Washington state as a seaweed processing hub: A systems and equity framework analysis of the Pacific Northwest's kelp supply chain

Report prepared for Maritime Blue by Charlotte McGoldrick
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I. Executive summary

Washington is well positioned to serve as a secondary processing hub for the Pacific Northwest's cultivated seaweed industry, filling a capacity gap that production engine regions cannot easily fill themselves. Established distribution networks, processing infrastructure, and market access make Washington a logical center for this growth. However, filling that gap does not guarantee a sustainable supply chain. Without deliberate attention to how value is distributed, and without the product and market development needed to support a Washington facility over the long term, the effort risks reproducing the same extractive patterns common to other agrifood and natural resource value chains, where benefits concentrate downstream while producers absorb the cost, labor, and risk of cultivation.

This report draws on a systems analysis of the Alaska-Washington-British Columbia seaweed supply chain and 32 stakeholder interviews to identify critical pain points facing the region's growers. Key findings include:

- Producers bear a disproportionate share of cost, labor, and risk across the supply chain, while having the least control over pricing, processing schedules, and the terms buyers set.
- Buyers and growers often see the supply chain from fundamentally different vantage points, and that gap in priorities tends to land hardest on producers. For example, growers and buyers have different levels of concern about the cost and labor of sourcing, cleaning, and shipping the IBC totes the market currently relies on for bulk packaging, with the burden falling more heavily on growers.
- Kelp's properties make it a difficult fit for standard co-packing infrastructure, leaving most facilities reluctant to take it on without proven demand to justify retrofitting their lines. Where shared infrastructure is available, other products typically take precedence, leaving growers with little control over scheduling.
- Unstable markets have already produced real consequences for growers: Cascadia's recent decision to cut its anticipated purchase volume in half hit Cordova and Kodiak

hardest, the regions farthest from their buyer, showing how distance from market access can translate directly into disproportionate risk.

- Vancouver Island's own processing ambitions could put it in competition with Washington's for the same underdeveloped regional market, though early signs of complementary specialization between the two suggest a coordinated path is possible.
- A handful of shipping companies dominate Alaska-Washington trade routes, driving up costs unevenly across the region. Alternative logistics models show promise but remain too early-stage to rely on yet.
- Many Alaskan farmers are open to offloading secondary processing to a Washington facility, provided it offers stable markets and a fair share of the value it creates. The central question is not who controls the supply chain, but how fairly its profits are distributed and what burden its design places on overextended producers.

Building on these findings, the report evaluates several ownership models for a Washington secondary processing facility, ranging from cooperative structures that give producers direct governance and ownership, to producer-owned partnerships without cooperative governance and non-producer-owned arrangements that trade some producer control for greater simplicity. Each model carries different tradeoffs around representation, capital access, and producer protection. All of them, however, face a shared underlying risk: a facility based in Washington, serving producers spread across Alaska, could give Washington-based members disproportionate influence and access simply by virtue of proximity, whether through governance participation, buyer relationships, or logistical burden.

The report outlines a set of complementary tools that strengthen equity within the producer-ownership and non-producer-ownership models specifically, including revenue-sharing arrangements, multi-year supply agreements, and cost-sharing provisions. The cooperative model carries its own equity mechanisms, particularly around governance and operating procedures that address capacity bottlenecks, divergent target market priorities, and unequal access to buyer relationships driven by location. None of these tools, however, can resolve issues like kelp's physical fit with existing processing infrastructure or the region's shipping economics, which call for investment in facility design and logistics, and rely in part on scale.

Higher-value food markets, where Washington's existing players are already focused and where the state's consumer base offers genuine alignment, may also create more room to sustain fair

terms for growers than the lower-margin commodity markets, like biostimulants, that Alaska and British Columbia currently depend on.

Ultimately, no single business structure guarantees a fair outcome. Equity follows from treating producers as partners in the supply chain, not simply suppliers of raw material – and from designing a facility around that principle from the start, rather than trying to address it once key decisions have already been made.

II. Seaweed sector and processing overview

Seaweed plays a critical role in both marine ecosystems and the global food system. Cultivating seaweed requires no arable land, fresh water, or inputs such as fertilizers, and grows exceptionally quickly – all while supporting the surrounding ecosystem through nutrient cycling, reducing acidification through carbon capture, and providing wildlife habitat. A vital part of diets around the world, seaweed can provide sustainable nutrition to billions.

North America's waters are home to historically vast forests of kelp, a group of brown seaweeds that thrive in cold, nutrient-rich waters. Threatened by warming oceans, overgrazing by sea urchins, agricultural runoff, and coastal development, the continent's kelp forests have declined by up to 90%.[1] Farming of declining native kelp species such as sugar and bull kelp (along with other species) has expanded rapidly over the last ten years. This growth was supported with state funding and driven largely by enthusiasm for seaweed's regenerative and climate-mitigation potential, paired with its diverse applications – from food and cosmetic ingredients, to chemical input-reducing agricultural products (e.g. biostimulants) and methane-reducing livestock feeds, to medical products and alternative biomaterials for plastics and construction.

Alaska and British Columbia are the West Coast's kelp production engines. In Alaska, production peaked in 2022 before struggling with seeding issues that contributed to falling volumes. Though efforts to address the issue were largely successful, demand softened, market development lagged, and tension between buyers' ingredient price needs and the cost of production have created significant bottlenecks for the industry's growth.

[1] Zuckerman, C. (2023, May 26). *The vanishing kelp forest*. The Nature Conservancy. https://www.nature.org/en-us/magazine/magazine-articles/kelp-forest/

The supply chain is also limited by the availability of processing infrastructure. Harvest begins to degrade mere hours after being removed from the water, so seaweed must be stabilized quickly – within 12-24 hours from harvest. Transporting raw kelp long distances is infeasible, creating the need for stabilization and primary processing infrastructure as close to source as possible. Processing capacity in North America cannot currently meet production volumes, and lagging market development has reduced incentives for large-scale investments in seaweed-dedicated facilities. This constraint further slows market development, creating somewhat of a vicious cycle for the nascent sector.

Seaweed processing can generally be divided into two stages, though precise steps vary greatly depending on the end product. Stabilizing and primary processing often occur together – seaweed is typically rinsed and then shredded, chopped, or ground before being preserved through drying, freezing, fermenting, or ensiling with an acid stabilization agent. Secondary processing converts stabilized kelp into commercial products and may involve seasoning, blending, cooking, pressing, compound extraction, filtering and refinement, and further drying or milling. In this report, discussion of processing in Alaska largely refers to primary stages. Discussion of Washington's development as a seaweed hub refers mainly to secondary processing, as kelp transported from out of state – the primary feedstock for any scalable Washington facility – would be stabilized.

III. Industry context & problem statement

Washington appears well positioned to expand its role in the seaweed supply chain by serving as a regional secondary processing hub for stabilized kelp cultivated in the broader Pacific Northwest region. Already a critical gateway on major trade routes, Washington offers established distribution networks, processing infrastructure, and market proximity that producing states like Alaska do not have readily available at the scale and maturity needed to support a healthy industry.

Maritime Blue commissioned an economic modeling analysis that found this pathway has the potential to deliver significant economic benefit to Washington – nearly 450 jobs and over $140 million in GDP over ten years.[2] The organization commissioned a follow-up analysis of optimal

[2] Confluence Environmental Company & Greene Economics. (2025, November). *Washington Seaweed Aquaculture Economic Potential Analysis.* Prepared for Maritime Blue.

technologies and locations for development of a secondary processing hub in Washington, which underscored the feasibility of this plan. Washington operating primarily as a secondary processing hub aligns with existing market structures and other industries' trends. More than 80% of the container shipments moving between Alaska and the lower 48 pass through Seattle or Tacoma, and one billion pounds of Alaskan seafood lands in Washington every year.[3] Much of this material goes through secondary and tertiary processing within Washington. Although capacity is expanding in Alaska for seaweed stabilization and primary processing, labor availability, energy costs, lack of connectivity between remote locations, and small consumer markets make secondary, commercial scale processing in Alaska especially challenging and costly. With these limitations, Washington fills a logical role and can deliver real value for the emerging North American seaweed industry.

However, business as usual in supply chains often delivers low margins to producers, leaving small-scale growers in particular struggling to maintain financially viable businesses. Where larger players can take advantage of economies of scale to drive down their per-unit costs and secure buyers, small farmers struggle to compete. Across supply chains, asymmetric profit sharing concentrates benefits at downstream processors and distributors. Within the Alaska-Washington seafood trade, many cite extractive supply chain structures that siphon value towards the state that owns post-primary processing steps. While Washington delivers much needed secondary processing capacity and linkage to markets, operating under a typical model risks replicating extractive systems powering many agrifood value chains.

Alaskan seaweed cultivation is facing a tenuous moment – a large, grant-funded, Southeast Conference-led initiative to advance mariculture is winding down, and lagging market development has created continually uncertain demand. Producers are struggling to sell their harvest, and – with some existing markets demanding low prices on a per weight basis for their seaweed feedstock – often see low margins when they do. Under these conditions, a trade model that concentrates value downstream is not only inequitable, it is unlikely to sustain itself.

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[3] Brown, L. (2025, May 19). *Maritime cargo comings and goings 2024*. Port of Seattle. https://www.portseattle.org/blog/maritime-cargo-comings-and-goings-2024; McKinely Research Group, LLC. (2024, April). *The economic value of Alaska's seafood industry*. Alaska Seafood Marketing Institute. https://www.alaskaseafood.org/wp-content/uploads/MRG_ASMI-Economic-Impacts-Report_2023_WEB-PAGES.pdf

This report includes a systems analysis of the Pacific Northwest's seaweed aquaculture supply chain, and identifies governance structures, partnership opportunities, logistics pathways, and manufacturing priorities that could help Washington deliver truly additive value that fills gaps across the supply chain; support a more equitable distribution of value across growers and processors; and serve the interests of growers and other industry stakeholders across the region.

IV. Methodology

Project scope

For the purposes of this report, the Pacific Northwest refers to the region that includes Alaska, British Columbia, and Washington. This study concentrated on domestic trade relations and seaweed industries of Washington and Alaska. British Columbia plays an important role in the region's seaweed supply chain and was included in the analysis, but proposed solutions prioritize domestic actors – largely because the maturity and production potential of Alaskan seaweed farms offers the greatest feedstock potential for Washington processing infrastructure.

Research and data collection approach

The author reviewed relevant internal Maritime Blue reports, surveyed literature on the North American seaweed industry and equitable value chain models across agrifood subsectors, and conducted extensive stakeholder interviews.

The report is primarily derived from this expert and stakeholder interview data. The author interviewed 32 individuals, concentrating largely on subjects with a direct interest in the seaweed industry. Their expertise spans cultivation, logistics, processing, product innovation, applied research, and partnership development. The stakeholders' regional expertise spans Alaska, British Columbia, Washington, and Maine. Interviewees were selected with the following topic areas in mind: logistics and transportation pathways, direct experience with the challenges in building seaweed businesses in North America, and exposure to recent collaborative partnerships in the industry. Outside experts – including those with knowledge in policy, equitable value chains more broadly, and the Alaskan fishing industry – were also consulted. Individuals consulted are listed in Table 1 below.

Table 1. Consulted individuals and their affiliations

Name	Organization	Area of expertise	Regional focus (if relevant)
Helene York	Haas Business School; Culinary Institute of America	Equitable value chains	
Emily Patrick	CARE International	Equitable value chains	
Elizabeth Bennett	Lewis and Clark College	Equitable value chains	
George Leonard	University of California, Santa Cruz	Aquaculture policy	
Rod Fujita	University of California, Santa Cruz	Seaweed industry	
Peter Green; Niclas Riecken	Hatch Innovation Services	Seaweed industry	
Kendall Barbery	GreenWave	Seaweed industry	
Samantha Garwin	GreenWave	Seaweed industry	
Thiago Correa	International Bioeconomy & Macroalgae Center	Seaweed industry	
Melissa Good	Alaska Blue Economy Center	Seaweed industry	Alaska
Mike Conathan	Upwelling Consulting	Seaweed industry; Ocean policy	Maine
Mark Smith	Pacific Seaweed Industry Association	Seaweed industry	British Columbia
Jordan Hawkswell	Pacific Seaweed Association	Seaweed industry	British Columbia; Alaska
Larry Mellum; Mike Spranger; Riley Starks	Lummi Island Sea Greens	Cultivation	Washington
Jon Kroman	Blue Dot Sea Farm	Cultivation	Washington
Jackie Dexter	Holdfast Mariculture	Cultivation	Washington
Nick Mangini	Kodiak Island Sustainable Seaweed	Cultivation; Processing; Logistics	Alaska
Evie Witten	Kachemak Kelp	Cultivation; Seaweed industry	Alaska
John Smet; Nick Stern	Pacific Kelp Co	Cultivation; Processing	Alaska
Sean Den Adle	Alutiiq Pride Marine Institute	Cultivation; Processing; Logistics	Alaska
Matthew Obee	Cascadia	Cultivation; Processing; R&D; Logistics	British Columbia
Emily Power	Ocean Made	Processing; R&D	

Matthew Perkins	MacroOceans	Processing; R&D	
Travis Bettinson; Joth Davis	Blue Dot Kitchen	Processing; R&D	
Santan Chaurasiya	Environmental Defense Fund; Cornell University	Processing; R&D	
Chris McDowell	Yakobi Fisheries	Fishing industry; Logistics	Alaska
Tim Fitzgerald	American Seafoods	Fishing industry	Alaska; Washington

Exclusions and further study

This project used a systems analysis approach to identify key pain points to building an equitable seaweed supply chain and pathways to address them while building a secondary processing facility in Washington. Deeper study, including thorough financial analysis and additional stakeholder consultation, would be required before embarking on early implementation stages. An in-depth feasibility assessment of the outlined business model solutions is considered premature and was not included in the scope of this project. Stakeholders were not necessarily consulted about their interest in all specific proposals or potential partnerships identified in this report.

The author's interviews concentrated on seaweed aquaculture and closely related industry stakeholders, and did not extend to many specialists in cooperative ownership or other alternative business models from external industries. Consultation with stakeholders from successful equitable value chain projects would offer critical guidance for future stages of developing Washington's seaweed processing capacity.

While British Columbia features in this report, an in-depth review of U.S.-Canada trade regulations was not conducted. This would be a necessary next step for any efforts to develop a trading partnership between Canadian farms and U.S. processors.

V. Pacific Northwest seaweed systems analysis

Regional seaweed cultivation and processing landscape

This section discusses key players and their relationships in the Pacific Northwest's seaweed supply chain. It is not all-inclusive of stakeholders cultivating seaweed, making seaweed-derived products, or otherwise having a vested interest in the sector.

Washington

Washington's cold currents and long coastline offer abundant natural potential for seaweed cultivation. However, lagging market development has tempered recent years' enthusiasm for seaweed aquaculture in the state. Without sufficient market demand, there is little incentive to streamline the state's already long and complex permitting processing. Since a storm in March 2025 induced a gear failure at one of Puget Sound's newer seaweed aquaculture sites, Pacific Sea Farms, authorizations by issuing state agencies have stalled further. While regulatory hurdles and lagging marketing development have prevented Washington from reaching its production potential, the state is not large enough to become a commercial cultivation hub to supply emerging markets – Alaska and British Columbia are better suited for this role. At its smaller scale, shared infrastructure that meets the needs of farmers across the region would help Washington's farmers reduce costs and meet market demands.

Today, two farms are actively cultivating seaweed in Washington – Lummi Island SeaGreens (LISG) located near Bellingham close to the Canadian border, and Blue Dot Sea Farms about 100 miles south, off of the Hood Head peninsula. Additional parties remain interested in establishing kelp cultivation should the regulatory environment and market demand become more favorable. Vashon Kelp Forest, a restoration-focused project, aims to grow sugar and bull kelp off the northwest of Vashon Island near Seattle. Jackie Dexter, a Whatcomb County-based scientist, shellfish farmer, and owner of Holdfast Mariculture, is working towards establishing a multitrophic aquaculture site near LISG. Interviewees reported some Indigenous communities in the area have expressed interest in kelp cultivation, though whether these projects would be for commercial purposes or exclusively for cultural practices and ecological restoration is unclear.

Lummi Island SeaGreens & Bounty of the Salish Sea

While LISG is currently focused on overcoming seed failure challenges, they expect to expand their operation in the coming years. Their 10-acre lease offers the greatest biomass potential in the state, able to produce up to 50,000 wet pounds of sugar kelp annually. LISG's plans target high-value, niche markets, such as kelp ingredients for local restaurants and premium seaweed-based bath items for local specialty markets. A common story among North American seaweed farmers, LISG has vertically integrated their supply chain largely out of necessity. They've been heavily-involved in stabilization and processing steps, working with an apple processor, Sauk Farm, to dry seaweed in the orchard's off-season. LISG's affiliate business, Bounty of the Salish Sea, develops products and – confronting the nascency of many seaweed product markets – is pursuing a retail location at Seattle's Pike Place Market to showcase these products and develop demand for their own seaweed and other Salish Sea-sourced products. Given recent seed and nursery challenges, the LISG team is exploring developing their own spore gathering and nursery operation as well, which would make them fully vertically-integrated – from seed to sale. However, the owners ultimately see total vertical integration as unsustainable. While open to acting as market leaders and taking ownership of stages of the supply chain beyond cultivation, they hope to outsource components of the value chain through contract partnerships and other means in the long term.

In their pursuit of expanding production and involvement in market development, the LISG team has also expressed openness to partnerships with Alaskan growers and interest in serving a range of markets, including those characterized by lower-value, higher-volume products like agricultural inputs. However, their focus on local, premium markets means LISG relies on place-based marketing featuring their distinct quality and unique cultivation site, which is shared with an Indigenous reef-net fishery.[4] Therefore, LISG does not expect to benefit from commodifying or aggregating the majority of their product with harvests from other farms.

Without a significant shift in LISG's business model, any processing facility in Washington that aims to serve both in-state and out-of-state producers must not rely solely on aggregating harvests or serving high-volume, low-value markets.

[4] Reef-netting is a traditional, low-impact fishing method developed by the Lummi Nation and other Coast Salish Indigenous peoples.

Blue Dot Sea Farms & Blue Dot Kitchen

Originally oyster farmers, the Blue Dot team started experimenting with seaweed as part of a 2016 research project to support shellfish farming by reducing water pH levels. Seeking a financially viable destination for the seaweed, Blue Dot began developing packaged food products with kelp. The team found it near impossible to gain a strong foothold in the CPG (consumer packaged goods) market, with power heavily consolidated at the retailer and distributor levels, and fierce competition in a crowded snack market. The company moved away from seaweed-based consumer package goods to prioritize oyster production. They continue to grow small amounts of seaweed for new research initiatives.

Through their experimentation with seaweed production, Blue Dot developed expertise in seaweed processing and decided to create Blue Dot Kitchen, an affiliate company conducting product development and processing innovation spearheaded by food scientist and chef Travis Bettinson. Unable to find a cost effective way to dry seaweed at their small scale, the company developed proprietary, ambient-temperature stabilization systems[5] that opened the door to the higher-value foodservice channel. Like Lummi Island SeaGreens, the Blue Dot team has been directly involved in each stage of the supply chain.

Blue Dot is now largely focused on seaweed as an ingredient for foodservice and has begun a salting/brining stabilization method trial with farming partners in a Cordova, Alaska facility this season. At the time of writing, they are actively seeking a secondary processing location in Washington to make seaweed products for restaurants and other foodservice entities.

The primary species cultivated in the region, sugar kelp, presents a challenge for Blue Dot's chosen target vertical. Bull kelp, a threatened, ecologically critical species along the West Coast, may be more suitable and present higher value potential than sugar kelp in foodservice. While far less established as a farmed species, bull kelp is fast-growing, particularly palatable, and its large stipe gives the species a wider variety of culinary applications. Barnacle Foods out of Juneau, Alaska has made inroads in the CPG industry with their bull kelp-based pickles, salsas, and more. The species' unique morphology presents challenges for commercial scale cultivation, though a group of collaborators out of the Alaska Mariculture Research and Training

[5] Seaweed must be stabilized (preserved) within hours post-harvest. Common methods include drying, fermenting, acid stabilization, and freezing. Fermentation and acid allow seaweed to maintain moisture content and texture.

Center (AMRTC) have been developing solutions.[6] Sea Quester Farms – in partnership with the AMRTC collaborative and supported by Joint Innovation Project funding from the Alaska Mariculture Cluster (AMC) – continues to spearhead sustainable bull kelp cultivation field trials at their Juneau site.[7] Blue Dot is working with multiple Alaska growers in hopes to usher a shift towards cultivating this culinarily promising species, though the feasibility of doing so at scale remains uncertain.

Any shared processing effort inclusive of Blue Dot Kitchen would likely need to account for variations in working with different species, capabilities, and procedures specific to a range of foodservice products, as well as the company's privacy around their proprietary methods.

Ocean Made

Ocean Made is a Washington-based manufacturer of kelp-derived plant starter pots and consumerized, small-quantity biostimulants. The company offtakes commercial seaweed product waste streams to create molded fiber pots that decompose and feed soil after planting. The volume of seaweed residue needed to scale production led the company to move from cosmetic byproducts to their current residue supply, biostimulant production. Signs of significant market potential for their highly sustainable plastic pot alternative are appearing. One of the world's largest agricultural companies approached Ocean Made about replacing the plastic pots in their supply chain with kelp pots. However, Ocean Made relying on seaweed biostimulant markets for material supply creates significant hurdles to fulfilling customer demand. On top of liquid extract markets limiting their production, Ocean Made is committed to using sustainably cultivated seaweed versus wild harvest, and North American seaweed farming is not yet at the scale needed to serve large corporate customers.

The company has been testing seaweed products from farms and processors across the region, but true scale will require a more centralized input stream. Achieving favorable unit economics presents a problem when the product is competing with plastic prices and manufacturing calls for shipping significant quantities of a high water content material from remote locations only to

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[6] *Bull Kelp Research Squad (BKRS)*. (2024, April 18). Alaska Mariculture Research & Training Center. https://amrtc.org/project/bull-kelp-research-squad-bkrs/

[7] Alaska Mariculture Cluster. (2025). *Final report 2023/2024 Joint Innovation Project: Evaluating infrastructure and seeding methods for scalable bull kelp cultivation*. https://alaskamaricultirecluster.org/wp-content/uploads/2025/03/JIP-1-Sea-Quester-Farms.pdf; Alaska Fisheries Development Foundation. (n.d.). *Assessing optimal infrastructure and seeding approaches for large-scale cultivation of bull kelp*. https://afdf.org/innovations-in-seaweed-farming-project-2

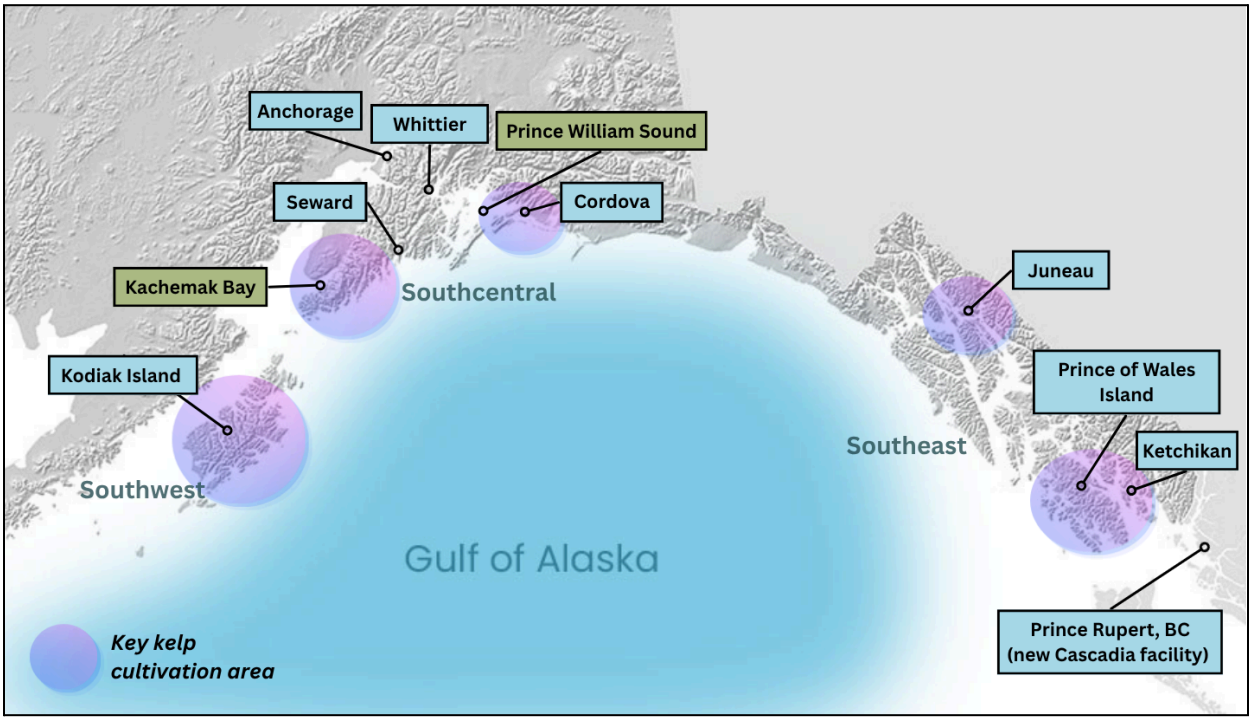
further lose volume in drying. Ocean Made would achieve better cost efficiency if the product was dried to their specification before shipment, but the infrastructure to do so doesn't often exist at the site from where the partially dewatered residue originates.

Ocean Made currently operates under a co-packing arrangement with a molded fiber manufacturer in Washington, but is considering shifting future operations to bring manufacturing, or – at a minimum – their R&D process in-house. They would also consider licensing their IP to other manufacturers. A collaborative effort to develop processing capacity in the state could consider a design that serves some of Ocean Made's niche needs, presenting an opportunity for Washington to lead in much needed residue innovation and circularity for seaweed biomass.

Alaska

Over the last decade, Alaska has made significant strides towards meeting their production capacity. With a shorter and more straightforward regulatory process, about 1,300 acres already permitted for seaweed cultivation, and vast stretches of suitable coastline available for expansion, Alaska holds incredible potential to serve as the kelp biomass production engine of North America. While some rural growers are primarily interested in creating stable employment opportunities for their local community, most producers intend to scale operations for commercial markets. Commercial seaweed production spans three distinct geographies – Southwest, with cultivation clustered around Kodiak Island; Southcentral, with hotspots in Kachemak Bay and Cordova; and Southeast, namely Prince of Wales island area and, to a smaller degree, Juneau. These regions span an incredible distance. As the crow flies, over 800 miles lie between Kodiak to the west and Ketchikan to the east.

Figure 1. Map of Alaska's southern coast (excluding the Aleutian Islands and the western portion of the Alaska Peninsula) highlighting kelp cultivation hotspots.



The 2021 Build Back Better Regional Challenge's[8] $49 million award to the Alaska Mariculture Cluster injected much needed capital to bolster seaweed and shellfish aquaculture development in the state, but lagging processing capacity and soft markets have hindered its progress.[9] The economic sustainability of the industry now faces a critical juncture, with the official grant period closing in September of this year, 2026.

Alaskan producers are stretched thin and yet to see a substantial return on their financial, time, and energy investments. Stabilization and processing have fallen increasingly on the farmer as markets moving towards functional ingredients for food and cosmetics, as well as agricultural inputs.[10] Co-packing options are few and far between in Alaska, leading farmers to come up with their own solutions. On top of processing, massive surplus has led many farmers to add research and development to their plates.

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[8] A program of the federal economic stimulus American Rescue Plan package
[9] AMC monthly update: April 2026. (2026, April 29). Alaska Mariculture Cluster. https://alaskamariculturecluster.org/announcements/amc-monthly-april-2026/
[10] GreenWave. (2026, February 5). *State of the kelp industry: A decade in review and the road ahead.* https://media.hub.greenwave.org/wp-content/uploads/2026/02/11194010/State-of-the-Kelp-Industry-Report_Feb-2026.pdf

While producers deepen their involvement in the value chain and take on increasing risk, market maturity hasn't caught up. Today, Alaskan producers are reliant on very few buyers. Kodiak and Cordova farmers in particular are largely selling their harvest to British Columbian grower-producer Cascadia for biostimulant manufacturing. Another agribusiness firm, California's Pacific Northwest Organics, also buys Alaskan bull kelp for biostimulants. With the majority of Alaskan kelp destined for agricultural liquid extracts, growers are dependent on an unstable market and the success of a product facing slow adopters and a competitive landscape of established alternatives.

Seaweed-based biostimulants show real promise for their power to improve plants' drought tolerance, enhance growth, and regenerate soil health.[11] Enthusiasm exploded for seaweed-based agricultural solutions' game changing potential to reduce the need for harmful chemical inputs, and the market is growing. However, moving from demonstration plots to industrial-scale field application, while underway, will require immense effort. While seaweed-based products are a significant portion of the biostimulant market, widespread adoption remains sluggish. There are less expensive feedstocks to make biostimulants. Beyond this price disadvantage; disharmonious regulations, differences in species used, unstable supply, and inconsistent production and processing methods have hindered adoption across the world.[12] North American, cultivated seaweed-based products face additional challenges. Most seaweed biostimulants on the market use cheaper, wildsourced and/or Asian feedstock. Cultivated seaweed could stabilize supply and product quality with scaled production in the future. However, whether there are efficacy or other advantages that justify the price premium that would come from farmed North American kelp remains unclear. Commercial farmers tend to be risk-averse, slow to adopt new inputs, and unlikely to apply an industrially nascent product to entire fields without developing a high degree of trust in its efficacy. Further trials and commercial development will be required to make cultivated seaweed biostimulants a scalable, enduring solution for North American producers.

Macro Oceans, a biomaterial manufacturer in Northern California making seaweed polymer-based food texture and cosmetic ingredients, has also sourced cultivated Alaskan kelp

[11] Rabhi, M. L., Derbak, L., Bendif, H., Boufahja, F., Abu-Elsaoud, A. M., & Garzoli, S. (2025). Seaweed-derived biostimulants for sustainable crop production: A review. *Journal of Biotechnology*, *408*, 201–216. https://doi.org/10.1016/j.jbiotec.2025.09.013
[12] Rabhi, et al. (2025).

slurry. Its future relationship with Alaskan producers, however, is uncertain. The company has indicated cultivated kelp will not be a financially sustainable feedstock for their products in the long term unless scaling production pushes prices closer to wild harvested seaweed.

One local buyer, Barnacle Foods, uses wild harvested and cultivated bull and sugar kelp from Juneau-based Sea Quester Farms in their seaweed-forward salsas, sauces, and other packaged consumer products. Some growers use part or all of their supply for their own products – these include Pacific Kelp Co.'s branded kelp extract for plants, Sea Quester's locally-sold kelp burgers and freeze-dried kelp flakes, and others making food and bath products sold into local markets on a small scale.

At the time of writing, farmers are experiencing significant upheaval as harvest season begins. Cascadia, citing cash flow issues, recently announced they would be purchasing half the product they had originally anticipated sourcing – 300,000 pounds down from 600,000. Farmers in Cordova and Kodiak – those regions farthest from their buyer – faced the steepest cuts. As a result, farmers are scrambling to find additional buyers and preparing to upend their primary processing and stabilization method plans.

On top of unpredictable purchasing, growers are navigating a buyers market, with prices well below what would provide them a sustainable margin at their current scale. Compared to several other end uses, biostimulants are a lower-value product. Extracted kelp is competing against a range of relatively low cost inputs in agribusiness. According to interviewees, Cascadia is currently offering $1 per pound of wet, ambient-temperature stabilized seaweed packed in 1,500-pound intermediate bulk container (IBC) totes.[13] Stakeholders only anticipate this pricing will fall, and farmers largely do not have the harvesting or processing systems in place to make this feasible on a long-term basis. Some reported production costs up to $1.06 per pound, excluding stabilization. Without other high volume buyers entering the market this season, farmers may have no other option but to take a loss.

The status of seaweed processing and manufacturing in Alaska

Alaska's manufacturing sector is small. Full-scale processing and manufacturing of seaweed products in the state would face several barriers. With a persistent, severe labor shortage, seafood processors in the state are largely reliant on foreign workers under temporary H-2B

[13] IBC totes are stackable plastic containers often used for chemical and other bulk liquid cargo transport.

visas.[14] The state's remote location and disparate geography add a serious challenge for any firm bringing in ingredients, packaging, equipment, and other manufacturing inputs from continental North America. Shipping north to Alaska is incredibly expensive and adds costs onto goods that are then sold back into the markets their elements came from.

Freezing, drying, and end-to-end manufacturing face power cost barriers

Freezing and drying have been the preeminent stabilization methods for Alaskan kelp. Both generally demanding significant power, these primary processing solutions present serious economic challenges. Alaska's average commercial electricity rate is 23.12¢ per kWh – 50% higher than the national average of 14.12¢.[15] The state average doesn't show the full picture, with disconnected grids and a wide range of power sources, prices vary greatly across regions. Many of Alaska's rural communities face particularly unpredictable, egregious rates, leading some to develop cutting edge renewable-powered microgrid systems to bring down costs. Across kelp cultivation hubs, prices vary significantly. The coastal Southeast region, home to Juneau and Ketchikan, has access to consistent hydropower and the lowest electricity prices in the state, from 9¢ to 14¢ per kWh for small commercial operators.[16] In Kodiak, home to a 100% renewable-powered remote microgrid, commercial customers pay about 20¢ per kWh.[17] For neighboring Kenai, home to Kechamak Bay, rates sit at 26.60¢.[18] Prince William Sound's Cordova is saddled with rates as high as 45¢ per kWh, though seafood processors receive discounts.[19] Reliant on diesel when the area's inconsistent hydropower generation slows, Cordova's rates vary and are highly sensitive to the price of fuel. Thus, low-energy primary processing techniques are critical for Southcentral seaweed farmers in particular.

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[14] Fiorillo, J. (2025, April 7). *US lawmakers introduce measure to tackle labor shortage in Alaska Processing Sector*. Intrafish. https://www.intrafish.com/processing/us-lawmakers-introduce-measure-to-tackle-labor-shortage-in-alaska-processing-sector/2-1-1803887

[15] Rates as of May 2026; Electric Choice. (2026, May). *Electricity rates by state.* Retrieved May 5, 2026, from https://www.electricchoice.com/electricity-prices-by-state/

[16] Rates as of June 2026; Ketchikan, Alaska, Municipal Code § 11.08.040 (2026). https://ecode360.com/48423174; *Current rates*. (n.d.). Alaska Electric Light and Power Company. Retrieved June 1, 2026, from https://www.aelp.com/Customer-Service/Rates-Billing/Current-Rates

[17] Rates as of May 2026; Kodiak Electric Association. (n.d). *Electric rates*. Retrieved May 5, 2026, from https://kodiakelectric.com/rates

[18] Rates as of May 2026; Find Energy. (n.d.) *Homer Electric Association rate & electric bills.* Retrieved May 5, 2026, from https://findenergy.com/providers/homer-electric-association/

[19] Rates as of May 2026; Cordova Electric Cooperative. (n.d.). *Rates and payment*. Retrieved May 5, 2026, from https://www.cordovaelectric.com/rates-payment/

Investment in drying capacity offers benefits and introduces risk

Alaska has made substantial investments in rapidly increasing capacity and innovating drying methods designed specifically for kelp. Drying kelp makes a substantial dent in one of the industry's greatest bottlenecks – the cost of shipping. Eight to ten times the amount of kelp can be packed into a container when dried compared to using wet stabilization methods – fermented, acid-stabilized, and potentially salted (a method Blue Dot Kitchen is developing). Previously, freezing was the favorite preservation method. On top of inefficient shipping and expensive cold storage, producers were met with a lack of buyers interested in frozen kelp.

While allowing for more efficient shipping, drying is itself a substantial cost – often growers' largest line item. As discussed in the previous section, power costs for drying vary greatly depending on location. Developing energy efficient and mobile drying capabilities could improve the economics of drying and be a boon to the industry, but some interviewees fear this solution is driven by the urgency to utilize AMC grant funds and short-term logistical advantages, rather than by true market indicators. Market research indicates that major buyers today want wet slurry or shredded, acid-stabilized kelp, and multiple experts interviewed expressed concern that dried kelp may fail to find large enough markets to sustain producers and not enough investment capital will remain available to substantially develop parallel capabilities.

Primary vs. secondary processing in Alaska: current efforts and possible future developments

Processing developments in Alaska are predominantly focused on primary steps such as shredding, blanching, drying, and acid stabilizing. Most of this primary processing currently occurs in facilities onshore – though some onboard solutions are in development (see *Alternative logistics for aggregation and supply chain efficiencies*). While some stakeholders hope to see subsequent processing and manufacturing steps happen in-state, most agreed that end-to-end, commercial scale manufacturing – including most secondary processing – close to the source is not viable. Biostimulant manufacturing was an exception, with multiple stakeholders invested in the vertical indicating they predict full production can and should occur in Alaska. This assessment may be reasonable for this application, given most liquid kelp extracts have relatively few steps and use simpler equipment than some other end uses.

Key existing kelp-dedicated stabilization and primary processing projects in Alaska are listed below (non-exhaustive):

- In Cordova, Blue Dot Kitchen and local farmers are working with the Prince William Sound Economic Development District to test salt brining stabilization and new bulk packaging methods at a recently closed Silver Bay Seafoods' processing facility.
- In Kodiak, the AMC recently awarded $2.3 million to the Sun'aq Tribe to build what's known as the Kelp Primary Processing Platform (KP3) under their seafood processing company, WildSource.[20] Kodiak farmers have been working with WildSource's existing, small facility to process kelp for several years. Expansion plans include capabilities to produce dried whole leaf kelp, chopped kelp, plant biostimulants, liquid kelp bioactive extracts, and dried kelp pulp residue. The project continues to seek funding, with building costs only partially funded according to an interviewee familiar with the initiative.
- Kachemak Kelp Innovation Hub in the Southeast region is innovating high-tunnel drying methods that use heat from the sun. The method's low energy demand only operates as intended in ideal weather conditions, presenting significant challenges in the current buying landscape where farmers do not have much choice over when they harvest.

These projects largely focus on stabilization and early processing steps. As previously discussed, most interviewees agreed that secondary steps will need to happen closer to markets and in areas with more manufacturing.

British Columbia

British Columbia (BC) is home to several active kelp farming companies, and many more cottage industry farms and inactive leases. According to GreenWave, BC has 441 permitted hectares – about 30% of Alaska's nearly 1,300 ha.[21] First Nations play a particularly active role in the area's seaweed cultivation, including with the territory's three largest producers. Cascadia Seaweed grows kelp at five sites for their agricultural biostimulant products in partnership with several coastal First Nations communities. Sea Forest also partners with local First Nations to cultivate and manufacture both food products and agricultural inputs with kelp from two sites. Naas Foods, an Ahousaht Nation member-owned kelp seasoning and seafood company, grows giant and bull kelp at a large site in Vancouver Island's Clayoquot Sound.

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[20] Alaska Business Magazine. (2025, September 12). *Kodiak tribe receives $2.3 million to boost kelp processing.* https://www.akbizmag.com/industry/manufacturing/kodiak-tribe-receives-2-3-million-to-boost-kelp-processing/

[21] GreenWave (2026).

Cultivation is clustered around southern Vancouver Island, with Cascadia more recently scaling production for biostimulants off the coast of Prince Rupert near the Alaskan border. Having outgrown their original processing space – a small shared facility owned by the Port Alberni Port Authority and created to help early stage food businesses distribute startup capital costs with shared assets – the company is relocating processing to two new locations. They plan to continue processing their Vancouver Island kelp at a larger facility on the island, which they are currently scouting. Most of their expansion plans revolve around development of their northern Prince Rupert hub. The company has invested heavily in a 100 hectare site and commercial scale processing facility in the area, which opened in May of 2026.[22]

Cascadia is also the leading regional buyer

In 2026, British Columbia's most prominent role as a regional seaweed industry player is as the primary destination for Alaskan kelp. While Cascadia doesn't source from other BC farms, their manufacturing has reached a higher throughput than their farms can service. Hoping to derisk their supply by diversifying feedstock sources, Cascadia began buying kelp in bulk from most producer regions of Alaska, including Kodiak, Cordova, and the Southeast region's Prince of Wales. Cascadia's expansion to Prince Rupert has some logistical advantages, being much closer to Southeastern Alaska's seaweed farms. However, the port city does not lie on any major commercial shipping routes. In anticipation of logistics challenges, Cascadia has begun pursuing alternative transportation solutions (see *Alternative logistics for aggregation and supply chain efficiencies*).

Most of Cascadia's biostimulant product is applied to fields in California and the American Midwest. The U.S. offers much larger markets and a significantly faster approval process than the agricultural market in BC. California approved the product for use in 90 days, where Canadian sales were only recently authorized several years after submitting for application.

Vancouver Island is another potential processing and innovation hub

The Pacific Seaweed Industry Association (PSIA), a member organization promoting and advocating for coast-to-coast collaboration and national development of Canada's seaweed industry, sees Vancouver Island as a future research, innovation, and value-added processing

[22] The Fish Site. (2022, October 17). *Cascadia lands $4.3 million for stepping up seaweed production and processing.* https://thefishsite.com/articles/cascadia-lands-4-3-million-for-stepping-up-seaweed-production-and-processing/

hub. As of 2018, the island was granted Foreign Trade Zone status. The designation offers duty deferrals and exemptions for re-exported goods, streamlined customs procedures, and other benefits to attract foreign investment and promote international trade activity. The nearby city of Vancouver hosts at least two firms innovating in seaweed residue-based industrial biomaterials (acoustic panels and insulation) without the need for a full-scale biorefinery facility. With two deep water ports, five airports, a skilled workforce, underutilized industrial infrastructure, a low provincial corporate tax rate, and central location within the Pacific Northwest's seaweed production landscape, Vancouver Island could help solve many of the industry's processing and product and market development challenges.[23]

The Canadian government's phased shut-down of open-net salmon farms has put the island's economy at a critical juncture. While the regional and local governments work towards new plans for industrial redevelopment and land use, PSIA hopes seaweed can help fill the gap left by salmon processors exiting the island. Processing capacity efforts in Washington should closely watch developments on Vancouver Island. Parallel efforts to develop overlapping capabilities could result in challenges for both locations if markets aren't developed enough to support two full-scale processing hubs in the Pacific Northwest.

Cross-border collaboration could provide opportunities to develop symbiotic, rather than competing, processing and manufacturing capabilities that together bolster the region's seaweed supply chain as end markets mature. Complementary subregional specialities have already started to emerge. British Columbia is home to biomaterial developers and a leading biostimulant manufacturer, while Washington players have focused more on food and cosmetic ingredients and products. Continuing product and market development along these lines could limit unnecessary competition across the region, streamline supply chains, and help grow the market for cultivated seaweed as a whole.

Co-packer identification and onboarding is uniquely challenging for kelp

Co-manufacturing or "co-packing" arrangements – a service agreement where an existing processing facility is contracted to provide one or more processing or manufacturing steps – are commonplace across agrifood business. Co-packing facilities that dry, ferment, chop, mill,

[23] Collins, B. & McCannel, J. (2019, February). *Business cases for foreign direct investment on Vancouver Island.* Vancouver Island Economic Alliance. https://ftzvi.com/wp-content/uploads/2019/11/Foreign-Direct-Investment-Report.pdf

refine, extract, extrude, mold, bottle, and package work with thousands of food and agricultural products across the West Coast. Seaweed, however, faces a variety of unique challenges in gaining a foothold with co-packers. Producers and product developers across the supply chain have stories of failed attempts to build these partnerships.

Allergens are perhaps the biggest hurdle. Small crustaceans live on kelp, and washing may not get rid of them completely, creating a shellfish allergy risk for seaweed destined for food markets. This creates a huge sanitation burden for any shared processing lines. Co-packers are, understandably, reluctant to take on such a labor- and time-intensive responsibility. For some, introducing shellfish to their facility at all is a non-starter due to their certifications and customers' requirements.

Sugar kelp is 90% water, and dryers and other equipment used in most processing settings are not designed to handle such high liquid content. In some cases, facilities would need wet drainage to work with a seaweed product. This feature is not a given in processing or manufacturing.

Large co-packers – who may be more capable of handling kelp's more challenging properties – are disincentivized from onboarding the product without a proven market offering significant returns. As one interviewee put it, kelp is "too small to get in with the big guys" and "too weird" for the smaller operators.

The author found diverging opinions about the possibility of utilizing existing seafood processing facilities (as opposed to agricultural processors) for kelp. Shellfish allergens may be less of a concern for seafood products, and many of these facilities sit undercapacity or empty, often relatively nearby to seaweed farms. While many see a match made in heaven, multiple experts cited incidences of failed, short-lived, or lackluster partnerships between seaweed producers and seafood processors. The industries may have some logistical synergies, but ultimately the products' processing needs are completely different – with some equating the concept to trying to process kale at a beef finishing facility. These arrangements would require new technologies, infrastructures, and skills, and most seafood processors are yet to consider this investment to be a worthwhile venture when existing seafood products offer a much higher margin. Where facilities are able to bring in kelp, incoming seafood will always take priority.

Most arrangements where Alaskan seaweed producers have used seafood facilities for processing have operated more like space rentals than co-packing agreements, with farmers expected to handle planning and labor for the seaweed side of the operation. Sun'aq Tribal Enterprises' WildSource is an exception, where the facility and its staff have developed meaningful expertise in kelp processing. Larger processors that could serve as more traditional co-packers generally are not willing to accommodate the level of collaborative problem solving and iteration required to evolve their lines and processes to work for kelp. They expect kelp growers to approach the partnership with a finished product specification, guaranteed markets, an organized system for quality assurance, as well as a clear understanding of their processing, packaging, and storage plan. Partnerships have stalled with most producers unable to meet this expectation – as they operate at small scales, with expertise concentrated on cultivation, and a lack of clarity into market demands.

Logistics channels between Alaska and the lower 48

Trade routes between Alaska and Washington are well-established. Massive quantities of seafood, coal, oil, and minerals originating in Alaska reach markets through the ports of Seattle and Tacoma. Essential freight travels in both directions, with 90% of Alaska's inbound food and other goods reaching the state via Washington.[24] Goods travel to and within Alaska by sea, air, road, and train. Sea freight is the most applicable mode of transit for the seaweed industry and the focus of this report. Relevant notes on the three other modes include the following:

- ***Road***: Goods can be transported through Canada to the lower 48 on Alaska's ALCAN highway. The region's extreme climate may pose significant disruptions for much of the year. Multiple seaweed cultivating regions, including Kodiak and Cordova, are only directly accessible by sea or air.
- ***Train:*** Freight train service in Alaska extends only from Seward north to Fairbanks, located in the middle of the state.
- ***Air:*** Alaska Airlines does provide frequent cargo service. Interviewees reported this mechanism can be cost-effective for small quantity shipments and possibly larger shipments of dried kelp. However, shelf-stable cargo shipped at lower rates is typically de-prioritized and delayed should a plane lack space for more urgent freight.

[24] Patriot Logistics. (2025, June 9). *Tariff crosswinds: How U.S. trade policy ripples through America's supply chain, and the unique impact on Alaska.*
https://transportalaska.net/blog/tariff-crosswinds-us-trade-policy-alaska

Additionally, common kelp stabilization agents, such as certain acids, can be classified as hazardous, making them difficult and potentially prohibited from plane transport.

Formal cargo lines connect Alaskan ports with Washington

Ambient-temperature stabilization techniques, such as citric acid stabilization, have opened up access to more affordable sea transportation opportunities, but many bottlenecks remain. Interstate sea freight is dominated by a handful of companies – Matson, Samson, and Lyden/Alaska Marine Lines (AML).[25]

The state's seaweed industry is largely reliant on tug and barge services Samson and AML. Both companies operate on a hub-and-spoke system, meaning all shipments land in Washington before they can be moved, separated, or consolidated. The tetris-like loading and stowage system of the vessels makes it impossible to selectively unload cargo at intermediate stops – enroute to Seattle, these services exclusively load. This means that goods traveling between Alaskan locations may stop through their ultimate destination as a port of call, but they will land in Seattle before unloading, reloading, and heading back to Alaska for delivery. Traveling great distances with long stops, cargo barges move slowly. See Tables 2 and 3 for estimated transit times to Seattle.

Table 2. Samson southbound Seattle service schedule for seaweed growing communities

Region	Service frequency	Location	Estimated transit time
Southeast	Weekly	Ketchikan	3 days
		Prince of Wales	5 days
		Juneau	7 days
Southcentral	Biweekly	Cordova	8 days
		Seward	9 days
		Anchorage	13 days
Southwest	Biweekly	Kodiak	14 days

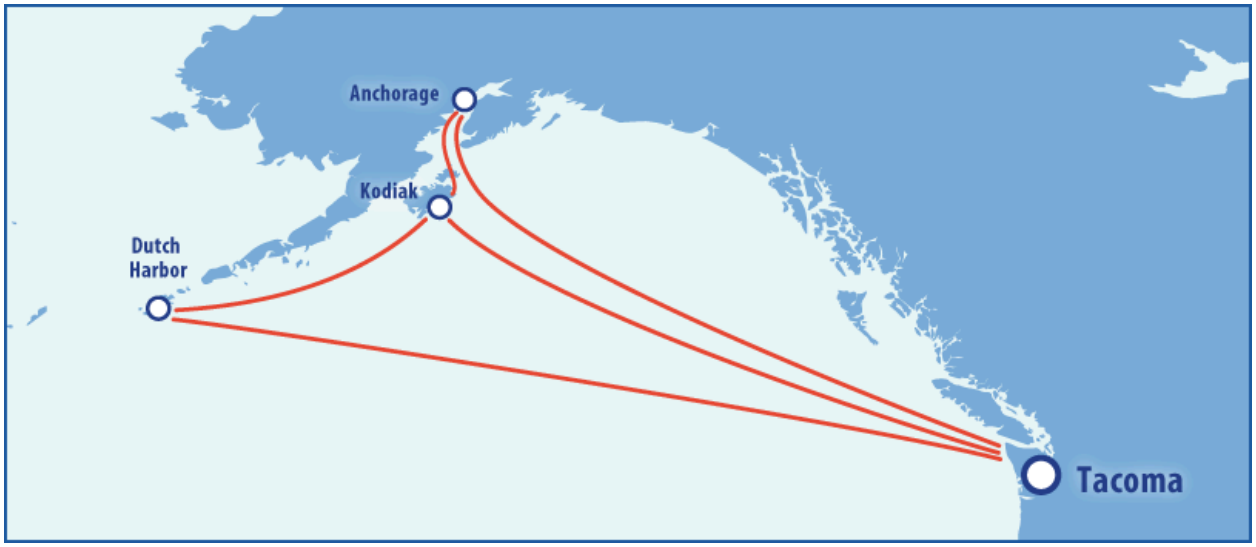
[25] Other sea freight companies such as TOTE and Coastal Transportation service the state, but they do not service seaweed growing hubs.

Table 3. AML southbound Seattle service schedule for seaweed growing communities

Region	Service frequency	Location	Estimated transit time
Southeast	Weekly, year-round	Ketchikan	5-7 days
		Prince of Wales	7 days
		Juneau	7-9 days
Southcentral	Weekly, year-round	Cordova	10-14 days
		Anchorage	10-14 days
Southwest	Irregular service, seasonal	Kodiak	14-21 days

Matson operates large, self-propelled container ships between Tacoma and deep water ports in western Alaska. Of the major seaweed hubs, only Kodiak has access to Matson routes, which offers twice weekly Tacoma service. The Kodiak Ocean Growers Cooperative reports they have used both Matson and tug and barge services to transport stabilized product to the mainland.

Figure 2. Matson container ship routes.



The Jones Act – a 1920 federal statute aimed at supporting the American maritime industry – has unintentionally given this handful of freight companies a stronghold over Alaskan

transportation.[26] The bill states that vessels traveling between U.S. ports must be built, owned, and operated by American citizens or permanent residents. Few vessels qualify and those that do are significantly more expensive to operate.[27] Along with high operating costs and remote Alaskan destinations, the resulting lack of competition has led to exorbitant and unpredictable transportation costs.

In December 2025, Samson quoted Cordova producers over $20,500 to ship four 40' containers with a total of 72 IBC totes holding 108,000 pounds of wet, stabilized kelp to Seattle – or $0.19 per pound. This cost does not account for transport from Seattle to Cascadia's facility or the cost to ship empty IBC containers to Cordova. Due to lower demand, northbound shipments tend to be more expensive. Sending 80 empty IBC totes in two[28] 40' containers cost over $14,850. While quotes from other destinations were not obtained, multiple interviewees reported transit costs are substantially higher for seaweed producing regions to the west. Between the Southeastern ports and Kodiak, shipping costs can more than double.

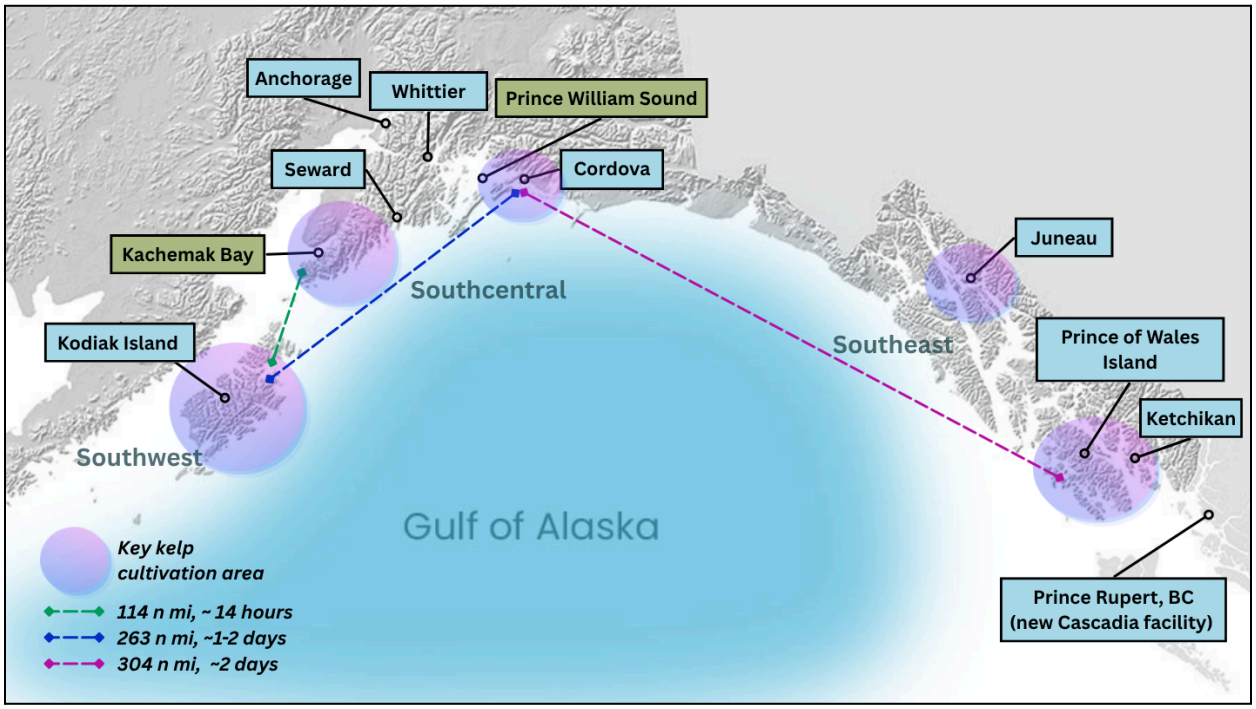
Alaska Marine Highway ferries connect coastal communities within Alaska

Combining kelp harvests across regions for shipment south may offer economies of scale, but the dispersed nature of Alaskan kelp farms and difficult transit conditions (rough seas, long distances, and regionally disconnected cargo services) make aggregation difficult. The Alaska Marine Highway – the state's system of ferries – offers frequent services within regions, but only runs *between* regions a small handful of times per year due to the high cost of operating vessels rated to cross the Gulf of Alaska. Thus, the ferry service does not offer many promising opportunities to collaborate between production hubs. It does, however, provide possibilities within the Southcentral and Southeast regions in particular, where seaweed growers are quite far apart. The ferry will transport unattended vehicles carrying supplies, but requires someone to pick up upon arrival. If smaller volumes from several sites within a region are stabilized locally, the ferry service could consolidate product in a barge or port community for shipment to BC or

[26] At the time of writing, the Jones Act is waived due to the war on Iran, but permanent repeal appears unlikely.
[27] Kenton, W. (2026, March 13). *Understanding the Jones Act: Key facts, history, and economic impact.* Investopedia. https://www.investopedia.com/terms/j/jonesact.asp
[28] A 40' container can accommodate stacked IBCs, but only when empty. Double-stacked IBCs when full (each holding 1500 pounds of wet stabilized seaweed) would exceed the barge services' per container weight limit. Shipping empty totes does not offer cost savings, as quotes are based on number of containers, not their weight.

Washington. The additional transit cost to consolidate harvests may or may not be economical depending on locations, volumes, processing costs, and market price.

Figure 3. Map of Alaska's southern coast showing approximate nautical mileage and sea travel time between kelp cultivation hotspots, illustrating the barriers to cross-hub aggregation – especially for the purpose of stabilization. Times were calculated based on typical fishing tender speed (8 knots) traveling on the most direct route without significant weather/sea condition delay, and are likely underestimated.



Current packaging methods create significant hurdles

With many current buyers seeking wet, ambient-temperature stabilized kelp, the industry has defaulted to using stackable, plastic, IBC totes – containers frequently used for chemicals and other bulk liquid transportation. Many biostimulant buyers prefer to receive products packaged this way. New composite IBCs are costly, adding up to $0.30 per pound to the cost of wet, stabilized kelp. Used totes come at a much lower cost, but can be difficult to find and intensive to clean – sometimes requiring specialized equipment and multiple passes. These large containers, which are about 1500 pounds when full, also require a forklift to move between vessels. This equipment is not readily accessible to all producers. While Cascadia has paid to purchase and transport the containers north, producers still take on the logistical burden of

locating and preparing IBCs for use, and the cost undoubtedly limits the price Cascadia can offer farmers for their product.

Figure 4. Stacked IBC tanks

The weight of an IBC tote also presents a challenge for container shipment efficiencies. While a standard 40’ container can vertically accommodate double-stacked IBCs, cargo service weight limits prohibit producers from shipping wet seaweed in this way. The result is a very inefficient use of cube space (see Figure 5). With freight companies charging by container, not by weight, this solution creates incredible shipping cost inefficiencies. Producers could explore using 20’ containers instead. Double-stacked, the smaller, cheaper-to-ship container could sit under the carrier weight limit while holding 20 IBCs, more than a 40-footer’s 18. A container loaded in this manner could cause issues when transferred to a truck, exceeding the weight limit for certain roadways and bridges. Depending on the destination, the container may need to be cross-docked and split across two trucks upon arrival at port. The author did not identify any efforts to employ this shipping configuration among seaweed producers in Alaska, though it is possible some have explored the option.

Figure 5. Loading configurations for various packaging solutions.

Packaging is driven largely by the product format and buyer. Alternatives to IBCs include food-grade steel or plastic drums, plastic-lined corrugated boxes, and, in certain cases, liquid cylinder trucks.[29] Interviews revealed a dissonance between buyers' and producers' perspectives on the challenges IBC totes present. Several producers emphasized issues with IBC totes at length and presented preferable alternatives. Their buyer, however, while acknowledging they may not be the ideal solution, was explicit that finding an alternative was a lower priority. The sector's current packaging method, while driven by the buyer, appears to place a greater burden on the producer.

Farmers have had to adjust packaging and transport procedures as new customers come into the picture. The range of forms of stabilized kelp can offer access to a diverse customer base, but it also presents a challenge for optimizing systems. Producers will need to work with

[29] Drums and lined boxes could also be used for kelp stabilized in other forms (e.g. dried).

processors, end-product manufacturers, and each other to consolidate packaging solutions efficiently while meeting market demand.

Alternative logistics for aggregation and supply chain efficiencies

Producers and buyers have begun exploring alternative transportation options in the hopes of finding new opportunities for aggregation and shipping efficiencies. The location of Cascadia's new facility in Prince Rupert, where freight carriers do not offer direct service, has in part driven this effort. There are three primary pathways for alternative transit.

Dedicated onboard processing and transport for kelp: Mothers of Millions

Cascadia and Alaskan farming groups have explored partnership with Mothers of Millions (MoM) – a company retrofitting fishing tenders for dedicated onboard kelp processing and transportation – to chop, stabilize, and pack IBCs with kelp from Cordova before transporting to BC. By consolidating several steps and minimizing handling, this solution could offer considerable savings on processing and shipping costs. However, this particular effort needs further development in collaboration with both farmers and customers. Several reports indicated that the current costs were unfeasible for both producers and buyers. Producers also cited the vessels are not able to come in close proximity to all kelp cultivation sites and load the product directly onto the processing vessel. Instead, farmers had to transport their harvest from smaller boats to the larger vessel, a significant time and labor burden.

Process iteration in close partnership with producers could overcome some of these hurdles. Not only could the MoM model minimize the need for onshore processing infrastructure across remote sites – a huge bottleneck for the sector – it also introduces the possibility of aggregating between regions. If well-developed, this model could offer incredible efficiencies. However, stakeholders are hesitant to invest in a capital-intensive, specialized system before markets are well-established and the processing and packaging capabilities they call for are clear. A system that depends on aggregation of harvests means different producers must have significant alignment on handling, processing, and harvest schedules. Stakeholders report that aggregation across regions is being explored, but is in its early stages.

Utilizing the fishing fleet: backhaul arrangements

North and southbound fishing vessel traffic between Alaska and Washington is substantial, with tenders often moving empty or undercapacity on at least one side of their season. Backhaul

cargo arrangements that take advantage of this empty space are commonplace in the fishing industry. Washington-based American Seafoods, for example, frequently ships fruit and other goods across the Pacific after delivering their catch to their destination. With fuel already covered and the leg of the journey where the vessel is empty or undercapacity considered an unavoidable sunk cost of fishing, this arrangement could offer substantial cost savings for seaweed farmers.

Several producers and associates interviewed discussed the possibility of partnering with the fishing fleet to move seaweed. These conversations appeared to be in very early stages. While utilizing this extra fishing vessel capacity to transport kelp is potentially advantageous, farmers are likely to encounter a few barriers. First, the commercial fishing industry can be opaque to outsiders, with backhaul agreements happening informally among a tight-knit circle. Some of Alaska's seaweed farmers come from fishing backgrounds and could potentially help mitigate this barrier. Scheduling presents another challenge. Fishing industry experts emphasized that these arrangements may not be bookable months in advance, and farmers may need a call sheet of 20+ vessels to find availability somewhat last minute. Relying on such an informal, uncertain transportation system would not be feasible for seaweed farmers or buyers. Finally, loading seaweed onto fishing vessels may not be logistically straightforward – regulations, cross-contamination concerns, and handling procedures could all present additional barriers. Successful utilization of the fishing fleet may require developing strong relationships and more formal agreements than fishing backhaul arrangements typically operate under.

Freight charters

Freight charter companies offer more route and scheduling flexibility than firms like Samson, AML, and Matson. With low-value, high-volume commodities, it is paramount to limit the number of times the product is transferred to avoid mounting shipping costs. Charters offer a potential solution for this issue, and may also support cross-regional aggregation, but hiring a vessel for a special route typically involves renting the entirety or at least a large portion of its cargo space. This arrangement would not become economically efficient until much larger volumes are achieved down the road.

Takeaways for Pacific Northwest seaweed value chain development

Interviews revealed a tension between how manufacturers and growers look at partnership, product, and market development – with manufacturers often working from the product

backwards and growers working from plant forward. Value chain development that works better for producers and sustains partnerships in the long term calls for a collaborative, two-pronged approach that considers the plant and product market simultaneously.

While time, additional strategic investment, and scale may resolve some of the economic dissonance between each end of the supply chain, there is no guarantee that value distribution will ultimately allow growers to thrive without overextending their time, energy, and/or physical capacities. Any sustainable and just effort to build processing capacity in Washington must design for long-term equitable distribution and consider how it can incorporate downstream and upstream actors' circumstances throughout the supply chain, product, and market development processes. With the right product and market development – paired with synergistic processing capabilities that serve these markets efficiently – Washington has the opportunity to derisk the value chain, diversify the buying landscape, and expand access to higher-value markets for growers across the region.

The author's analysis revealed several key factors limiting the value producers are able to obtain from farming kelp or otherwise challenging the sustainability of their business (e.g. requiring extra labor, limiting producers' decision-making power, etc.). An equitable value chain calls for processing developments to consider each challenge during their partner selection, process design, business modeling, and implementation. These issues featured in research for this project, but the following is not an exhaustive list of problems kelp farmers or the sector as a whole face.

1. **Underdeveloped seaweed product markets and limited sales opportunities exacerbate power concentration downstream with buyers**. Farmers have little control over price setting, primary processing steps, or packaging.
2. **There is a significant disparity in the price large buyers can offer and the price that would support thriving farming businesses.** The markets Alaskan seaweed in particular can access are currently for lower-value products like biostimulants.
3. **Farmers struggle to access timely processing.** Kelp's properties – including shellfish allergen risk and high water content – make it a poor fit for standard co-packing equipment and sanitation requirements, leaving most co-packers reluctant to take it on without proven market demand to justify retrofitting their lines. Where infrastructure has

been shared with other products, like seafood or fruit, those products take precedence and kelp growers have little control over the schedule.

4. **An unstable buying landscape results in frequently changing product specification requirements.** Farmers must repeatedly adapt to divergent processes to secure sales (e.g. changing stabilization techniques on back-to-back harvests, pursuing effortful packaging solutions that may not be applicable for future buyers). These circumstances make determining strategic investments in equipment, partnerships, and process development – as well as general business planning – very difficult.
5. **Unstable markets have also resulted in unexpected loss of sales affecting producing hubs differently**. Cascadia's recent decision to cut its anticipated purchase volume in half hit Cordova and Kodiak hardest, the regions farthest from their buyer, illustrating how distance from market access can translate directly into disproportionate risk. This kind of disruption may incentivize farmers to grow less kelp in future seasons, exacerbating the sector's production-market misalignment, where production hasn't expanded enough to drive market development and sluggish markets fail to drive increasing production.
6. **Vancouver Island's ambitions to become its own seaweed processing and R&D hub could put it in competition with Washington's efforts if regional markets remain too small to support two full-scale hubs**. However, emerging complementary subregional specialties – BC's focus on biomaterials and biostimulants, Washington's on food and cosmetic ingredients – suggest coordinated rather than competing development is possible.
7. **Prioritization gaps between buyers and producers put an outsized burden on growers**. For example, multiple growers emphasized challenges with procuring, cleaning, moving, and efficiently shipping IBC containers, with some expressing a hope to develop other solutions. Resulting logistical burdens have fallen heavily on farmers.
8. **Market and product development doesn't always consider producers' on-the-ground reality or consult farmers throughout the process, leading to cost and logistical issues.**
9. **Growers face consequential information asymmetry**. They are not always informed or consulted about shifts in their buyers' businesses that might impact them in a timely manner.
10. **Expensive shipping prevents market access by driving up costs, but small markets limit shipping efficiency possibilities.** Alternative logistics models – including

dedicated onboard processing vessels, backhaul arrangements with the fishing fleet, and freight charters – could improve costs and enable cross-regional aggregation, but each currently faces real barriers, from operational incompatibilities and informal scheduling to the minimum scale needed to make charters economical.

11. **Popular primary processing investments may not be informed by markets**. Dried kelp could face similar issues to frozen kelp that couldn't find buyers, and farmers will face the steepest consequences. Since capital to invest in primary processing is limited, capabilities will be narrowed and access to future emerging markets restricted, should initially chosen processing methods not meet customer needs.

Farmers face a real tradeoff: shoulder more of the supply chain themselves, or hand off control and risk losing the say that comes with it. Many producers are already saddled with more hands-on involvement in processing and product development than they want long-term. At the same time, stepping back from those tasks risks a loss of decision-making power that could ultimately work against farmers' interests. The business structures and tools outlined in the following section are aimed at resolving this tension – letting producers shed some of that burden without giving up the influence needed to protect their own interests.

VI. Ownership models and tools for equitable value distribution

Alaska-Washington relations in the maritime trade

Value distribution in the Alaska-Washington maritime trade can be a source of contention between stakeholders in the seafood supply chain and beyond. With a significant proportion of "value addition" happening after biomass leaves the state, some Alaskans feel Washington benefits unfairly from their natural resources. While out-of-state processing of seafood caught by Alaskan vessels plays a significant role, the sentiment is exacerbated by the hundreds of Washington-owned vessels that travel to Alaska to fish themselves. Value capture issues underpinned by a lack of processing capacity in the state extend to other industries. For example, Alaska ships millions of barrels of crude oil to refineries in Washington and California every year only to pay a premium for refined fuel sent back to the state. Despite a wealth of natural resources, Alaska's remote location, small resident workforce, limited manufacturing sector, and the dominance of multinational corporations contribute to significant economic value flowing out of the state.

In preparation for this project, there was concern within Maritime Blue and partners that the suggestion of Washington as a processing hub for another Alaskan resource would be met with pushback from farmers hoping to maintain control or ownership of the value chain. However, some industry experts in the state expressed surprise at the suggestion that seaweed farmers would be hesitant to send their stabilized product south for further transformation. While there was variation in which stages of the value chain interviewed producers were interested in maintaining responsibility for, the author's general finding was that a majority of growers interviewed would happily offload parts of it, as long as Washington offers stable markets and adds shared value. Consulted experts working with growers across the state suggested this sentiment is shared relatively widely. The fundamental concern about supply chain structures appears less about total ownership or control, and more about fair distribution of profit and the maximization of biomass value with strategic multivalorization processes and product development.

Aligning the seaweed supply chain with the Pacific Northwest region's established flow of goods can return capacity to overextended seaweed producers and offer efficiencies across the supply chain. However, as noted in the previous section, such a shift may put growers in a tenuous position if they are not included as true partners in the value chain's design. Collaborative planning that considers alternative business ownership and value sharing structures is imperative to avoid reproducing patterns of unjust value capture across statelines. The remainder of this report outlines a selection of models and tools a Washington secondary processing facility may employ to produce a fairer system of value distribution for the region's seaweed industry.

Interstate processing in Washington

A collaboratively designed interstate secondary processing entity in Washington state must address a variety of needs for both Alaskan and Washington producers. Alaskan producers would send locally stabilized kelp packed in bulk, and given most producers' smaller scale, harvests from multiple farms would be aggregated before making their way south. The facility would further transform the product to deliver to customers – potentially in its final form, or for further manufacturing.

If the facility intends to serve local Washington producers' needs holistically, it would also need *primary* processing and stabilization capabilities. It may also consider its location in proximity to Lummi Island SeaGreens in evaluating the ease and feasibility of stabilizing their product. Regardless of ownership structure, it must have enough flexibility in its business model and operational design to allow for LISG to process their kelp independently of other sources, given the team's desire to maintain their ability to employ place-based marketing.

Capital costs and operational efficiency needs will require that kelp arrives according to few specifications – particularly in regards to stabilization technique and bulk packaging – regardless of its source. Market research and development are absolutely critical to getting this right and avoiding unnecessary, effortful changes to processes at source. However, if many farmers from across the PNW region use the facility, finding alignment may be challenging. Early cross-collaboration as well as careful selection of secondary processing capabilities to serve a variety of customers' needs are both critical for providing stable value to Alaska's and Washington's farmers in the long term.

Cooperative ownership models for regional processing

For seaweed farmers across states, their operations and market access have been limited by the scheduling and capacity restrictions of shared-use processing facilities they have entered co-packing or facility rental arrangements with. Lack of control over processing infrastructure creates delays and restricts producers in countless sectors. Processing cooperatives – producer-owned, democratically controlled organizations that add value to their members' products through collective ownership of processing and/or manufacturing – have improved services, market access, and incomes for farmers in many industries.

For example, until last year, a lack of processing capacity in Tennessee forced many cattle farmers to make a difficult choice: wait up to a year for processing at externally-owned, local slaughterhouses, or forgo revenue by selling into lower-value commodity markets. Aiming to improve circumstances for smaller-scale producers, community leaders started the Appalachian Producers Cooperative and opened a new, farmer-owned slaughterhouse. In a matter of months, the region's processing capacity was doubled and processing timelines slashed to 2-4 weeks.[30] While the two sectors are not entirely parallel, seaweed farmers face similar challenges

[30] Wood, I. (2025, November 17). *This farmer-owned meat processing co-op in Tennessee changes the game.* Civil Eats.

that may be addressed through cooperative ownership of secondary processing infrastructure in Washington.

Collaborations in development may support a cooperative ownership model

Attitudes and recent developments towards collaboration may offer a foundation for interstate cooperative ownership of a secondary processing facility.

In Washington, where there's only one established farm pursuing commercial kelp production, there are few opportunities for formal producer partnerships locally. However, stakeholders understand that the industry's struggle to cohesively develop and access markets calls for collaboration. They expressed clear interest in working with parties in and outside the state. For some, interstate partnerships have already formed.

Recognizing the complexity of navigating the seaweed market and supply chain alone, a precedent of collaboration is growing in Alaska. In Kodiak, five farms have organized to form the state's first formal seaweed producer cooperative.[31] The Kodiak Ocean Growers Co-op aggregates their harvests to access primary processing, stabilization, and shipping at a lower cost, pools resources to develop and market kelp as an ingredient for various end-use markets, and negotiates with buyers acquiring stabilized kelp for further processing. This effort has offered advantages for farmers by easing administrative, business development, and logistical burdens on individual producers. It has also simplified purchasing for buyers by consolidating contracts and transportation.

In Cordova, three farmers recently started aggregating their harvest and sharing sales opportunities. Smaller sales were split equally among the three farms, with a larger Cascadia order divided by production capacity (Noble Ocean Farms currently has significantly more production capacity than its neighbors). While their collaboration assists in securing and fulfilling sales orders, the group does not currently see a reason to form a cooperative. Formalization may become more advantageous for gaining collective bargaining power as markets mature.

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https://civileats.com/2025/11/17/this-farmer-owned-meat-processing-co-op-in-tennessee-changes-the-game/

[31] Hovey, D. (2026, March 24). *Kodiak kelp farmers form a co-op, plan to sell a million pounds.* KMXT. https://www.kmxt.org/news/2026-03-24/kodiak-kelp-farmers-form-a-co-op-plan-to-sell-a-million-pounds

In Kachemak, collaboration serves a vital function, but operates quite differently than other regions. The Kachemak Kelp Innovation Hub is both a sector development initiative and serves as the sole purchaser of raw kelp from the area's three farms, which it then goes on to process and sell as stabilized kelp for manufacturers and finished consumer goods for local markets. As the hub transitions from a grant-supported, informal collaborative to a more formal business operation, leaders are exploring a variety of legal structures to support farmers' continued coordination.

While many stakeholders see collaboration as a necessity to solve many of the roadblocks discussed in this report, difficulties in initiatives that have formed may suggest that finding alignment among a larger, interstate group could be quite challenging.

For the Kodiak Ocean Growers, establishing the cooperative was not easy. Planning and negotiation between just a small group of producers took five years, and some familiar with the process have reported there are challenges with the cooperative's operation. Interviewees report operating cooperatives can be particularly difficult in Alaska in general, where a strong culture of independence can add complexity to efforts requiring cohesion and collaborative participation. Still, other industries have proven it's possible to use the model to benefit producers. Seafood cooperatives are commonplace in the state. Organizations like the Seafood Producers Cooperative, Alaska Seafood Cooperative, and the Alaska Longline Fishermen's Association have successfully organized individual producers to share costs, pool bargaining power, streamline access to processing, and free up fishers' capacity, while improving overall fishery management and sustainable fishing practices.

In Washington, a shift of plans for Blue Dot's business model made exploring forming a cooperative among local producers inapplicable to the state for now. However, this does not preclude the formation of a secondary processing cooperative in partnership with Alaskan stakeholders.

Designing a secondary processing cooperative for interstate kelp farmers

While immense structural variation exists among cooperatives, at the core, a cooperative is owned and controlled by its users, with benefits distributed proportionally and profits returned to members. Their primary purpose is to serve an unmet community need, as opposed to focusing on profit generation for shareholders. Cooperatives allow small producers to pool resources for

otherwise inaccessible equipment for processing, distribute risk, and more easily gain market access.[32] If designed and implemented well, they also allow farmers to distribute responsibility while maintaining ownership of a larger segment of the value chain – potentially crucial for addressing core equity issues in the kelp sector. Small producers are often forced to cede revenue to downstream actors "adding value" to cultivated products via processing and manufacturing. Instead, a cooperative model places ownership of value addition processes in the hands of farmers, allowing them to derive more value from their products.

A regional kelp processing cooperative would offer members benefits beyond economies of scale, improved income through the shortening of the supply chain, and the ability to compete with larger producers. It also gives producers the ability to participate in governance and management decisions in processing and product and market development, without taking on the entire burden of these efforts – a challenge multiple stakeholders cited. The facility's design would, however, require care to address disadvantages Alaskan producers might face from being more geographically distant from the facility.

Governance

Cooperatives traditionally operate under a "one share, one vote" system, with members having equal say regardless of capital investment.[33] However, alternate governance structures exist. In many dairy cooperatives, voting rights are based on supplied milk volume.[34] While introducing such a hierarchy may create challenging dynamics around fairness and power, it may be appropriate in situations where producers with vastly different production capacities form a processing cooperative. For seaweed, such a structure could create a problematic power imbalance where farms have different levels of access to capital – one Alaskan farm, for example, is backed by Trident Seafoods. Democratic, equal voting rights are considered a foundational principle of cooperatives that distinguishes them from traditional corporations. It acts as a mechanism for redistributing power to the smallest producers and maintaining the

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[32] Munch, D. (2024, June 24). *The crucial role of farmer cooperatives and why active participation matters*. American Farm Bureau Federation. https://www.fb.org/market-intel/the-crucial-role-of-farmer-cooperatives-and-why-active-participation-matters

[33] Bigus, J., & Grahn, A. (2025, December 9). Cooperatives' 'one-shareholder-one-vote' principle and financial reporting quality. *Accounting and Business Research*, 1–39. https://doi.org/10.1080/00014788.2025.2579304

[34] Munch, D. (2024, June 24). *The crucial role of farmer cooperatives and why active participation matters.* American Farm Bureau Federation. https://www.fb.org/market-intel/the-crucial-role-of-farmer-cooperatives-and-why-active-participation-matters

organization's core purpose to serve members' needs. The best structure ultimately depends on the membership makeup. Washington, like many states, offers significant flexibility for cooperatives' ability to create their own governance structures and members may design their voting distribution and decision-making processes as best suits their needs.

Democratic governance can, however, create administration and relational burdens for members. Without carefully designed processes and appropriate administrative support, cooperative governance can create significant inefficiencies. Drawn out decisions, meeting overload, decision fatigue, and leadership development without creating excessive concentration of power are all significant challenges, and outcomes are highly dependent on individual relationships.[35] However, structural nuances can help to mitigate conflict and avoid overextending producers' capacity. Lessons from worker cooperative frameworks may be informative. Those with flat governance, where members are assigned to functional rather than hierarchical roles, tend to operate more smoothly.[36] Such a model can allow for informal leadership that emerges naturally, while maintaining equality, distributing responsibility, and allowing producers to focus on parts of the supply chain they're particularly interested or skilled in while offloading the rest. With the region's seaweed producers already having developed a range of skills through heavy involvement in processing and many expressing different levels of interest in downstream activities, members may more easily establish a niche.

Coordination, communication, and equal involvement may be particularly challenging for a cooperative facility located far from what would likely be the majority of its members. There are several governance and operational procedures that may help Alaskan members maintain influence and connectivity to the Washington facility. Holding key votes via reliable remote and asynchronous methods – recorded video, in addition to extended, asynchronous voting windows would help prevent travel, timezones, and schedule from being barriers to participation. Rotating some annual meetings to Alaska, even if logistically harder, may prevent the facility location from becoming the default power center. Finally, a regular written newsletter or operations report sent to members may help distant producers stay informed and connected.

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[35] Yalla Cooperative. (2025, March 5). *How to scale a worker cooperative: Challenges and solutions.* https://www.yallacooperative.com/resources/how-to-scale-a-worker-cooperative-challenges-and-solutions
[36] Network for Business Sustainability. (2022, March 6). *Management models that help reduce conflict in cooperatives.* Medium. https://bthechange.com/management-models-that-help-reduce-conflict-in-cooperatives-5d6c2680595

Surplus (profit) dividends

Profit distribution plans may be predetermined in bylaws or left up to a board vote, when the ratio of surplus income to be reinvested, retained in reserve, or distributed to members is decided each year. The nascency of the rapidly changing seaweed market may require the flexibility of the latter structure. Profits may be distributed to members evenly, split based on size of investment, or divided based on a patronage system, where members receive surplus proportional to their use of the cooperative's service(s) or volume of product supplied.[37] Under patronage – the standard profit sharing system for cooperatives – Alaskan producers would need to have mechanisms in place to fairly and accurately measure volumes from each producer before any aggregation for such an arrangement to work. Like with governance rules, cooperatives in Washington are allowed flexibility in determining how to manage distribution of surplus revenue. The facility's profit distribution system would be critical in ensuring value flows back to Alaska, while Washington derives the added benefit of job creation.

Membership

Centralized, federated, and mixed cooperatives

The appropriate type of cooperative depends on who ultimately partners, and how those producers are organized amongst themselves. In a centralized cooperative, individual farms are member-owners. Given most kelp farms in the region are not organized as local farming cooperatives, this structure may be appropriate to start as the sector develops further. It may not be possible to maintain a centralized system in a situation where only select members of a pre-existing cooperative like the Kodiak Ocean Growers were interested in joining a secondary processing cooperative in Washington, given they aggregate harvests and collaborate on sales. Even without local cooperatives, it would be advantageous for membership to include geographically clustered farms, especially those already working together on primary processing or logistics.

Many large, cooperative-based industries operate under a federated system, or a cooperative where members themselves are cooperatives. This structure is a long-standing solution for bureaucratic and governance complexities that arise in large organizations and/or where members are geographically disparate. Dairy industries across the world have had success

[37] Munch (2024).

adding and retaining value for producers under this model.[38] This structure isn't limited to dairy: in Nebraska, a regional cooperative called Ag Processing Inc. (AGP) recently opened a new soybean facility owned and controlled by 150 local cooperatives in several states across the Midwest.[39]

A similar structure could work for seaweed. Multiple stakeholders pointed to a federated model as a possibility for the supply chain, though this level of complexity will likely only be appropriate with further scale. In such a scenario, local cooperatives would form in seaweed hubs across Alaska, Washington (if more farms were established), and even BC to handle aggregation, stabilization, and primary processing. These local cooperatives would own and control the regional secondary processing facility they send their stabilized product to.

In federated cooperatives, instead of each farmer occupying a seat on the board, each cooperative elects a representative. This may be required even for a smaller scale federated organization (as would be the case for a regional secondary processing facility in Washington using this structure) in order to streamline decision making processes and reduce conflict, while preserving individual members' capacities. Such a model would allow kelp farmers to offload bureaucratic responsibilities outside their interests or capacities. Often the individual representing each local hub rotates. Rotational representation ensures a larger number of individuals are empowered to influence operations and bylaws, but the ability to opt out is likely to be important for seaweed farmers seeking to focus their labor on cultivation and/or primary processing.

Organizations may also blend these two models, forming a mixed cooperative where some members are individual producers and some are cooperatives – Sunkist is a well-known example. For the seaweed sector, a blended structure may be appropriate given a local cooperative is unlikely in Washington's foreseeable future, while they have begun emerging in Alaska. Mixed models must consider how to structure representation fairly, given a "one member, one vote" system would give disproportionate power to individual farms – in this case, likely favoring Washington farmers. Proportional representation offers an imperfect solution,

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[38] USDA Rural Development. (2005, September). *Cooperatives in the dairy industry* (Cooperative Information Report 1 Section 16). United States Department of Agriculture. https://www.rd.usda.gov/files/cir1-16.pdf

[39] Vanderford, J. (2025, October 17). *Cooperative month: How one regional coop is making a big impact.* 1011 Now KOLN KGIN.. https://www.1011now.com/2025/10/17/cooperative-month-how-one-regional-coop-is-making-big-impact/

introducing the risk that individual members could be permanently outvoted and potentially giving Alaskan members a lasting advantage. Some organizations have found a middle ground by capping weighted voting at a maximum. Artisans Cooperative, an online marketplace cooperatively owned by artisans and staff, designed a vote weighting system that ensures the larger of their two member groups (artisans) can be outvoted, while still giving them extra weight in some decision categories.[40] Similar policies could apply to a seaweed facility, grouping members either by individual/cooperative or by region. The relevance of creative vote weighting is highly dependent on the number of and makeup of members.

Non-producer investor members

Cooperatives are not designed around shareholder profit maximization and, therefore, often struggle to raise capital from traditional investors. This could be particularly challenging for seaweed processing, given the high cost of equipment and evolving seaweed product markets potentially calling for new capital investments. A 2019 state law opened the door to an alternate cooperative model that can more easily attract investors. Washington created a new business structure, Limited Cooperative Association (LCA), that opens cooperative membership to non-patron investors. To maintain the spirit and purpose of cooperative organizations, investor-members' voting rights can be significantly limited in organizational bylaws, and the law requires patron-members to retain a minimum share of 51%.[41] Still, LCAs may attract less capital than traditional businesses, and the primary structural mechanism to counteract this issue is to increase investor power at the expense of patrons.

Canadian participation

Laws do not impose any residential or citizenship requirements for cooperative membership in Washington, so British Columbian kelp producers are not precluded from participating. While the majority of BC kelp is currently going towards Cascadia's biostimulant products, existing and new producers may benefit from membership in a Washington cooperative if seeking access to additional markets.

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[40] *Our bylaws & board*. (2023, May 20). Artisans Cooperative. https://blog.artisans.coop/blog/our-bylaws-board/

[41] Droke, M. (2019, July 8). *Washington State's Limited Cooperative Association statute*. JD Supra. https://www.jdsupra.com/legalnews/washington-state-s-limited-cooperative-38864/

Operating procedures for an equitable interstate cooperative model

Diverging product market priorities

Many cooperatives sell products under an umbrella brand – a model used by cranberry farmers across the U.S. and Canada manufacturing and selling products as Ocean Spray.[42] Such a structure aligns with existing processes of many Alaskan farmers aggregating their harvests with neighbors for commodity markets. However, the facility's design must accommodate both combining harvests as well as separate processing and brand differentiation from the outset. Lacking this option may be a nonstarter for potential Washington members like Lummi Island SeaGreens, who rely on place-based marketing in targeting higher-value end product markets and would require the ability to maintain that distinction. With this hybrid approach, farmers invest in and run the facility collectively, but may combine harvests for shared product lines or process them separately depending on their goals, with lines running a range of volumes for different members or groups of members. Given the high cost of equipment, members will need some convergence on the range of products the facility supports, even while preserving the technical and contractual option for brand separation from day one to avoid locking out members whose business models depend on it. Further market and product development is paramount to determine how different producers' interests may align in a way that supports an array of members.

Unequal access to buyer and vendor relationships

Similar to the coordination and equal involvement challenges discussed in the *Governance* section above, the facility's distance from Alaskan members may give Washington members an advantage in building rapport with vendors and visiting buyers, possibly translating to preferential treatment. This would primarily be concerning if the organization takes over any sales and marketing functions from individual members. One possible solution is hiring a staffperson specifically responsible for representing Alaskan members interests, relay relationships and market intel to Alaska-based members, and ensure Alaska-grown kelp gets fair representation in marketing and sales conversations. Branding products by region may also help Alaska producers retain visible identity with buyers. Premium pricing tied to provenance may provide an opportunity to build in price differentials based on species type or regionally-differentiated qualities to help Alaskan kelp decouple deriving value from local buyer

[42] Ocean Spray. (2025). *2024 corporate sustainability report.* Retrieved May 8, 2026, from *https://www.oceanspray.com/sustainability-report-page*

rapport. This possibility, however, is highly dependent on target markets and whether compelling and genuine differentiation can be developed. A pooled system where feedstock is aggregated and a uniform price is set may circumvent this issue, but this homogeneous model may not be workable for members seeking to keep their product separate. Finally, members could write sales, contracts, and/or pricing transparency requirements into the organization's bylaws, making any disparities visible to and addressable by the entire membership.

Capacity bottlenecks during peak harvest season

With harvest season in the region spanning roughly 8-12 weeks, a secondary facility risks scheduling bottlenecks as multiple members' stabilized harvests arrive in a compressed window. Producing products that use ambient-temperature stabilized kelp (e.g. dried, ensiled) eases much of this pressure, since feedstock can wait for processing without spoiling. Bottlenecks remain a risk, however, if members or member groups have competing buyer deadlines during the same period. Modular or expandable processing lines, along with a transparent, rotating intake priority system – rather than a default favoring whichever members are geographically closest – can help the facility manage demand fairly as volume scales.

Models outside cooperative governance

A critical mass of interested, similarly positioned growers may not exist to support a cooperative, or producers may simply prefer the ability to access a shared facility without committing to the administrative and relational demands of cooperative governance.

Collective producer ownership without cooperative governance

Under the right circumstances, producer-owners may derive some of the benefits of a cooperative arrangement without the added complexity. Individual producers and processors, regardless of location, could collectively invest in shared secondary processing in Washington without forming a cooperative, instead holding direct equity in an LLC or corporation. Profit flows to members or shareholders in proportion to ownership stake rather than patronage volume. Management structures differ between entity types: an LLC can give owners complete control, while a corporation's required board dilutes it, even among owner-directors. Such a facility could be owned exclusively by individual producers, or in partnership with external, non-grower investors. This arrangement offers producer-ownership and higher value capture for upstream

actors, while allowing more flexibility for farmers to opt-in or out, a concern shared by several interviewees.

However, this model presents some equity concerns. Neither entity carries a legal obligation to treat non-owner users equitably. Instead, a producer who sells to or co-packs through the facility without holding equity has no governance standing, protected only by the terms negotiated in their individual contract. The model gives advantages to those who want and are able to opt-in at the start, but value distribution among producers who use the facility without ownership is not guaranteed.

Non-producer ownership

An entity or individual interested in investing in Washington processing could own and run a facility independent of producer ownership or control, serving as an outright buyer or co-packer. This would provide an option for farmers who want less involvement in post-harvest operations. In Washington, a handful of potential buyers already exist to support this model. Blue Dot Kitchen, whose affiliate company focuses on seaweed research rather than production, is seeking a facility for its foodservice products and is already developing cross-state producer-processor relationships. Bounty of the Salish Sea, an affiliate of producer Lummi Island SeaGreens, expressed openness to purchasing and processing Alaskan seaweed to supply their own product lines, should market demand allow. Bounty represents a related but distinct pattern: rather than an outside buyer, here a single producer's affiliate occupies the buyer's seat for other, unaffiliated growers, who would hold no stake in the secondary processing facility despite transacting with a producer-owned company. Such existing or potential buyers are illustrative of the model, not an exhaustive list – any outside investor willing to build equity considerations into the facility's design from the outset could fill this role.

Atlantic Sea Farm's (ASF) guaranteed offtake model, despite the company's recent restructuring, offers a useful template for instilling equity in non-cooperatively-owned businesses. ASF agreed to contracts ahead of the growing season, at a preset price for the full harvest, solving one of seaweed farmers' greatest challenges – taking on the cost and labor of cultivation while facing high uncertainty in securing a buyer. Reviving elements of ASF’s approach requires a buyer with a financially sustainable business model that balances sales volume with per-unit value – one that could offer growers premium pricing and stable offtake.

The non-producer ownership model offers farmers the least administrative burden of any structure discussed, but also the least built-in protection. With no governance standing or ownership stake, equity for sellers depends entirely on the strength of values-based partnership development, contract terms, and pricing structures negotiated directly with the buyer. The following section outlines tools to consider in building those protections for models outside cooperative governance.

Strengthening equity without cooperative governance

Social Purpose Corporation

A Washington processor structured as a corporation, rather than an LLC, may consider incorporating as a Social Purpose Corporation (SPC) to support a sustainable seaweed value chain.[43] This legal structure builds in protections for values-based companies, allowing them to operate in pursuit of social good without risking legal action by current or future shareholders should decisions fail to maximize profit.[44] The designation requires a company to consider the impact of business decisions on not just shareholders, but also on employees, customers, suppliers, the environment, and the surrounding community. While enforceable accountability is lacking and this kind of corporate structure is uncommon in manufacturing, baking in social purpose from incorporation can set a precedent of values-aligned business practices, partnership arrangements, and operating procedures for the long term. This structure has natural alignment with the seaweed industry as a whole, with many producers and seaweed product innovators pursuing the sector in part for its climate benefit, local ecosystem restoration, and other sustainability potentials.

Revenue-sharing contracts

Revenue-sharing arrangements offer another mechanism for redistributing value across the supply chain without requiring shared ownership. Rather than charging a buyer the full per-unit rate, the seller accepts a lower upfront price and instead receives an agreed share of the buyer's downstream sales revenue to recover the gap.[45] A 2022 case study of a revenue-sharing contract between a Chinese supermarket and a farmer cooperative found the

[43] Social Purpose Corporations are more commonly known as Benefit Corporations. SPCs are specific to Washington.
[44] Washington Commercial Registered Agent. (n.d.). *Washington social purpose corporation.* Retrieved on May 8, 2026, from https://www.washingtonregisteredagent.com/washington-social-purpose-corporation/
[45] Van der Rhee, B., Schmidt, G., van der Veen, J. A. A., & Venugopal, V. (2014). Revenue-sharing contracts across an extended supply chain. *Business Horizons*, *57*(4), 473–482. https://doi.org/10.1016/j.bushor.2014.03.008

arrangement kept the supply chain stable in the long term, with both sides earning more than they would have under a conventional wholesale deal.[46] Applied to seaweed, a similar structure could tie a portion of farmers' payment to the eventual sale price of finished products, giving growers some exposure to the upside their kelp ultimately creates, rather than bearing all downside risk from a flat, pre-negotiated rate. A guaranteed minimum price floor could be layered beneath this structure, protecting farmers from the kind of below-cost pricing some Alaskan growers have already experienced, while still preserving their share of any upside above that floor.

Long-term supply agreements with price adjustments

Multi-year or rolling supply agreements offer growers planning stability beyond a single season, often pairing an ongoing volume commitment with a price that adjusts at set points based on agreed conditions – such as inflation, input costs, or a market benchmark – rather than locking in one flat rate for the full term. WWF's Markets Institute has documented this approach in banana sourcing, where a large buyer splits its purchasing between long-term and spot market channels, locking in roughly two-thirds of its needs through multi-year contracts while sourcing the rest as needed.[47] This gives growers the security to plan production and input costs around a guaranteed buyer while preserving flexibility for both parties. This kind of structure is most workable once a market has matured enough for buyers to reliably forecast demand years out. Given how early-stage and volatile seaweed markets remain, a Washington buyer's willingness to offer true multi-year terms may depend on further market development. In the near term, even a partial, portfolio-style commitment modeled on this approach could offer growers more stability than season-to-season spot pricing alone.

Packaging and logistics cost-sharing

Buyers can also share or subsidize the cost of packaging and logistics that otherwise fall on growers by default. Some buyers already cover the cost of packaging and its transport as part of their purchasing terms. A Washington secondary processor could adopt this practice from the outset, helping ensure Alaskan growers – who face substantially higher packaging and shipping

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[46] Liang, P., Sima, M., Huang, Y., & Sun, X. (2021). Assessing the coordinated revenue-sharing contract of China's farmer-supermarket direct-purchase model. *International Food and Agribusiness Management Review*, *25*(2). https://doi.org/10.22434/IFAMR2020.0196

[47] Clay, J. (2018, December 10). *How long-term contracts can help drive more sustainable agriculture*. Medium; The Markets Institute at WWF. https://medium.com/the-markets-institute/long-term-contracts-c0ccc09dbbc9

burdens than producers located near the facility – aren't disadvantaged simply due to their distance from Washington.

The tools outlined in this section are not an exhaustive solution to every equity issue raised in this report, nor are they mutually exclusive. A Washington facility could draw on several at once, layering them onto whichever ownership structure it ultimately adopts. Other mechanisms deserve consideration as the sector matures, including advance-notice provisions that keep growers informed of material changes to a buyer's business, and structured opportunities for producer input earlier in product and market development decisions, not just in facility governance. Continued attention to the region's specific market and logistical constraints will likely surface additional tools worth exploring.

VII. Conclusion

A future Washington seaweed hub may consider countless processes and partnership models to build fair value for stakeholders across the seaweed supply chain, but none of them succeed on their own. What determines whether any of them deliver equity is whether producers are treated as partners in the supply chain, or simply as suppliers of raw material to be managed. Across the industry, the same pattern recurs: producers bear the bulk of the cost, labor, and risk of cultivation and stabilization, while having the least control over pricing, scheduling, and the terms buyers ultimately set. Underdeveloped markets, unstable demand, and a lack of processing capacity compound this imbalance, leaving growers to absorb shifting specifications, sudden order cuts, and logistical burdens that downstream actors are better positioned to manage.

The ownership models and tools outlined offer a range of ways to put real partnership into practice, whether through cooperative governance that gives producers a direct stake in the facility, contractual mechanisms like revenue-sharing and multi-year agreements that redistribute risk without requiring shared ownership, or simpler measures like cost-sharing and transparency requirements that any buyer could adopt. No single solution resolves every issue identified in this report, and the right combination will depend on how many producers are willing to formally organize, how mature regional markets become, and how much capital a facility can attract. What unites all of them is a basic commitment: producers should have a genuine voice in decisions that affect their livelihoods.

That commitment should also guide the markets a Washington facility chooses to serve. Higher-value markets create more room to offer producers fair terms than commodity markets like biostimulants, where margins are thin, growers have little leverage, and British Columbia already dominates. Washington's existing players are more oriented toward food rather than industrial applications, and the state's consumer base offers real alignment with that focus: a large, sustainability-minded population primed for plant-based and ocean-derived ingredients, deep cultural ties to seafood and maritime identity in the Pacific Northwest, and a significant Asian American population with longstanding culinary familiarity with seaweed as a food. Realizing this potential, however, still depends on the kind of product and market development this report has identified as a persistent gap across the supply chain. Leaning into these existing strengths, rather than competing for the same markets Alaska and British Columbia growers currently depend on, could give a Washington facility a market position that can actually sustain fairer terms for the producers supplying it – not just the intention to offer them.

The processors most likely to get this right are the ones who understand their own success depends on producers being able to keep farming seaweed for years to come, even if that means slower returns. By treating producers as partners, and working collaboratively to develop products that take both upstream needs and market realities into account simultaneously, processors can help make scalable, regenerative seaweed cultivation possible in North America.