Scale Farmer Enablement:** Mapping should prioritize infrastructure and regulations that support small-scale farmers, maximizing regional supply and fostering inclusive industry growth.

To begin to answer some of these transportation infrastructure questions, Maritime Blue engaged a graduate student at the University of California, Berkeley, Charlotte McGoldrick, who was interested in conducting her thesis project on the challenges facing the West Coast seaweed aquaculture industry. The results of her analysis are presented below in the [Addressing Transportation Channels and Logistics](#), and [The Need for Equitable Ownership and Benefit-Sharing Models](#) sections.

**Market Development:** A regional "Pacific Seaweed" or "West Coast Kelp" brand, where kelp from multiple farms is aggregated under a single brand name, was discussed to support joint marketing. This initiative would:

- **Establish a Premium Brand Identity:** Position the region's kelp as high-quality, sustainable, and traceable, leveraging the Pacific's reputation as clean and well-regulated.
- **Increase Consumer Awareness:** Pool resources across farms and regional industry to develop campaigns to educate consumers on kelp's benefits.
- **Create Value-Added Opportunities:** The unified brand would help differentiate products from competitors across markets (food, feed, nutraceuticals, bioplastics), potentially allowing producers to capture higher value.
- **Facilitate Industry Collaboration:** A shared brand would encourage collaboration and best-practice sharing among regional producers, processors, and marketers.

**Blended Finance:** Participants called for a new finance model, utilizing a mix of public, philanthropic, and private funding to create revolving loan funds to de-risk early-stage investments. This funding model would be specifically designed to:

- **De-Risk Early-Stage Investments:** Offer patient, flexible capital to kelp farmers and emerging processors, effectively lowering the financial risk to other funders associated with pioneering new farming techniques, developing initial infrastructure, and navigating early market volatility.

- **Provide Accessible Capital:** Ensure that small and medium-sized enterprises (SMEs), particularly those led by historically underserved groups, have access to financing that might be unavailable through traditional banking channels.
- **Support Scalability:** The revolving nature of the fund — where principal and interest payments are recycled back into the fund to finance new projects — creates a sustainable and perpetual source of capital to support the long-term growth and expansion of the regional kelp industry.

### Next Steps for Regional Coordination

In response to this Roundtable, and the other ongoing efforts to engage stakeholders across the West Coast, Maritime Blue and AFDF are planning and raising funds for the formation of a **West Coast Seaweed Industry Coalition**. This Coalition could provide critical connective tissue for a rapidly growing but fragmented industry, moving beyond geographical silos to address systemic barriers that no single state or province can solve in isolation. By fostering a non-regulatory, inclusive platform for coordination, the Coalition can add value by synchronizing the region’s disparate assets, such as Alaska’s high production volume, Washington’s established processing and shipping hubs, and California’s market innovation, into a unified economic bloc. This collaborative approach is essential for breaking the risk cycle, where investment and

permitting are stalled by a lack of shared data, which is in turn stalled by lack of production and processing. It also ensures that the seaweed farming industry remains equitable for Indigenous nations and small-scale farmers as it scales. Ultimately, the Coalition would serve as a central hub for knowledge exchange and coordination, de-risking the entire value chain and supporting the social license necessary for a thriving, regenerative Pacific seaweed economy.

### Explore Potential for Washington to Act as a Regional Processing Hub

There has been significant growth in the production of farmed seaweed on the West Coast in recent years, particularly in Alaska and to a lesser degree, British Columbia. However, these regions continue to face a processing bottleneck due to limited shoreside infrastructure and high energy costs.<sup>a</sup> Although stabilization and primary processing capacity is developing, the inability to transform stabilized seaweed ingredients into economically viable end use products (e.g., cosmetics/nutraceuticals, biostimulants, livestock feed additives, food products) through secondary processing infrastructure has stalled industry growth and resulted in high waste and low profit margins for growers in these areas. In contrast, Washington is uniquely positioned to serve as the primary value-add hub for the West Coast seaweed industry. The vast majority of Alaska’s seafood — over one billion

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<sup>a</sup> As discussed above, product and market development need to occur in parallel with processing development, but the latter is a prerequisite to the former, as the ability to produce products and samples is critical to expanding market opportunities.

pounds annually — already flows through Puget Sound ports (Seattle and Tacoma) to reach regional and global consumers, and kelp-based products will almost certainly need to follow these same distribution patterns regardless of whether they are processed or finished in Alaska. Washington offers a strong maritime and processing workforce, as well as abundant agricultural and seafood processing technology and infrastructure. When paired with Washington’s significantly lower industrial energy costs, the state becomes the most economically viable location for advanced, secondary processing. There is thus an urgent need and opportunity to invest in this capacity within Washington to transform regional harvests into high-value commercial goods, effectively bridging the gap between nascent farms and global retail markets.

Two related analyses were commissioned as part of this granted work to help catalyze action on this high-priority need. First, Maritime Blue and their partner Ocean Strategies contracted with Confluence Environmental Company and Greene Economics, LLC to produce an analysis of the economic potential of the seaweed aquaculture industry to Washington state [28]. The goal was to identify pathways for industry growth and assess economic impacts under different investment scenarios, including exploration of Washington as a seaweed processing hub. The approach and key outcomes of this analysis are summarized here. The full Report is available [here](#).



Sugar kelp growing at Kodiak Island Sustainable Seaweed in Alaska.  
Photo by Willow Battista

Second, the comprehensive processing technology analysis conducted for Maritime Blue by Hatch Blue (introduced [above, under Pathway 1](#)) built on the results of this State Economic Potential Analysis. It outlined specific recommendations for the technologies and locations that can support this long-term vision for Washington to evolve into a secondary processing hub for seaweed biomass harvested across the West Coast. These results are summarized [below the following section](#).

# RESULTS OF STATE ECONOMIC POTENTIAL ANALYSIS

The research team assessed four hypothetical growth scenarios using the IMPLAN1 economic analysis program to explore potential industry growth over 10 years and consider the economic ramifications for Washington of different investment pathways. These scenarios were:

## 1. Business as Usual (BAU) Development:

Assumes slow, natural growth without external support.

## 2. Production Supported Development:

Focuses on expanding seaweed farming acreage to 2,000 acres.

## 3. Processing Supported Development:

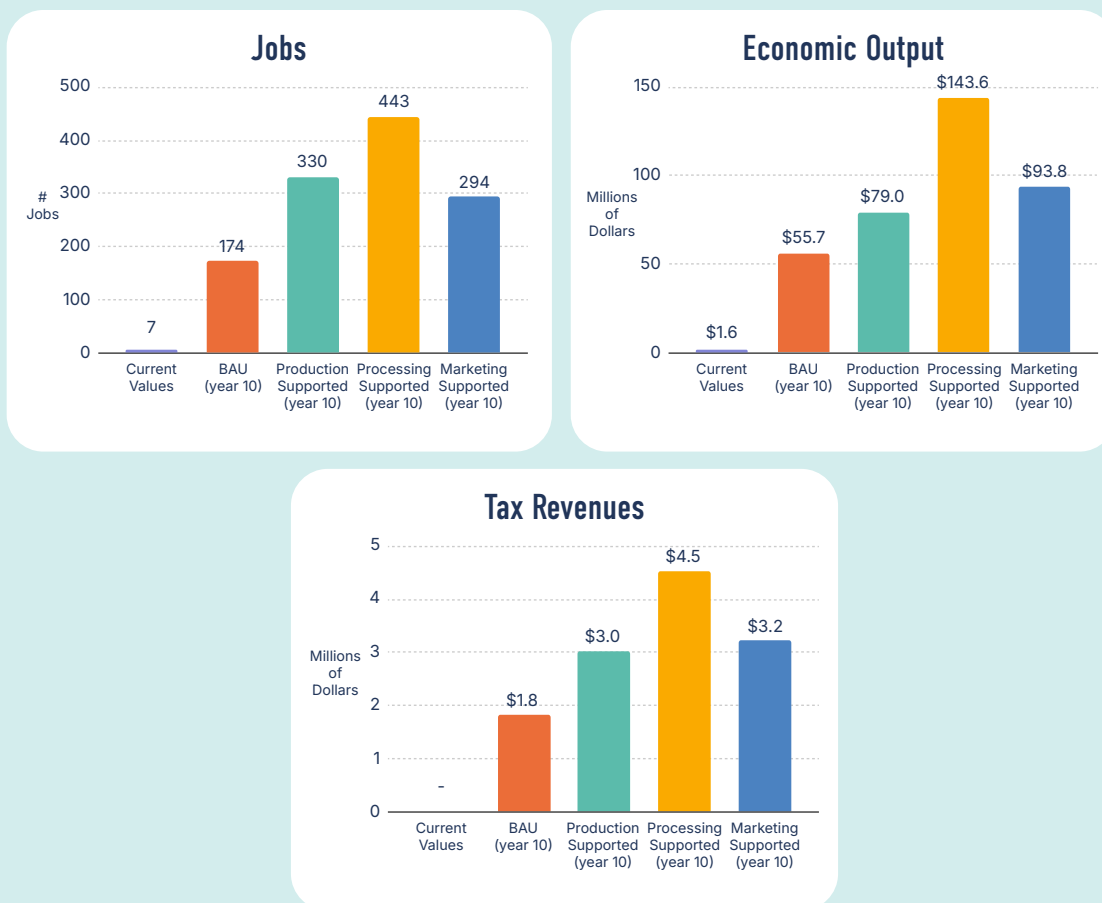
Prioritizes investment in processing infrastructure, including a large-scale facility to serve as a regional hub for seaweed processing.

## 4. Marketing Supported Development:

Focus on increasing demand through marketing campaigns, doubling production acreage and building a large processing facility.

The analysis concludes that prioritizing the **development of processing infrastructure, specifically large-scale, high-tech, secondary processing facilities that can act as regional hubs**, offers the greatest potential for economic growth in Washington.

**FIGURE 10: SUMMARY OF MODELED REGIONAL ECONOMIC IMPACTS IN YEAR 10 BY SCENARIO, ADAPTED FROM WASHINGTON SEAWEED AQUACULTURE ECONOMIC POTENTIAL ANALYSIS**



By establishing itself as a central processing hub, Washington can attract and process feedstock from high-production areas like Alaska and British Columbia, effectively integrating regional supply chains and maximizing the utility of existing seafood and transportation networks. Furthermore, if designed carefully and in collaboration with seaweed farmers from across the region, this strategy can benefit Washington's small-scale farms as well as small-scale operations across the coast. While larger-scale, more advanced operations from elsewhere in the region can support the development of a robust processing and transportation network across the state, local, smaller-scale farms can take advantage of these systems without substantial investment costs.

With targeted support, Washington's seaweed aquaculture industry could create significant economic benefits for the state, including jobs, revenue, and tax contributions, while enhancing coastal ecosystem health. The "Processing Supported" Scenario modeled here offers the greatest potential for growth, but investments in production and marketing could also help overcome barriers and stimulate demand. By addressing regulatory challenges, developing processing technologies and infrastructure, and promoting local products, Washington could become a leader in the U.S. seaweed industry, contributing to both economic growth and environmental sustainability.



Bull kelp lying on a beach in Washington.  
Photo by Spring Images

## RESULTS OF PROCESSING TECH ANALYSIS - PART 2: REGIONAL CASCADING BIOREFINERY

The analysis of optimal processing technologies conducted by Hatch Blue, and introduced under [Pathway 1](#), also further explored this possibility of Washington acting as a secondary processing hub for seaweed production flowing from Alaska<sup>a</sup>. Drawing on interviews with 30+ seaweed processing companies, technology providers, and ecosystem builders, the analysis details Washington's opportunities and potential investment pathways, and distills recommendations from a diversity of relevant international operators.

The strategic case for Washington to invest in processing infrastructure is predicated on its alignment with the wider West Coast seaweed value chain. The extensive research and interviews conducted by Hatch Blue confirm that Washington should focus on developing secondary processing, as primary processing and stabilization are already expanding in Alaska, and are most efficient when they occur as close to the farm as possible. Further downstream, Washington can play a critical role in supporting Alaska with market access, buyer development, product off-take and secondary processing. In particular, Seattle and Tacoma sit on established transportation routes for Alaskan products, and the region has access to large U.S. markets for multiple

products, including biostimulants, cosmetics, food ingredients, and biomaterials. Washington also has advantages in workforce availability, relevant processing partner density, research and innovation capacity, energy costs, co-packing infrastructure, and proximity to downstream customers. Washington should leverage these strengths to develop secondary processing capacity that creates equitable value for Alaskan stakeholders.



Photo by Kelly via Pexels

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<sup>a</sup> For the purposes of this analysis of Washington's potential role as a secondary processing hub, seaweed production flowing from Alaska was centered because the volumes coming from other sub-regions along the West Coast (British Columbia, Oregon, California, the Baja peninsula) are still quite small. However, such a hub could theoretically support seaweed flowing from any of these geographies if the logistics and transportation costs were not prohibitive.

An additional component of the evolving regional landscape is that many already established product developers have found it difficult to manage the full value chain in-house, especially when processing infrastructure and product and market development all require simultaneous investment. Many have therefore focused primarily on building out one product line, at least as a starting point. These entities have been working to expand their capacity to process these individual product lines, and advances have been made very recently. For example, Cascadia significantly increased their capacity to produce biostimulants with the recent opening of an additional processing facility in Port Edward, British Columbia [29], and Macro Oceans has been exploring expansion pathways and locations for increased production of their proprietary seaweed-based cosmetic ingredient product [30]. Washington should pay close attention to these developments and ensure investments to capacity are additive and complementary, rather than competitive, for the industry as a whole.

With these strategic considerations in mind, the assessment includes a set of recommendations for processing infrastructure investment that align with increasing levels of seaweed feedstock

availability, capital availability, and market readiness. These range from a low-equipment investment (i.e., capital investment, or “CAPEX”) model for individual producers processing their harvests at or near the farm gate, to a regional processing hub serving multiple growers and product pathways, to an industrial biorefinery model that would require larger volumes and stronger offtake commitments. An example sequence of investment phases is presented in [Table 4](#) below. This phased development approach allows for processing capacity, and related investment, to increase gradually as both markets and production develop through support from this expanded processing capacity (this symbiotic/dependent relationship is discussed further in the [Challenges](#) section above).

The analysis is built around two key variables: the availability and reliability of both production (feedstock) and demand (confirmed buyers). These two factors should dictate when processing investments should ramp up, moving from low-cost producer tools to shared-use hub infrastructure and, eventually, to larger extraction or biorefinery systems.

**TABLE 4: Possible Phased Processing Equipment Investment Sequence aligned with Increasing Seaweed Feedstock Volumes and Market Demand Signals**

Phase (in order of increasing CAPEX requirement)	Description	Phase Trigger (volume + demand)	Estimated CAPEX Required <sup>a</sup>
<p><b>Phase 0: Shared-Use Agreements (detailed under <a href="#">Roadmap Pathway 1</a>)</b></p>	<p>Shared-use and co-packing agreements support the development of markets around current volumes of Washington seaweed.</p>	<p>Current WA volumes and markets</p>	<p>&lt;\$30k</p>
<p><b>Phase 1: Farm-Gate Processing</b></p>	<p>Individual Washington producers or small producer groups expand in-house primary processing capacity with relatively low-cost, high-leverage equipment that supports innovation across food, personal care, and agricultural input markets. This may include improved milling equipment, blending capacity, and packaging equipment.</p>	<p>Current WA volumes; increased market demand necessitates year-round processing</p>	<p>\$31k - \$51k</p>
<p><b>Phase 2.1, Shared-use Hub for Market Flexibility</b></p>	<p>Multiple producers across Washington and Alaska share a regional processing hub with improved milling, blending, and packaging capacity while still supporting the production of multiple product formats flowing from separate farms. Small-scale heat-pump dehydrators are also available, and open higher-quality drying pathways.</p>	<p>Increased seaweed volume in WA and/or flow of seaweed from AK; multiple product formats and separate branding needed</p>	<p>+\$20k - \$75k</p>
<p><b>Phase 2.2, Market Clarity Demands Extraction</b></p>	<p>If demand signals become clear, the regional processing hub can add:</p> <ul style="list-style-type: none"> <li>• An aqueous extraction module to support production of <b>liquid biostimulant extract</b> and solid residue, or</li> <li>• A hot water extraction module to support production of <b>functional food ingredients</b></li> </ul> <p>as dedicated by market demand.</p>	<p>Increased seaweed volume in WA and/or flow of seaweed from AK; Confirmed buyer demand for extracts</p>	<p>~\$290k</p>

Phase (in order of increasing CAPEX requirement)	Description	Phase Trigger (volume + demand)	Estimated CAPEX Required <sup>a</sup>
<b>Phase 3.1, Higher-throughput Biorefinery</b>	If biomass volumes and buyer commitments justify further scale-up of a specific product line (e.g., liquid biostimulant), a higher-throughput system would support larger-volume processing and potentially additional drying capacity.	1000+ metric tons of wet seaweed/ year secured across the region	\$870k - \$1.2m
<b>Phase 3.2<sup>a</sup>, Advanced Cascading Biorefinery</b>	With substantially stronger feedstock security and clear offtake agreements, advanced extraction modules can be added to process residue from production of primary product lines (e.g., liquid biostimulant) for additional higher-value products, such as alginate, fucoidan, cellulose, or other biomaterial and biochemical pathways.	Secured feedstock + offtake agreements	~\$2M+

<sup>a</sup> It's critical to note that specific processing technologies and investment costs will depend on final products targeted and the specifics of production, distribution, infrastructure, etc. at the time of investment. The values and equipment listed in the table above are for illustration only and based on approximate market rates in early 2026.

<sup>b</sup> Note: market clarity and feedstock volume increases required to justify investment in Phase 2.2 or 3.2 could occur at any time, potentially supporting advancement to those phases along with or instead of their smaller-scale counterparts (i.e., Phases 2.1 and 3.1)



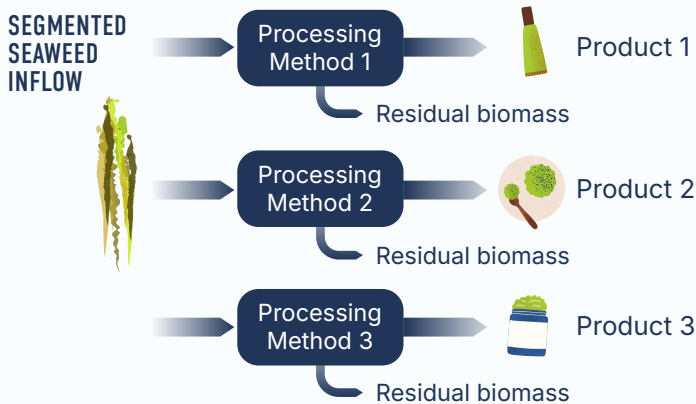
Multiple species of wild kelp near a sugar kelp farm off of Kodiak Island, Alaska.  
Photo by Willow Battista

The recommended pathways also emphasize the value of preserving flexibility in end-product possibilities, and where possible, investing in technologies that allow for the creation of multiple formats and products, until confirmed buyers are secured with specific product demands that can account for total production volumes. Just as primary processing decisions can impact the possible end products that can be created, secondary processing investments in especially expensive and specialized technologies should not be made lightly. The Phases presented in [Table 4](#) therefore provide recommendations for multi-product production, even at very high volumes of seaweed inflows. This is achieved through modular and cascading processing platforms.

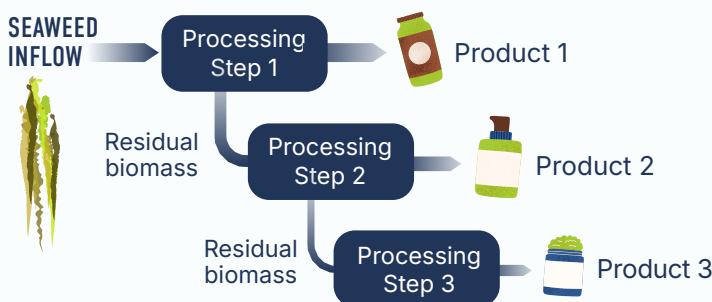
Modular processing refers to a system of complementary and adjacent technologies that can support production of multiple end product formats under the same roof and utilizing the same distribution infrastructure. Cascading processing refers to a system where a single batch of stabilized biomass is processed sequentially to extract specific compounds before the remaining material is used for other, generally (but not always) lower-value applications like compost or energy. For example, high-value active ingredients (e.g., fucoidan and alginate) can be extracted for food and/or nutraceuticals, followed by extraction of specific components desirable for kelp based lotion or soap, and then the remaining fibrous nanocellulose can be turned into a range of valuable materials, from medical products to surface coatings. It should be noted, however, that if whole foods (e.g., dried kelp leaves for soup) are a desired product, the options for cascading processing will be limited to products that can be made from unused parts of the kelp organism, such as holdfasts and stipes.

**FIGURE 11: MODULAR VS. CASCADING PROCESSING STRATEGIES**

**Modular Processing**



**Cascading Processing**



In addition to the analysis report, the Hatch Blue team also generated an interactive Excel-based Processing Equipment Decision Support Tool, which further details the best available processing equipment options for both single-product pathways and multi-product cascades. This tool contains many more possible pathway combinations than are discussed here, and users can adapt the tool to their own feedstock volumes, budget, partner network, product focus, and market knowledge. A publicly available version of this tool is in development.

Regarding possible location for expanded processing capacity, and in particular for a Phase 3 system with capacity for significant feedstock inflows (>1000 metric tons wet per year), the Hatch Blue team evaluated 13 potential locations in Washington state. The analysis considered a variety of factors such as the availability and cost per square foot to obtain appropriately-zoned warehouse space, access to port infrastructure and existing maritime and over-land shipping routes, and availability of skilled workforce. This evaluation pointed to Tacoma as the preferential location to develop later-stage processing and large-scale biorefinery operations (beyond the co-packing agreements and pilot-scale platforms that are recommended for Washington's existing production volume, under Roadmap Pathway 1). This determination is based on Tacoma's deep-water port access (including access to significant biomass flows from Alaska's highest-producing regions), massive cold storage capacity, and alignment with opportunity zones.

Ultimately, the analysis underscores that the immediate priority should be to build the enabling conditions that allow the sector to move from pilot activity toward validated commercial pathways. This includes:

- Deepening coordination with Alaska to ensure processing models pursued support Alaskan stakeholders rather than undermining them.
- Supporting market validation and product development across biostimulants, food ingredients, personal care, and biomaterials.
- Strengthening the investment case for an advanced processing facility through a detailed cost-of-production comparison across Washington, Alaska, British Columbia, and Oregon to clarify competitive advantages.

For more information on this analysis of Optimal Processing Technologies conducted by Hatch Blue, as well as on the accompanying Equipment Decision Support Tool, reach out to [Maritime Blue](#).

**KEY RECOMMENDATION:** Washington state should invest in secondary processing capacity that can support production flowing out of Alaska and elsewhere along the West Coast with a focus on developing additive and complementary processing capacity. In particular, a **modular platform** would allow for the phased production of multiple high-value products without requiring significant investment before markets are ready. **Cascading biorefinery**, where multiple products are produced from a single kelp input stream, thereby maximizing value and minimizing waste, may be feasible once feedstocks exceed 1000 metric tons annually, but this investment should not be made lightly, and is not necessary at this phase.

Siting a regional processing hub in **Tacoma** can best support the needs of Alaskan growers while allowing Washington's small-scale farmers to take advantage of infrastructure developments without outsized investment risk.

## RECOMMENDATION IN ACTION: CASE STUDY: BLUE DOT KITCHEN

The strategic potential for Washington state to evolve into a secondary processing hub for seaweed biomass harvested across Alaska and British Columbia is exemplified by the trajectory of Blue Dot Kitchen (BDK), a Washington company formed as an affiliate of Blue Dot Sea Farms (BDSF). Blue Dot Kitchen is a graduate of Maritime Blue's Innovation Accelerator program.

The founding premise of BDK was that consumer packaged foods (CPF) could support a vertically integrated seaweed enterprise capable of utilizing sugar kelp harvests from Blue Dot Sea Farms (among other sources). While the company achieved some regional traction with its flagship snack product, "Seacharrones™," BDK ultimately determined that this strategy had too limited growth potential long-term due to the systemic hurdles of the retail CPF sector, compounded by a critical lack of cost-effective and accessible drying infrastructure in the Pacific Northwest.

As the company worked on adapting its processing strategies to improve yield from raw seaweed and control for select nutrients, it uncovered a more impactful strategy drawing from other sectors in the broader food system. This approach centers on a multi-step, cascading processing model, where sequential processing phases create value-added products from each subsequent seaweed form. BDK's specific process is designed to produce: (1) seaweed as a functional, clean-label ingredient for established CPF formulations; and (2) finished food products for high-value foodservice, private label, and white label distribution channels. To catalyze this new

ocean-based food system, BDK recently entered into a lease with the Port of Seattle for its initial processing facility. Once operational, expected in Q3 2026, this facility will allow BDK to produce products for immediate sale, while also providing samples to advance its broader business development and partnership efforts.

While sugar kelp remains a viable species for the company's commodity foodservice lines, bull kelp is BDK's preferred feedstock for its premium, high-value product formulations. Consequently, the company has developed and expects to expand strategic sourcing relationships in Alaska and British Columbia, where bull kelp is already being commercially cultivated — thus advancing towards the model of Washington serving as a processing hub for the region, although exclusively within the food space. If current regulatory obstacles in Washington can be addressed, BDSF intends to cultivate bull kelp locally for use by BDK, potentially aggregating this harvest with other Puget Sound supply as new farms come on board to support the regional hub model.

**KEY DECISION POINT:** The Blue Dot Kitchen team drew lessons from other food production sectors to develop a new processing strategy that links multiple steps to allow for the creation of multiple high-value food products from a single stream of seaweed feedstock. The company's new facility will produce both functional seaweed ingredients for established packaged food formulas, as well as their own finished food products targeted at higher-end markets.

## Exploring Transportation Channels and Logistics

In order for Washington to realize its potential to act as a regional processing hub, it will be necessary to find ways for Alaskan seaweed farmers to transport their harvests down to Washington at minimal cost and with no loss in quality. Alaskan seaweed farmers face unique logistics, shipping, and packaging hurdles due to Alaska's geographically isolated coastline and remote location. Because freshly harvested kelp begins to degrade within 12–24 hours, stabilization must take place as close to the source as possible, and before transportation across long distances is undertaken. This was one of the critical challenges identified in the One Ocean Week Seattle West Coast Kelp Farming Roundtable ([discussed above](#)), and transportation infrastructure mapping was called out as a key first step.

In early 2026, Charlotte McGoldrick, a graduate student at University of California, Berkeley approached Maritime Blue with interest in focusing her Master's thesis research on the West Coast seaweed aquaculture industry system. She agreed to investigate these crucial questions around transportation channels. Her research explored multiple logistics pathways, and identified three main alternative transportation options currently available to Alaskan growers trying to get their harvests to Washington, each with distinct benefits and drawbacks [31]. These are:

- **Formal Cargo Lines (e.g., TOTE Alaska, Samson, AML, Matson):** These services operate large container ships or hub-and-spoke tug and barge systems connecting Alaskan ports to Seattle and/or Tacoma. Ambient-temperature stabilization has opened up more affordable access to these routes. However, the costs of transportation in this channel are high, and have become unpredictable with recent trade policy changes. Additionally, weight limit restrictions prevent farmers from double-stacking standard 1,500-pound plastic intermediate bulk container (IBC) liquid totes, causing highly inefficient use of container space since freight companies charge by the container rather than by weight.
- **Dedicated On-Board Processing and Transport (e.g., Mothers of Millions):** This pathway involves partnering with companies that retrofit existing vessels, such as fishing tenders, to stabilize, lightly process, and transport kelp to bespoke destinations.



Harvesting sugar kelp for Lummi Island SeaGreens.

Harvesting sugar kelp for Lummi Island SeaGreens

This pathway minimizes the need for expensive shoreside infrastructure in Alaska’s remote locations and introduces the possibility of aggregating harvests across multiple farms and regions while underway. However, current cost structures of this pathway are unfeasible for both growers and buyers. Furthermore, existing vessels available are too large to get close to all shallow cultivation sites, creating an added labor burden for farmers to transport their harvest out on smaller boats.

- **Utilizing the Fishing Fleet (Backhaul Arrangements):** This more theoretical option takes advantage of empty or under-capacity north-and-southbound fishing traffic, transporting kelp in empty hulls on the fishing vessel’s outbound journey. Taking this path could have significant cost savings for seaweed farmers, as vessel fuel is already treated as an unavoidable sunk cost of the fishing season. However, the opacity and informal nature of the commercial fishing industry, which requires extensive networking to secure agreements may necessitate booking a shipment last-minute, rather than months in advance. Most seaweed farmers are not able to bear this significant uncertainty. Furthermore, there are concerns around cross-contamination, as kelp may carry shellfish and other allergens and contaminants which other forms of seafood do not have. Finally, in some cases regulations prohibit fishing vessels from carrying any cargo other than their target species, in particular across state or international borders.



Packing sugar kelp harvest for transport.  
Photo c/o Jon Kroman / Blue Dot Sea Farms

### Co-Developing Equitable Ownership and Benefit-Sharing Models

As processing capacity develops, it will be critical to ensure benefits are shared equitably to preserve the viability of small-scale farms and diverse market access. Though the findings herein present a strong case for the establishment of a regional processing hub, stakeholders across the West Coast have expressed some concern around industry consolidation, which tends to limit opportunities and increase costs for small- and mid-sized farms, and often to channel benefits away from communities and toward a small number of already-privileged actors [32]. To effectively balance equity across the region for small-scale farms, the expansion of processing infrastructure should:

- Draw lessons from the history and practices of the wild capture fishing industry, namely avoiding the perception or reality of Washington State benefiting from the extraction of natural resources from Alaska without equitable benefit return.
- Actively promote participatory ownership models, fair labor practices, and shared economic prosperity across the entire West Coast to build a truly sustainable and just mariculture industry.

Ms. McGoldrick also explored equitable ownership structures that might align well with the cross-regional needs of actors in this system [31]. Her research identified a variety of existing models that can support equitable benefit sharing from a shared processing facility, including across a wide geographic range and multiple state boundaries. A federated system, or a cooperative of cooperatives, for example, links smaller localized cooperatives together to maximize market leverage and operational efficiency. Dairy industries across the world have used this model to effectively increase and maintain value for their producers, and a new soybean processing facility was recently opened in Nebraska owned by a federation of 150 local soybean grower cooperatives across the Midwest [33], [34].

Even in non-cooperative structures, equitable distribution can be achieved through producer partnership investments, where

farmers across the region could buy equity directly into a Washington-based processing operation, or through formalized direct trade agreements between two or more regional entities that can bypass traditional middlemen to guarantee stable prices, transparent profit-sharing, and long-term market commitments for the growers.

The development and success of any such partnership or cooperative agreements will depend on ongoing collaboration and strong relationships between seaweed farmers and processors across the region. The West Coast Seaweed Industry Coalition model could support this necessary relationship-building.



A sugar kelp blade in front of Mount Rainier, WA, from the beach on Victoria Island, B.C.  
Photo by Willow Battista

## Summary of Roadmap Pathway Two

The second key pathway for a thriving Washington seaweed industry focuses on leveraging the state's existing infrastructure, skilled workforce, and strategic geographic location to serve as the regional processing and innovation hub for the entire West Coast. Despite Washington's low production volume, analyses show that investing in large-scale, high-tech secondary processing, such as a cascading biorefinery, to handle feedstock from high-production areas like Alaska and British Columbia, offers the greatest

economic return. This approach will maximize value, minimize waste, and benefit not only Washington's, but also Alaska's and BC's small-scale farms by providing access to advanced infrastructure that they cannot necessarily afford on their own. Crucially, this development must incorporate equitable ownership and benefit-sharing models to prevent industry consolidation and ensure sustainability and justice across the region. Finally, there is a broader need to facilitate knowledge sharing, coordinated investment, and shared advocacy and marketing efforts across the West Coast.



Aerial view of kelp farm off the coast of Kodiak Island, Alaska.

Photo by Willow Battista

## KEY NEXT STEPS FOR PATHWAY 2

### 1. Improve the Alaska-Washington Kelp

**Pipeline:** Partner with major maritime shippers to optimize cold-chain and other logistics for stabilized kelp arriving from Alaska and identify port-adjacent sites for centralized bulk receiving and storage to reduce food miles and handling costs for regional farmers. Additional analysis is also needed into optimal aggregation hubs, improved options for rural kelp farms, and regulatory complexities that impact cross-border transportation of goods.

### 2. Strategic, Blended Capital Investment

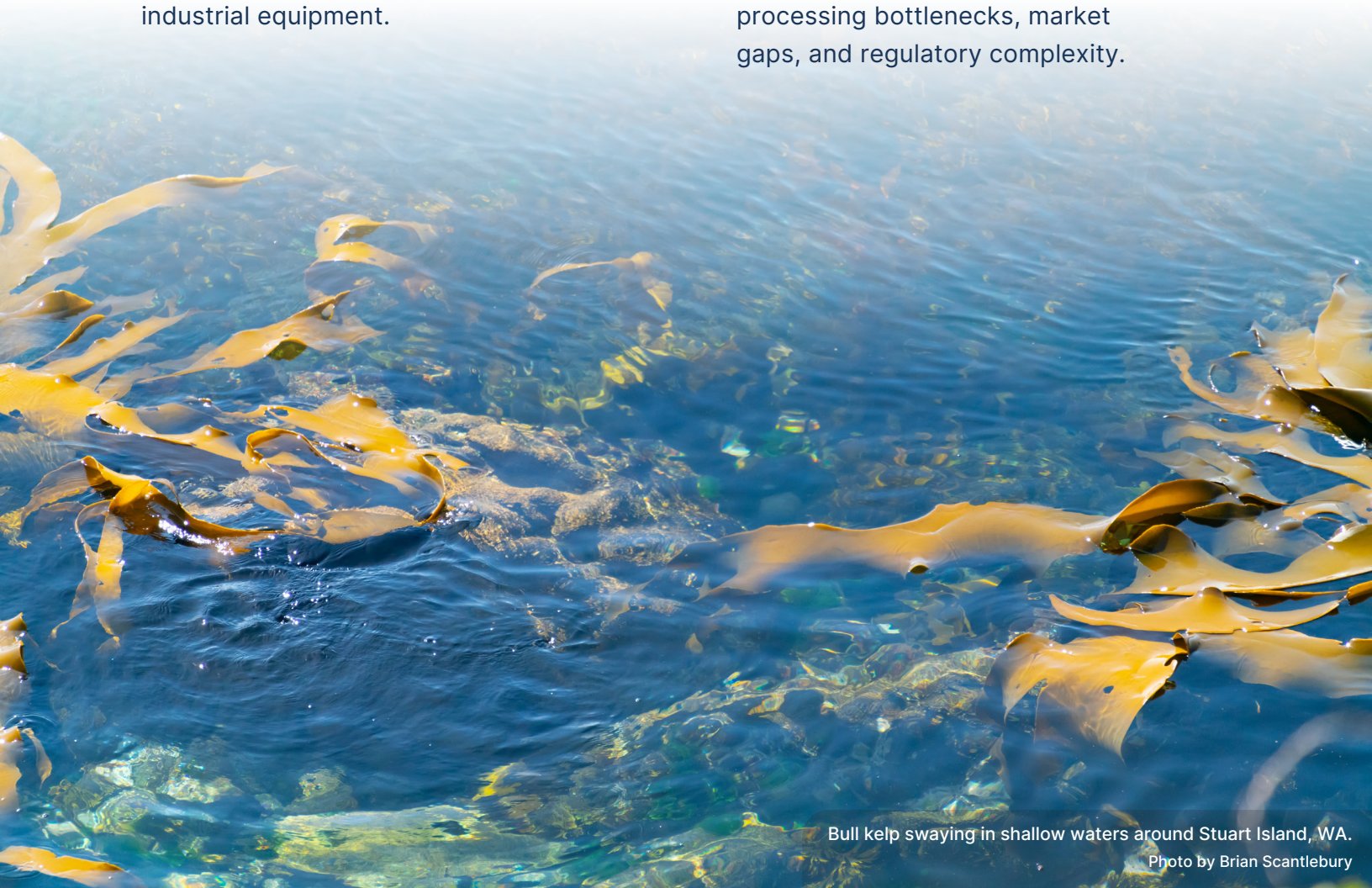
**Fund:** Seek state grants and develop public-private funding partnerships specifically targeted at seaweed processing infrastructure to move beyond farm-site funding toward high-capacity industrial equipment.

### 3. Accelerate Value-Added Processing

**Infrastructure:** In collaboration with farmers and other stakeholders across Alaska and Washington, develop a shared modular and/or cascading secondary processing facility to convert stabilized kelp from across the region into high-value ingredients; ensure complementarity with Blue Dot Kitchen's food processing model and capacity, as well as other emerging processors in the region.

### 4. Establish a West Coast Seaweed

**Industry Coalition:** Develop a cross-border knowledge exchange hub to facilitate sharing of best practices, technical data, research and analysis results, and to identify and address shared regional challenges – including processing bottlenecks, market gaps, and regulatory complexity.



Bull kelp swaying in shallow waters around Stuart Island, WA.

Photo by Brian Scantlebury

# CONCLUSION

This Roadmap serves as a comprehensive blueprint for the development of a regenerative seaweed farming industry in Washington state that balances economic ambition with ecological stewardship. By synthesizing the research, analysis, stakeholder interviews, and financial modeling presented in this document, a clear trajectory is identified for Washington to move from industry nascency to a leadership position in the regional sector.

This progress will depend on addressing two key challenges simultaneously: (1) weak market demand is disincentivizing growth in production, but current production volumes are insufficient to catalyze market growth (the “chicken and the egg” challenge); and (2) insufficient processing capacity is hindering growth in both markets and production, but investment in expanded processing capacity before industry scale demands it carries significant risk (the “cart before the horse” challenge). It will also be critical to collaboratively address the fundamental research and knowledge gaps that are influencing perceptions and hindering progress toward shared goals.

## Two Key Pathways to a Thriving Industry

Overcoming these challenges depends on the concurrent advancement of two distinct but complementary pathways:

### Pathway 1: Supporting the Economic Viability of Small-Scale Seaweed Farms in Washington Waters.

Realizing a “bottom-up” industry requires addressing the high barriers to entry and viability for local producers. This pathway focuses on stabilizing the economic foundation of farms within Washington’s waters by reducing capital expenditures through shared processing equipment, catalyzing the development of right-size markets and diversifying product streams, and reducing uncertainties driving permitting and licensing barriers. Advancing this along pathway ensures that the industry remains rooted in local communities and provides direct ecological benefits — such as nutrient removal and habitat restoration — within the Puget Sound and coastal estuaries. Success will require:

- **Expanding “right-sized” markets** — specifically, high-value, low- to medium-volume opportunities like packaged foods and personal care products, while supporting **vertical integration, product diversification, and the formation of a broader network of industry advocates** to enhance social license and collaborative innovation;
- Addressing the processing bottlenecks by utilizing **short-term strategic co-packing and shared-use agreements** with existing agricultural and seafood facilities, while moving towards establishment of a **shared, modular regional processing hub** in Washington to support secondary processing of harvests from across Washington state and beyond.

### **Pathway 2: Supporting Development and Expansion of Washington’s Role in the Regional Seaweed Farming Industry.**

While local production will remain small-scale, Washington is uniquely positioned to serve as the critical secondary processing and distribution hub for the entire West Coast. By leveraging Washington’s extensive

infrastructure and logistical assets, and supporting equitable benefit sharing and region-wide collaboration through the formation of a West Coast Coalition, this pathway ensures Washington can capture significant economic value, while providing synergistic support to neighboring regions like Alaska and British Columbia. Success entails:

- **Building a West Coast Seaweed Industry Coalition** to cultivate relationships and identify opportunities for synergy and collective action, focusing on **improving regional kelp transportation infrastructure**, potential for **shared marketing and market development**, and development of **blended finance**;
- Implementing a **phased approach to develop Washington’s capacity to act as a regional secondary processing hub**, with emphasis on **high-value, medium-volume product streams** that complement other developments across the region, and efforts to **preserve and expand product stream diversification through modular and/or cascading technology**.

## Immediate Next Steps

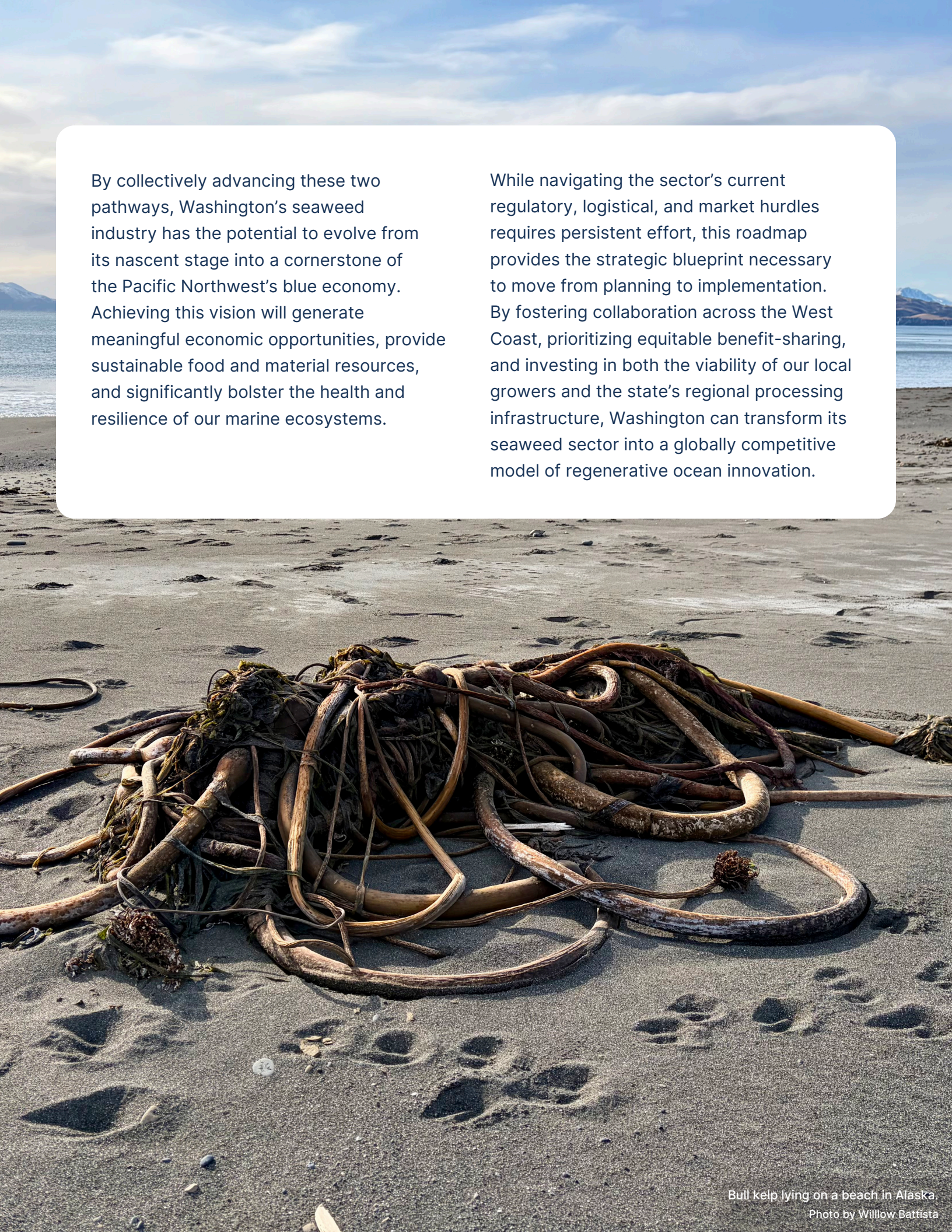
Moving from planning to implementation requires the targeted support of, and investment in, following priority actions:

### Pathway 1:

- **Facilitate shared-use processing agreements** with processors in agriculture, seafood, and fermentation, and explore opportunities to ease regulatory barriers, like precautionary allergen restrictions, where safe and feasible.
- **Catalyze local product innovation** through investment in a shared product development and processing space in Washington.
- **Fund the continuation of the Washington Seaweed Collaborative** or a similar non-regulatory convening body designed to support the sharing of information between the seaweed restoration and cultivation communities.
- **Convene shellfish growers engaged in *Ulva* removal with kelp farmers** to explore shared processing interests and barriers to merging harvest streams.
- **Launch a coordinated regional research initiative with regulators, scientists, and seaweed farmers** to advance critical research and reduce uncertainties that are driving permitting hurdles and other barriers.
- **Develop and strengthen relationships** across seaweed farmers, shellfish growers, seaweed farmers in neighboring regions, and Tribes to identify opportunities for partnership and expand industry champions.

### Pathway 2:

- **Fund efforts towards market validation and product development** across biostimulants, food ingredients, personal care, and biomaterials, with focus on developing product cascade opportunities and advancing high-value products that require a medium-volume of stabilized kelp.
- **Expand mapping of transportation corridors** (sea, air, and land) to identify optimal aggregation hubs in rural Alaska, efficient routes from harvesting sites to Washington processing centers, and regulatory streamlining to ease cross-border transportation of goods.
- **Conduct financial modeling, feasibility analysis, and a regional cost-of-production comparison** (across WA, AK, BC, and OR) for a modular or cascading secondary processing facility in Washington state to clarify competitive advantages, de-risk investment, and strengthen the investment case for scaling Alaskan kelp production.
- **Establish a West Coast Seaweed Industry Coalition** — a non-regulatory collaborative body to deepen regional coordination and advance equitable secondary processing capacity development, infrastructure planning, market expansion, and best practice knowledge sharing across the West Coast. Maritime Blue is partnering with AFDF to advance this activity.
- **Develop new blended and “patient” funding mechanisms**, where a mix of government and philanthropic funding are used to de-risk early-stage private investments in shared processing and enable industry growth.



By collectively advancing these two pathways, Washington's seaweed industry has the potential to evolve from its nascent stage into a cornerstone of the Pacific Northwest's blue economy. Achieving this vision will generate meaningful economic opportunities, provide sustainable food and material resources, and significantly bolster the health and resilience of our marine ecosystems.

While navigating the sector's current regulatory, logistical, and market hurdles requires persistent effort, this roadmap provides the strategic blueprint necessary to move from planning to implementation. By fostering collaboration across the West Coast, prioritizing equitable benefit-sharing, and investing in both the viability of our local growers and the state's regional processing infrastructure, Washington can transform its seaweed sector into a globally competitive model of regenerative ocean innovation.

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# APPENDICES:

## A. List of Seaweed Industry Stakeholders Interviewed for this Roadmap

**TABLE AI.1: Seaweed industry stakeholders who were formally interviewed for this Roadmap**

Name	Organization
Emily Power	Ocean Made
Rhianna Nagel	CARTI, North Island College
Travis Bettinson	Blue Dot Kitchen
Matt Obee	Cascadia Seaweed
Nick Stern	Pacific Kelp Co.
Matthew Perkins	Macro Oceans
John Smet	Pacific Kelp Co.
Bobbi Hudson	Pacific Shellfish Institute
Tom Mumford	Marine Agronomics
Jackie Dexter	Holdfast Mariculture
Jordan Hawkswell	Pacific Seaweed Industry Association
Mark Smith	Pacific Seaweed Industry Association
Jillian Greenwood	WA Department of Natural Resources
Alex Stote	WA Department of Natural Resources
Jeff Whitty	Northwest Straits Commission
David Trimbach	WA Department of Fish and Wildlife
Teri King	National Oceanic and Atmospheric Administration (NOAA)
Jodie Toft	Puget Sound Restoration Fund
Todd Woodard	Samish Indian Nation
Marcus Campidilli	Samish Indian Nation

**TABLE AI.2: Seaweed industry stakeholders with whom Maritime Blue Staff had in-depth, but informal discussions over the course of this project, which informed this Roadmap**

Name	Organization
Alex Huller	Alaska Fisheries Development Foundation
Amanda Swinimner	Dakini Tidal Wilds
Bailey Moritz	World Wildlife Federation (WWF)
Bill Dewey	Taylor Shellfish
Bobbi Hudson	Pacific Shellfish Institute
Brett Veerhusen	Ocean Strategies
Briana Murphy	Mothers of Millions
Catherine Ohara	Sway the future
Charlie Herrington	South East Conference
Dan Lesh	South East Conference
Diane Boratyn	Sol-Sea
Doug Bush	Ocean Rainforest
Erick Dowell	Blue Carbon Green Fields
John Smet	Pacific Kelp Co.
Kendall Barbery	GreenWave
Laura Butler	Washington State Department of Agriculture
Lila Hobbs	Pew Charitable Trusts
Lindsay Olsen	GreenWave
Marah Beach	Deep Blue Draw Down
Meg Chadsey	Washington Sea Grant
Melissa Good	Alaska Sea Grant
Mike Conathan	Upwell Solutions
Molly Bogeberg	The Nature Conservancy (TNC)
Nick Mangini	Kodiak Island Sustainable Seaweed
Rod Fujita	UC Santa Cruz
Samantha Garwin	GreenWave
Sarah Gutzmann	Simon Fraser University
Sophe Silkes	COAST
Tamsen Peoples	University of Alaska, Fairbanks
Tiffany Waters	The Nature Conservancy (TNC)

## B. Shifting Industry Landscape in Washington

When Maritime Blue embarked on this Builders Vision planning grant in January 2025, the project goals were developed based the state of the industry at the time, which consisted of three existing farms and one pending lease approval, who were all (1) growing at least some sugar kelp; (2) actively seeking viable new markets for their harvests; and (3) willing to consider sharing investment in new processing technology to support accessing those new markets.

Over the course of the grant, for a variety of reasons, all three of those contextual conditions have changed, limiting the ability for farmers to collaborate beyond knowledge sharing:

- Multiple and consecutive seed failures prevented both Lummi Island SeaGreens (LISG) and Pacific Sea Farms (PSF) from outplanting for the 2024/25 season, meaning there was no need to develop a near-term processing strategy as originally planned.
- The Blue Dot Sea Farms (BDSF) team shifted focus from seaweed farming for commercial gain to focus on seaweed as support for their shellfish operations.
- Furthermore, BDSF has voiced a desire to switch from production of sugar kelp to production of bull kelp if allowed through

renewal of their seaweed farming lease with the Washington DNR in 2027. If BDSF shifts to bull kelp, it would significantly reduce the overlap in products, and thus processing technologies, that could be shared between existing farms.

- More recently, a catastrophic gear failure at PSF resulted in the termination of that farm's lease, effectively removing PSF from the field of potential collaborators on processing, at least in the near term.
- Finally, the gear failure at PSF has also delayed the issuance of the lease that Vashon Kelp Forest (VKF) is awaiting from Washington DNR. The VKF project is now on indefinite hold.

In confluence, these factors leave just two active seaweed farms in Washington waters — Lummi Island SeaGreens and Blue Dot Sea Farms. These two farms are a significant distance apart and have differing business models and goals. Thus, sharing investment in processing capacity is no longer an option. Instead, the seaweed farmers involved in this Builders Vision grant agreed to join forces to draft this Roadmap. Through this collaborative effort they aim to share their collective experiences, knowledge, and perspectives on what is needed for a seaweed aquaculture industry to succeed in Washington state and beyond.