

Planning for Sustainable Seaweed Aquaculture on the East Coast of Central Vancouver Island

by

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Ethics Statement

The author, whose name appears on the title page of this work, has obtained, for the research described in this work, either:

- a) human research ethics approval from the Vancouver Island University Research Ethics Board; or
- b) Advance approval of the animal care protocol from the Vancouver Island University Animal Care Committee; or
- c) Has conducted this research as a co-investigator, collaborator, or research assistant in a research project approved in advance of the author's involvement.

A copy of the application has been filed with the Research Ethics Board at Vancouver Island University and inquiries may be directed to that authority.

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Abstract

Vancouver Island's food system has low resiliency, which means that it cannot quickly adapt to external shocks and stresses. The result of this low resiliency is that the communities on the Island are left vulnerable to food shortages in times of crisis. Increasing the amount of food produced by Vancouver Island communities can help improve the food system resiliency. One crop which would be beneficial for communities to produce is seaweed, and Vancouver Island has been identified as the ideal place for BC to establish a thriving seaweed aquaculture industry. Worldwide studies indicate that introducing seaweed aquaculture to a community can provide numerous economic, environmental, and food security benefits. Planners can support the growth of this new industry by developing zoning bylaws that allow for the cultivation and processing of seaweed, creating official community plans that support the expansion of the industry, helping to preserve valuable aquaculture infrastructure, and raising awareness of the industry amongst the community members.

Keywords: food system resiliency; island food systems; local food; seaweed aquaculture

Dedication

This project is dedicated to my mother, Wanda Foulkes. She has an unstoppable zest for life and always inspires me with everything she achieves. I always hear her voice in my head encouraging me to do better and I would not have accomplished this much without her.

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List of Acronyms

Term	Initial components of the term
BC	British Columbia
CIP	Canadian Institute of Planners
FAO	Food and Agriculture Organisation of the United Nations
GMO	Genetically Modified Organism
OCP	Official Community Plan
VIEA	Vancouver Island Economic Alliance

Glossary

Term	Definition
Advocacy planning	The exercise of the planning function on behalf of specified individuals and groups, rather than on behalf of a broadly defined “public interest” (Davidoff, 1970).
Agritourism	Any activity incidental to the operation of a farm that brings members of the public to the farm for educational, recreational, or retail purposes (American Planning Association, N.D.).
Aquaculture	The farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants (FAO, N.D.).
Bioaccumulation	Bioaccumulation describes the accumulation and enrichment of contaminants in organisms, relative to that in the environment (Borgå, 2013).
Biosecurity	A strategic and integrated approach that encompasses the policy and regulatory frameworks (including instruments and activities) for analysing and managing relevant risks to human, animal and plant life and health, and associated risks to the environment (FAO, 2007).
Food insecurity	Food insecurity exists whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain (Hayes et al., 2020).
Food security	Food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 1996)
Food sovereignty	Food Sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems (Food Secure Canada, n.d.).
Food System	The chain of activities connecting food production, processing, distribution, consumption, and waste management (Pothukuchi & Kaufman, 2000).

Food system resiliency	The ability a community food supply has to readily adapt to changes in external and internal conditions (Toth et al., 2016).
Food system sustainability	Sustainability implies not challenging ecological thresholds on temporal and spatial scales that will negatively affect ecological systems and social systems (Sundkvist et al., 2005).
Genetically Modified Organism (GMO)	A plant, animal, or microorganism that has had its genetic material (DNA) changed using technology that generally involves the specific modification of DNA, including the transfer of specific DNA from one organism to another (U.S. Food & Drug Administration, N.D.).
Non-conforming land use	If, at the time a land use regulation bylaw is adopted, (a) land, or a building or other structure, to which that bylaw applies is lawfully used, and (b) the use does not conform to the bylaw, the use may be continued as a non-conforming use ("Local Government Act," 2021).
Official Community Plan (OCP)	Term used in British Columbia for 'Official Plan' (Epstein, 2017)
Official Plan	Document adopted by a municipality setting out policies and objectives for the development of the municipality, having regard to social, economic, and environmental matters; zoning by-laws must accord with the official plan (Epstein, 2017).
Right to farm	Statutory protection for normal farm practices, to shield farmers from certain lawsuits, usually those based on principles of nuisance (Epstein, 2017).
Zoning	Separation of land uses by classification according to type of use and intensity of use (Epstein, 2017)

1.0 Introduction

Since first occupation, humans have found ways to produce or harvest foodstuffs from the place now known as Vancouver Island, BC. First Nations peoples stewarded the land to develop reliable food systems since time immemorial, for example managing garry oak meadows to create productive camas beds (Lutz, 1995). The first European settlement was established on the island in 1842 in an area now known as the City of Victoria (Esquimalt & Nanaimo Railway, 1905). Even though these early European settlers could only farm small portions of the island due to dense forest, the conditions were considered to be some of the most promising in what later became Canada (Esquimalt & Nanaimo Railway, 1905). Current climate predictions anticipate the region becoming more favourable for crop growth due to longer and warmer growing seasons (Province of British Columbia, N.D.). Despite the long history of food production and temperate climate, the region currently imports around 85% of the food consumed by its population (Vancouver Island Community Research Alliance, 2011). While BC currently has slightly lower instances of food insecurity than other Canadian provinces (Tarasuk, 2020), this lack of island-produced food leaves the region vulnerable to food shortages if the current food supply lines were interrupted for an extended period. Additionally, province-wide statistics do not account for the supply-chain issues that impact the islands and the more remote areas of the province. In other words, the Vancouver Island food system has low resiliency because it cannot quickly adapt to external shocks and stresses (Toth et al., 2016). If food production on Vancouver Island is expanded, the overall resiliency of the food system would increase. Resilient food systems can also contribute to communities by improving health, increasing economic opportunity, and addressing environmental concerns (Pothukuchi & Kaufman, 1999).

Given the extensive benefits of expanding local food systems, more options for food production on Vancouver Island should be considered. One area of local food production which would be of interest

to communities on Vancouver Island is the production of seaweed. Vancouver Island has been identified as the ideal place for BC to establish a thriving seaweed aquaculture industry due to climate, geography, market proximity, and oceanic conditions (Pacific Seaweed Industry Association, N.D.) Establishing this industry will benefit local communities in this region because seaweed is a good source of macronutrients, fiber, protein, and minerals (Ferdouse et al., 2018). Studies have also shown that seaweed cultivation has improved food security for local communities across the globe (Leandro et al., 2020). As well as the food security benefits of seaweed, it can contribute to the economic development of coastal communities (Rebours et al., 2014). Seaweed aquaculture can also benefit the surrounding ecosystems as seaweed has numerous positive environmental effects (Alleway et al., 2019; Druehl & Clarkston, 2016). This industry could address a range of the wicked problems facing communities within BC today; this study aims to explore how planners can support the growth of this industry within coastal communities on the Central East Coast of Vancouver Island.

There is currently very little research on the topic of seaweed aquaculture within the context of BC and no research as to how planners can play a role in this emerging industry. Therefore, this research fills a gap in existing knowledge and opens up potential new opportunities for planners to support this evolving industry. In the event that this industry does become established as a primary source of food and income for coastal communities, planners need to understand how they can influence the industry and what impacts the industry may have on the broader community.

The research goal is to determine what practices planners need to employ to help communities establish a seaweed aquaculture industry. Aside from producing an academic paper, the study was carried out in order to produce an informational document that planners can use to increase their understanding of how planning practices can influence the seaweed aquaculture industry. The main research questions for this study are:

1. What benefits can the seaweed aquaculture industry offer coastal communities in BC?
2. Are communities in the Central East Coast of Vancouver Island expected to be receptive to the seaweed aquaculture industry?
3. What planning practices are required to establish a sustainable seaweed aquaculture industry in BC?

In order to answer these research questions, data collection techniques included a document analysis of Zoning Bylaws and Official Community Plans from the Central East Coast of Vancouver Island and semi-structured interviews with seaweed aquaculture professionals and local government planners.

Overall, this study aims to explore how planners can support the seaweed aquaculture industry. Interest in the industry is increasing rapidly, and planners must be aware of how it can impact their communities and how their work can impact the industry.

2.0 Literature Review

The following literature review will first study how food system planning has developed to become an integral part of human society. BC specific examples of how food system planning has changed have also been considered along with a brief review of the Agricultural Land Commission. The concepts of food system resiliency planning and food security will also be explored as these concepts support why seaweed aquaculture is a worthy pursuit for coastal communities within BC. Finally, current literature on the seaweed aquaculture industry will be studied along with how planners can play a role within this developing industry. As an understanding of the definition of food systems will benefit the reader, this section defines food systems as “the chain of activities connecting food production, processing, distribution, consumption, and waste management” (Pothukuchi & Kaufman, 2000). Section 2.2 more fully explores this definition.

2.1 Historical Context of Food System Planning

Food systems underpin every other sector of society (Pothukuchi & Kaufman, 2000). Modern planning primarily focuses on the food systems of populations who live in one place and do not migrate throughout the year. Agriculture is one of the main reasons why we have urban environments today as the practice created a more settled population (Mumford et al., 2016). The Fertile Crescent is an area in the middle east which once had favourable conditions for food production, and is often attributed to being the ‘cradle of civilisation’ (*Fertile Crescent*, N.D.). However, it has been proposed that that area was not as abundant as previously thought (Smith, 2019). Rather, it was the instability of agriculture in this area that led to human populations forming alliances with one another to maintain a secure food supply (Smith, 2019). Even though the population was settled, the food they consumed may have come from elsewhere.

Other human populations were nomadic and moved with food sources. For example, the Indigenous Peoples of the Pacific Northwest were known to reside in permanent village sites for the winter, then move to summer villages and hunting or fishing sites in the warmer months to make full use of the food sources available in their region (Suttles, 1960). Evidence from many Indigenous populations across the globe indicates humans were managing the natural environment to create a more resilient food system even though the agricultural practices looked very different from the ones many populations rely on in the modern-day (McMichael et al., 2017). While many of the food systems used previously by people created a symbiotic relationship between humans and plants (Kimmerer, 2013; Turner, 2020), this was not always the case.

There is much evidence suggesting that the collapse of past human civilisations was partly due to the mismanagement of natural resources by humans (Diamond, 2005). There are many ways humans can degrade the land around them, and Diamond (2005) has found agriculture to be the prime cause of damage. Flourishing civilisations tend to experience population growth, requiring the society to adopt more intensive agricultural practices (Diamond, 2005). High demand for food also encourages humans to manipulate their environment to make more opportunities for agriculture on unsuitable lands, for example, irrigation, double cropping, and terracing (Diamond, 2005). These intense agricultural practices then lead to land degradation and other environmental damage (Diamond, 2005). Once the land could no longer meet the human demand for food, there were increased levels of conflict between people, resulting in the collapse of these once successful civilisations (Diamond, 2005). While there are numerous examples of historical food systems which could be studied, this research only focuses on the development of food system planning from the perspective of the modern, western world.

One of the first planners in this context to fully explore food systems as a whole is Ebenezer Howard. Howard incorporated all the food system sections listed previously into the design of his Garden City concept. Within Howard's book *Garden Cities of To-morrow*, published in 1902, he aimed to

reunite people with the land. He achieved this goal by developing a sizeable agricultural belt around the city that provides enough food to feed the entire population (Howard & Osborn, 1965). The relationship was to be mutually beneficial to the town population and the agricultural landowners as the waste produced in the town would return to the land as fertiliser (Howard & Osborn, 1965). Despite his Garden City concept being popular, we can see from the cities we live in today that his plan for including the features of a complete food system were not incorporated into standard planning practice.

It was not just planners exploring how a city might create a sustainable food system that could adequately supply food to its citizens. Johann Heinrich Von Thünen, a farmer from Germany, published a book called *The Isolated State*, which has since become a staple in human geography courses for understanding urban settlements and trade models (Atkins, 1987). Von Thünen's model indicates that some regions of the hypothetical state will have growing conditions more suited to specific types of agriculture (Atkins, 1987). Farmers will then identify the most profitable product for their land (Atkins, 1987). The farmer's 'land rent' or profit will be the amount of money produced by sale of the product, minus the cost of production and getting the product to market (Atkins, 1987). However, this model means that farmers have an incentive to intensify agriculture wherever possible to maximise their land rent (Atkins, 1987). While this is an interesting concept for exploring the theory behind the location of agriculture in relation to human populations, the model is limited as it takes place separate from other civilisations (Atkins, 1987). While their impact on the development of sustainable, modern food systems is perhaps limited, certainly both Howard and Von Thünen were important figures in our understanding of how farming and cities interact.

Over two decades after Howard published his text, Clarence Perry developed his concept of the Neighbourhood Unit in 1929 (Hodge et al., 2020). While Clarence did not address the food system as a whole, his design concept did incorporate access to food outlets within 10 minutes walk of anywhere in the urban setting (Pothukuchi & Kaufman, 2000). However, as the popularity of the automobile rose and

there was an increased separation of land uses, the neighbourhood unit began to expand well beyond a 10-minute walk (Wekerle, 1985). The separation of people and their food was an ever-increasing issue that remained largely absent from the planning community's concerns until the rise of feminist planning in the 1980s who drew attention to food access and community food systems (Pothukuchi & Kaufman, 2000).

While planners may not have been acknowledging food systems in their work, citizens of North America's major cities were taking matters into their own hands (Lawson, 2005). Since the 1890s residents of Detroit, New York, and Philadelphia have been establishing community gardens on vacant lots and this practice was soon incorporated into school curriculum across the United States (Lawson, 2005). The popularity of gardening in cities also saw increased uptake in response to crises such as the great depression, both World Wars, and urban abandonments of the 1970s (Lawson, 2005; Maltz, 2015). As the literature shows, urban populations in North America have actively participated in creating their own food systems for over a century, despite planners not approaching the subject until decades later. Planning for whole food systems finally began to regain traction with planners around the turn of the 21st century.

Kaufman and Pothukuchi (2000) led the way in highlighting a lack of food systems planning in the United States and educating the planning community on how planners can play their part in strengthening food systems. Kaufman and Pothukuchi argue that food systems underpin every other sector of society. The way we produce and consume our food can impact the environment, which in turn affects human health, and society can not thrive with an unhealthy population (Pothukuchi & Kaufman, 1999). However, when planners do not recognise food systems, their connections to other aspects of the community are not acknowledged (Pothukuchi & Kaufman, 1999).

More recent additions to the field of food system planning are the concepts of sustainability and resiliency. Despite the field of food system sustainability emerging before food system resiliency, some researchers argue that sustainability is a quality that results from a resilient system over time (Campbell, 2009). Others have used the three pillars of sustainability - Environmental, Economic, and Social impacts - to evaluate a food systems' sustainability (Lamine, 2015). The contrast between these approaches is important to note: resiliency defines how food systems respond to stresses and shocks over time (Lamine, 2015), while a "three pillar" approach is often more of an evaluation of the holistic nature of a system at a single point in time. Maintaining a separation between these two terms is challenging but vital to ensure the correct interpretation of sources. Due to the complexity of food systems, much of the literature on food systems resiliency does not address the food system as a whole. Lamine (2015) notes that studies regarding resiliency and sustainability in food systems generally deal with the interplay between agriculture and the environment. Taking this approach neglects to consider food consumption, an important food system component (Lamine, 2015). Another typical result is that researchers promote the return to local food systems that hinge on alternative food sources, such as community gardens and farmers' markets (Lamine, 2015). There appears to be a greater focus on the latter subject area within the planning literature studied.

In summary, human civilizations show a long history of food system planning (Armstrong et al., 2021; McMichael et al., 2017), but little attention has been given to the food system as a whole in a modern planning context until recently. Encouraging planners to view food systems more holistically is vital in making impactful changes in how our food systems are structured.

2.1.1 Agricultural Land Commission

Within BC, efforts to protect prime agricultural land from development began in the early 1970s with the introduction of BC's *Agricultural Land Commission (ALC) Act* (Province of British Columbia, N.D.-b). The purpose of this act, as laid out in section 6, is to:

a) to preserve agricultural land;

b) to encourage farming in collaboration with other communities of interest; and

c) to encourage local governments, First Nations, the government and its agents to enable and accommodate farm use of agricultural land and uses compatible with agriculture in their plans, bylaws and policies (Province of British Columbia, 2021).

The commission created a new land-use zone to protect BC's agricultural land, the Agricultural Land Reserve (ALR) (Province of British Columbia, N.D.-b). The boundaries of ALR areas have shifted since they were introduced but the amount of land covered by ALR has remained around 5% of BC's land area since the designation was introduced (Province of British Columbia, N.D.-b). The lands which were initially included in the ALR are judged to be the most critical to the province's food production (Province of British Columbia, N.D.-b). However, there have been criticisms of the ALC as in recent years as the land which is being excluded from the ALR to allow for development was of a higher quality than the new lands which are being added, resulting in overall degradation of BC's agricultural land (Curran et al., 2005). Another threat to BC's ALR is the ever-decreasing work force available to farm the land.

Between 2011 and 2016, approximately 3,000 producers left the farming industry in BC, and the average age of food producers rose to 56 years old (Province of British Columbia, N.D.-c). The rising cost of agricultural land is one of the most significant barriers facing young people entering the profession (Province of British Columbia, N.D.-c). There are new initiatives that have been put in place by the BC Ministry of Agriculture, which increase young farmers' access to land, knowledge, and capital to increase business opportunities in the agriculture sector (Province of British Columbia, N.D.-c). For example:

- Land matching services bring together young farmers who need land and landowners who are unable or unwilling to farm the land themselves, but would still like the land used for agricultural purposes.

- Succession planning workshops help both established and new farmers plan for the future of their business. The ministry can facilitate the transition of farms to a new generation of farmers.
- Developing leaders and supporting mentorship ensures that more experienced farmers pass on their essential knowledge to those entering the field.
- The ministry provides training and events to facilitate new business start-ups by addressing farm management and budgetary concerns.
- The ministry works with financial institutions and other industry stakeholders to help address financing issues and provide adequate funding for new farming ventures.

2.2 Food System Resiliency Planning

Before exploring the issue of food system resiliency, we must first understand what a food system is. To remind the reader, this paper defines a food system as “the chain of activities connecting food production, processing, distribution, consumption, and waste management” (Pothukuchi &

Kaufman, 2000). This definition is comprehensive because there is a multitude of different ways to structure a food system. In developed nations such as Canada, food systems tend to fit within the generic food system model shown in Figure 1. This diagram displays the many different

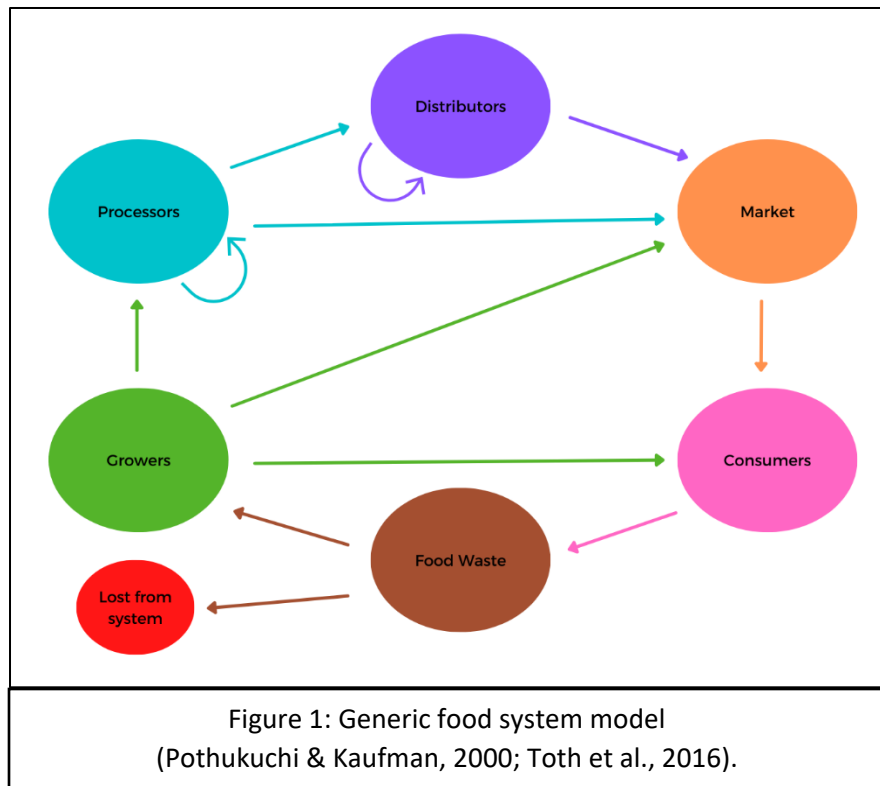


Figure 1: Generic food system model (Pothukuchi & Kaufman, 2000; Toth et al., 2016).

stakeholders within a food system and the connections between these stakeholders, which can form in many different ways. In the 21st century, we must also acknowledge that there are several different scales of food systems. From a review of the literature on the topic of food systems and the definitions found within it is concluded that a food-system must include at least two different stakeholders. The Food and Agriculture Organization of the United Nations indicate that a food system must encompass a range of actors (Nguyen et al., 2016). From this information it can be concluded that an individual who is self-sufficient in growing food to eat and then composting the waste would not be considered a food system.

Today, very few communities in developed nations are self-sufficient, which means that small-scale food systems also connect to a broader global system (Toth et al., 2016). There are many countries around the globe who are striving to create a self-sufficient food system to ensure a reliable food source for their citizens (Clapp, 2017). However, even if a country can provide enough food for its own population, it can still contribute to the global food system if any of the food produced there is exported to another country (Clapp, 2017). This interconnectivity within our food system leaves many communities vulnerable to a problem more recently identified by the planning community, one of food system resiliency. The definition of food system resiliency used within this research is from Toth et al. (2016), “the ability a community food supply has to readily adapt to changes in external and internal conditions.”

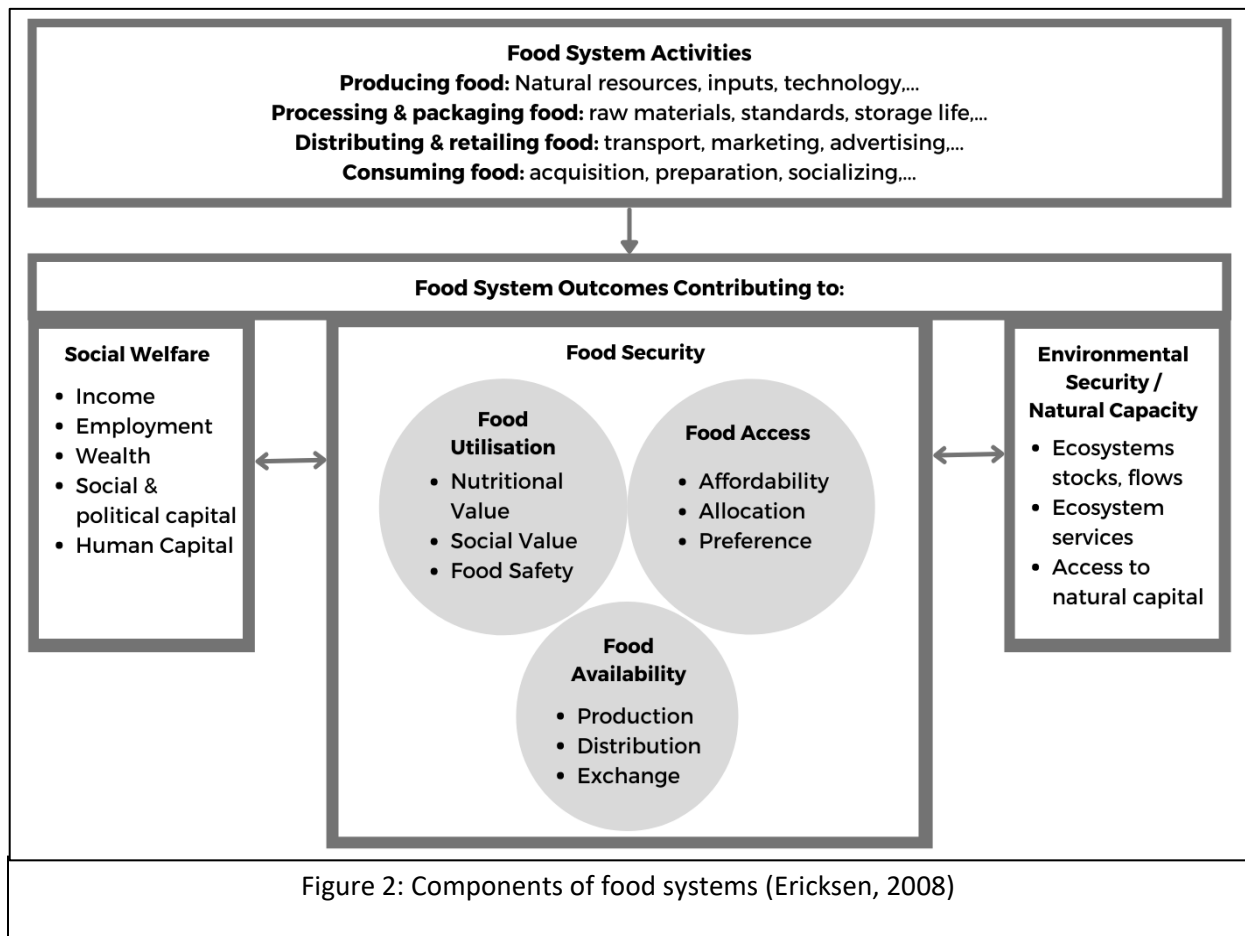


Figure 2 shows that food systems are complex and sit at the cross-section of many different issues from social welfare to climate change. For ease of conceptualisation, the food system is divided into four sections: consumer; producer; processing; and distribution. As much of the food production and processing happens in a rural environment, food systems are often not viewed as an urban issue, despite most product consumers living in urban settings (Pothukuchi & Kaufman, 1999). The complexity of these systems, combined with a lack of awareness from planners that food systems are an urban issue, has resulted in planners frequently overlooking food systems within the planning process.

2.2.1 Re-localisation as a Method of Creating Food System Resiliency

Much of the work encountered while structuring this literature review focused on the re-localisation of food systems. As planners generally work at a local scale, it follows that their solutions

tend to be local rather than global. The concept of re-localising food is a common element in the research regarding both food system sustainability and resiliency.

Sundkvist Å., et al. (2005) defined food system sustainability based on the Berkes and Folke (1998) definition - “sustainability implies not challenging ecological thresholds on temporal and spatial scales that will negatively affect ecological systems and social systems”- and combined this with the intention to provide all citizens of the globe with an adequate diet. Sundkvist Å., et al. believed that the disconnect between producers and consumers has led to our food supply's environmental and structural problems. The lack of communication between producers and consumers has caused feedback loops to loosen and decreased consumers' ability to make informed decisions about the food they purchase (Sundkvist et al., 2005). The overall conclusion of Sundkvist Å., et al. is that the tightening of feedback loops between different sectors of the food system will increase the sustainability of the process and the way in which they should be tightened is by creating a more robust market for local food production.

Toth, A, et al., (2016) also determines that local food production is vital for future food systems and adopts the concept of needing to tighten feedback loops. These researchers expand the model to incorporate five different sectors: Growers, Processors, Distribution, Market, and Consumers. Toth et al. conclude that the best course of action for creating a resilient food system is to directly link the growers with the consumers and encourage consumers to grow food of their own. Keeping food systems at a local scale promotes resiliency because food access is less reliant on outside sources, such as oil and transport systems, profits remain within the local community, and consumers can understand how their food consumption affects the local environment (Toth et al., 2016).

While the re-localisation of food systems has undoubtedly been a popular technique to increase the resiliency of a community's food supply, it is not without criticism. Firstly, “local food” is an ambiguous term that researchers have struggled to adequately define as it varies for every community

(Buchan et al., 2015). Secondly, the promotion of re-localisation vastly oversimplifies the issue at hand. People in the western world have become accustomed to eating a wide array of foods, and planners rarely address how people will be encouraged to adjust their eating patterns to fit the diet of a new food system (Lamine, 2015). Lastly, previous researchers, such as Lamine, have often criticized the promotion of re-localisation because studies lack the acknowledgment that global food systems are still an integral part of food access for many people. Toth et al. (2016) recognises the benefit of large-scale global food systems to resiliency because food may need to be accessed from outside the local area in times of crisis. However, they advise that appropriate production, processing, distribution, and consumption scales are necessary for each product.

In summary, re-localisation as a way of improving food system resiliency is a powerful tool for planners. Still, it is not without its concerns, and it is unlikely to replace the global food system.

2.2.2 Knowledge Mobilisation as a Method of Creating Food System Resiliency

Food system resiliency does not just hinge on our ability to produce food. It is also integral to maintain the flow of intergenerational knowledge, which gives society the tools to keep providing ourselves with nutritional food.

Many authors have acknowledged the importance of retaining knowledge within the agricultural industry (de Roest et al., 2018; Morgan & Murdoch, 2000; Sundkvist et al., 2005; Toth et al., 2016). Since the early 21st century, there has been growing concern over the standardisation of farming practices because it leaves farmers lacking in local ecosystem knowledge, which could allow them to adapt their farming techniques to respond to localised environmental changes (Morgan & Murdoch, 2000). As research uncovers new methods that food producers can use to increase their resiliency, it is vital to educate the farmers in these methods and share knowledge within the farming community (de Roest et al., 2018).

It is not just the retention of knowledge regarding the production of food that is important. For households and communities increasing their ability to recover from shocks is vital (Béné, 2020). An urban community can achieve an increased capacity for recovering from shocks by retaining knowledge about the preparation of food and urban agriculture (Béné, 2020). The increased demand for convenience food has left consumers in a position where they do not have the knowledge to prepare nutritionally balanced meals (Sundkvist et al., 2005). There have been times in recent history where an uptake in personal knowledge of food production and consumption has been vital, such as the Dig for Britain campaign in World War II (Maltz, 2015; Toth et al., 2016). During the campaign, the need for nutritious locally grown food encouraged knowledge of growing and food preparation techniques to be shared and led to Britain being more nutritionally secure after the war than the country was before (Maltz, 2015). At the same time, in the United States, Herbert Hoover organised educational programs to increase knowledge of food production and nutrition (Maltz, 2015). Maltz shows in this article that knowledge sharing among consumers is of paramount importance to maintaining a resilient food system in times of crisis, and these same techniques can be employed today.

The planning literature mainly focuses on the importance of knowledge mobilisation within the producer and consumer sectors. Though it would be logical to conclude that the food processing and distribution industries also benefit from knowledge mobilisation, there appears to be no research conducted on this matter in the context of food system resiliency.

2.2.3 Food System Resiliency on Vancouver Island

Vancouver Island is an important agricultural area due climate conditions that support localised production (Province of British Columbia, N.D.-d). Current climate change models predict longer and warmer growing seasons in the region, allowing for higher yields and more diverse crops (Province of British Columbia, N.D.-a). However, a study by the Vancouver Island Community Research Alliance in 2011, entitled the Local Food Project, found that although the Island has elements in place that would

support food production, the Island has a very low capacity for producing food and imports 85% of all food consumed in the region. The reliance on food imports means that communities would be vulnerable to food shortages should the supply chains be interrupted. As communities on Vancouver Island lack the ability to provide themselves with a stable food supply in the event of an external shock, the food systems within the region are considered to have low resiliency. Therefore, finding new food-producing industries which are viable on Vancouver Island and are not reliant on imports from outside of the region will improve the overall food system resiliency.

The Vancouver Island Community Research Alliance (2011) attributed low food production to a small agricultural sector and a lack of food storage and processing facilities. Increasing agricultural land costs have not aided this small agricultural sector. For example, in 2019, Vancouver Island had the most significant average farmland value increase in the province at 13.1% (Farm Credit Canada, 2020). The BC Agriculture & Food Climate Action Initiative (2020) also highlighted that the average age of a farmer on Vancouver Island is 57, which means many of the farmers currently producing food in this region will be retiring in the near future. This combination of factors means that food systems on Vancouver Island are becoming increasingly unable to feed the region's population.

The expansion of the local food movement on Vancouver Island is very important to increase the food-system resiliency of the region (Vancouver Island Community Research Alliance, 2011). The Vancouver Island Economic Alliance (VIEA) launched a campaign called "*Island Good*" in 2018. This campaign allows participating vendors to brand their items with the Island Good logo to certify that production took place on Vancouver Island. In October 2021, the VIEA reported that the total number of producers approved to use the "*Island Good*" logo is now 165, and sales in 2020 were 37.8% higher than in 2019 (Hanson, 2021). While this campaign has been very successful, there is concern over the type of food products now being produced on Vancouver Island. There is a continuing shift away from

commodity production and towards production for niche markets and agritourism (BC Agriculture & Food Climate Action Initiative, 2020).

Steps are underway to create more resilient food systems on Vancouver Island by making farming practices more suitable for the predicted climate changes, such as Vancouver Island Adaptation Strategies by the BC Agriculture & Food Climate Action Initiative (2020). There is also evidence found in numerous Official Community Plans across the island which indicate there is strong community support for expanding local food production capacity, including the City of Nanaimo, the Regional District of Nanaimo, the City of Parksville, the Town of Qualicum Beach, the City of Courtenay, and the Comox Valley Regional District. Island Food Hubs (2017) has also made a guide including suggestions for how different players in the island food system can help improve food security in communities across Vancouver Island. While this document's primary objective is to enhance food security, food system resiliency is also considered. One of the goals is to ensure Vancouver Island has an adequate food supply in the event of a disaster which leaves the communities in the region isolated (Island Food Hubs, 2017). For this reason, planners focused on emergency planning or disaster management may also use this document to guide the building food system resiliency.

Overall, the food system resiliency of Vancouver Island is at risk, but many schemes have been developed over the last few years to rectify this situation. Seaweed aquaculture is a developing industry that could expand the food-production capacity of Vancouver Island and contribute to the overall food system resiliency. Further discussion of the Seaweed Aquaculture industry will take place in later sections.

2.3 Food Security

Within this paper, the definition of food security is as follows: "Food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet

their dietary needs and food preferences for an active and healthy life” (FAO, 1996). This chapter will explore food security in Canada.

A lack of household food security in Canada is an ever-increasing issue. For example, 12.7% of families experienced some level of food insecurity between 2017 and 2018, which is higher than any previous national estimate (Tarasuk, 2020). British Columbia only suffered slightly less than the national average, with 12.4% of households being affected by food insecurity (Tarasuk, 2020). The root cause of this issue is challenging to address and will be discussed further in this section.

Food insecurity is rarely a stand-alone issue, and other social problems are often a contributing factor to food insecurity. Within Canada, the leading two indicators of whether a household will be food insecure or not are household income and health care utilization (McIntyre et al., 2014; Tarasuk et al., 2015). McIntyre et al. (2014) found that within Canada, the incomes of food-insecure households were considerably lower than those in food-secure households. Certain employment characteristics also increase the risk of food insecurity as they result in an unstable source of income (McIntyre et al., 2014). These characteristics include seasonal work, shift work, irregular hours, un-unionized positions, and lack of job mobility (McIntyre et al., 2014). Tarasuk et al. (2015) found a relationship between food insecurity and increased health care utilization within working-age adults. The researchers say that policies implemented by governments that reduce food insecurity will also considerably reduce the public funds spent on health care (Tarasuk et al., 2015). Knowledge of these indicators can help researchers infer whether food insecurity is likely to be an issue in the central region of the east coast of Vancouver Island.

While precise food security statistics for the study area on Vancouver Island are not available, the types of employment classifications on the Island can be obtained and can be used as a proxy measure to speak to issues relating to food security and insecurity. Figure 3 shows how employment

industries and sectors on Vancouver Island compares to the rest of BC. Employment industries and sectors for each of the municipalities and regional districts in the study area was also desirable but could only be located for the City of Nanaimo. As the data was not available from other communities for comparison, it was chosen to exclude the City of Nanaimo figures from this research.

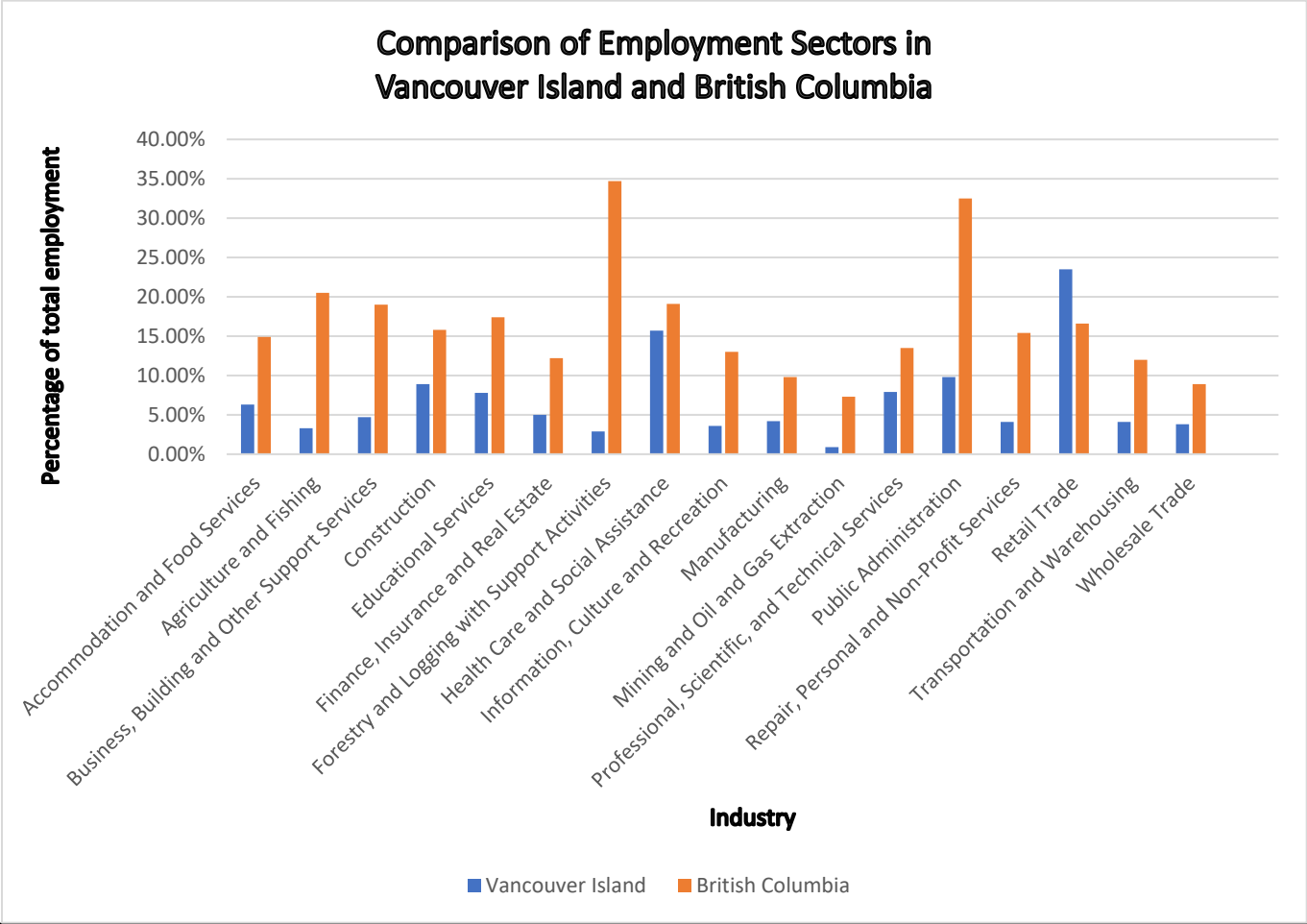


Figure 3: Comparison of Employment Sectors in Vancouver Island and British Columbia (WorkBC, 2020).

The data used in Figure 3 is from a provincial organisation. Studies taken place on Vancouver Island has found other sectors to dominate the employment sector, including: tourism, agriculture, aquaculture, forestry, manufacturing, high tech, and education (Vancouver Island Economic Alliance, 2019). While some of these industries provide year-round employment, the seasonal nature of tourism and food production means that permanent residents in this region are required to find alternative income sources throughout quiet seasons. However, the Vancouver Island Economic Alliance has been

running initiatives to increase employment on Vancouver Island. The initiative which pertains best to food production is Island Good. Since the launch of this initiative in 2018, it has been found that every 1% increase in sales of local products equates to 50 more jobs for people on Vancouver Island (Island Good, N.D.).

While it can be concluded that BC does not have abnormal instances of food insecurity compared to the rest of Canada, it is evident that the types of jobs available within the Vancouver Island region leave residents at a greater risk of becoming food insecure. The type of employment available combined with the knowledge that the Vancouver Island food system as a whole is of low resiliency means that communities here will be very vulnerable in the event of current food supply lines being interrupted. Developing a seaweed aquaculture industry is a method of increasing the amount and types of food available from Vancouver Island. Discussion of this industry will occur in the coming chapters.

2.4 Seaweed Aquaculture

2.4.1 Historical & Modern-Day use of seaweed

Seaweed has long been part of the human diet as it is a good source of macronutrients, fiber, protein, and minerals (Ferdouse et al., 2018). It has been a vital food source for Indigenous communities within BC since time immemorial and continues to be until this day (Druehl & Clarkston, 2016).

Ferdouse et al. (2018) report that the leading countries in seaweed cultivation are China, Indonesia, the Republic of Korea, and the Philippines. China is the largest producer and controls 60% of the market (Ferdouse et al., 2018). According to the Food and Agriculture Organisation of the United Nations (FAO), the seaweed industry is worth more than USD 6 billion per year. Human consumption accounts for 85% of seaweed production (Ferdouse et al., 2018). There are many different applications of seaweed within modern-day food systems. If there is a secure, safe and stable supply of seaweed, it has the potential to play a significant role in global food security (Leandro et al., 2020). Seaweed farming

is more prevalent in Atlantic Canada than Pacific Canada (Flaherty et al., 2018), but the Pacific Seaweed Industry Association (N.D.) has identified Vancouver Island as an ideal place to establish seaweed farming.

Seaweed cultivation improves food security (Leandro et al., 2020) and could be a factor in reducing unemployment within coastal communities (Rebours et al., 2014). Discussion of these benefits and others will be carried out below.

2.4.2 Economic Benefits of Seaweed Aquaculture Industry

The economic benefits of the seaweed aquaculture industry are not just contained within the industry itself by providing employment to coastal communities (Rebours et al., 2014). Seaweed aquaculture can also support other sectors of the food production industry and create opportunities for new agritourism pursuits.

Benefits to the broader food production industry

Seaweed aquaculture has the potential to support established land-based industries and is unlikely to cause conflict over natural resources because it does not require arable land, freshwater, or fertiliser (Charrier et al., 2017). A local source of seaweed could be beneficial to more traditional forms of food production, both on land and in the ocean. Seaweed aquaculture can be used alongside fish farming to maintain water quality as seaweeds are biofilters (Turcios & Papenbrock, 2014). Abalone and sea urchin roe production have also benefitted from seaweed aquaculture in the same area as it reduces the reliance on wild seaweed as a food source (Druehl & Clarkston, 2016). Both arable and pastoral agriculture could reap the benefits of local seaweed cultivation as studies show that seaweed can make a suitable animal feed and fertilizer (Charrier et al., 2017).

Agritourism

While no studies could be found on the effect of seaweed aquaculture agritourism, research has been conducted on other forms of agritourism in BC. The results of these studies have been included in this literature review to infer the potential benefits the seaweed aquaculture industry could have on a community.

Wittman et al. (2012) found that farmers' markets successfully link the local food system to the broader economy. While farmers' markets provide many valuable benefits beyond agritourism, researchers found that consumers' perception of authenticity at these markets was key to their success (Wittman et al., 2012). This information is valuable for emerging agritourism initiatives because creating an authentic link to the food product can heavily influence a consumer's decision to engage with the industry. The authenticity is created by consumers being able to interact directly with the producers (Wittman et al., 2012), which can be achieved in seaweed aquaculture agritourism as well, such as boat tours of seaweed growth sites.

Research also shows that agritourism is a suitable land use in rural-urban edge areas as it has fewer adverse effects on neighbouring residential properties than traditional food production processes (Stobbe et al., 2010). The presence of agritourism in the Lower Mainland and Fraser Valley, BC, was beneficial to both the tourism industry and the local residents as they can enjoy locally grown food and educational and entertaining farm experiences (Stobbe et al., 2010). It was recommended by Stobbe et al. (2010) that agritourism would be an effective planning tool for governments to pursue in areas of potential conflict between residential and food production land uses. It can be suggested from this research that local governments should encourage the establishment of seaweed aquaculture agritourism to increase acceptance of this newly emerging industry in the Vancouver Island region.

2.4.3 Environmental Benefits of Seaweed Aquaculture Industry

Seaweed aquaculture can benefit human populations, and it can be used to improve the health of the local and global environment. Seaweeds have been identified as an essential part of the coastal carbon cycle and are a significant carbon sink (Alleway et al., 2019). Their ability to sequester carbon and a natural tolerance for ocean acidification means seaweeds have a neutralising effect on ocean water which is beneficial to less tolerant species within the ecosystem (Druehl & Clarkston, 2016). Seaweed aquaculture can also replace the natural habitat which has been lost due to poor ecological management as it provides a structure for marine species to live amongst and can also be used to protect and stabilise shorelines (Alleway et al., 2019). As seaweed requires low-impact farming techniques, it has an excellent potential to be a popular alternative in the world's vegetable diet which can be used to supplement established food systems (Leandro et al., 2020).

2.4.4 Food Security Benefits of Seaweed Aquaculture Industry

As previously noted, seaweed is a valuable source of many different nutrients required by humans (Ferdouse et al., 2018). Having seaweed grown and processed within a community will provide an additional food source to the residents (Leandro et al., 2020).

As well as this, seaweed also has many uses in the food additive industry. For example, it has antioxidant and antimicrobial bioactivities, which can extend another product's shelf life, such as bread (Roohinejad et al., 2017). Therefore, seaweed can be used to keep food fresh for longer while it is transported from producer to consumer or kept in storage. The use of seaweed as an additive to extend the shelf life of other products is not a primary focus for this literature review, but it is worth noting as it could play a significant role in the structure of the Vancouver Island food system.

2.4.5 Environmental Considerations of the seaweed aquaculture industry identified on a global scale

While the positive impacts of seaweed cultivation are numerous, suitable precautions must be taken against the adverse effects of aquaculture. As seaweed aquaculture takes place in the open ocean, the practice must not negatively impact the local wild seaweed populations. Firstly, the chance for non-native species to cause genetic pollution must be heavily mitigated. Initial cultivation of seaweed in BC waters was focused on Nori, a Japanese species (Druehl & Clarkston, 2016) but recently the focus has been on cultivating local species which are better suited to the Pacific Northwest environment. Cascadia Seaweed, a leading seaweed producer in BC, grows two native species in their ocean-based growth sites, sugar kelp and winged kelp (Cascadia Seaweed, 2021). In Europe, the PEGASUS guidelines recommend only allowing the cultivation of native species and the creation of a list of native and alien seaweed species to ensure all cultivators are well informed as to which strains can be safely grown (Barbier et al., 2020).

Some researchers argue that using non-native or modified seaweeds could still be appropriate. Druehl & Clarkston (2016) recommend that selectively breeding several local seaweed species to create more suitable cultivars for commercial cultivation could be a viable course of action because a breeder can select for disease resistance and fast growth (Druehl & Clarkston, 2016). Barbier et al. (2020) have advised that researchers should study the different reproduction methods during the selection process to create a type of seaweed that is unlikely to crossbreed with the unmodified native population. However, many seaweeds have high phenotypic plasticity, which means they respond differently in different environments. Therefore, extensive study is required before use which is time-consuming and expensive (Barbier et al., 2020). This technique also includes the ambiguous term “local,” which is often left for the user to define (Barbier et al., 2020).

Another course of action is the cultivation of sterile non-native seaweeds, which will not have any long-lasting genetic effects on the native seaweed populations in the area. However, this means that cultivators must purchase new seaweed seed every year and creates an exclusive market for commercial breeding companies (Goecke et al., 2020). No matter which selection process is used, a gene bank of seaweeds that are suitable for cultivation should be maintained to ensure access to suitable strains for future generations (Ferdouse et al., 2018). Using species which have been altered from their naturally occurring counterparts can cause concern for consumers regarding genetically modified organisms (GMOs) (Bawa & Anilakumar, 2012). While GMO crops have the potential to solve many issues, particularly in regards to providing an adequate food supply, considerable effort will need to be put towards ensuring these plants are safe for the environment and humans, as well as alleviating consumer concerns about their use (Bawa & Anilakumar, 2012). However, using an invasive species may not be in keeping with the local food movement the seaweed industry aims to partake in (News, 2020). Aside from public perception, the health of the ecosystem is also a concern when introducing new species.

Whenever seaweed is transplanted into a site, even if it is native species, there is a potential risk of them introducing new pathogens or pest organisms to the pre-existing seaweed population (Ingle et al., 2018). Campbell et al. (2019) have highlighted the urgent need for biosecurity regulations due to the high prevalence of resistant diseases and parasitic pests within current seaweed aquaculture sites. The most common issues with current seaweed aquaculture regulations are as follows: inconsistent terminology regarding the use of cultivated seaweeds, lack of clarity as to which stakeholder is responsible, inadequate evidence-based data, and limited awareness of biosecurity hazards and risks (Campbell et al., 2019).

2.4.6 Food safety concerns of the seaweed aquaculture industry

Along with usual food safety standards, seaweed requires additional steps to ensure it is safe for consumption. As established above, seaweed is a biofilter which means it is capable of passing potentially harmful levels of heavy metals to animals who eat it through the process of bioaccumulation (Perryman et al., 2017). Wild harvest seaweeds have been declining in popularity because it is difficult to rule out the possibility of heavy metal contamination (Ferdouse et al., 2018). However, it is possible to monitor and maintain safe levels of heavy metals using cultivated seaweed. It has been suggested to grow another seaweed species, such as *Porphyra*, alongside the seaweed cultivated for human consumption to act as an indicator species of heavy metals (Rubio et al., 2017). If seaweed becomes a reliable food source for Vancouver Island, managing the level of contaminants is crucial, and robust food safety procedures are required.

2.5 Role of Planners in the seaweed aquaculture industry

2.5.1 Advocacy

While there is little work on what planners have done to advocate for seaweed aquaculture specifically, there is a long history of advocacy in planning. Advocacy planning is the practice of a planner using their expertise in the field to plan for specific individuals and groups, rather than on behalf of what the wider society has defined as the “public interest” (Davidoff, 1970). While professional neutrality is included in the Canadian Institute of Planners code of conduct (CIP, 2016), there are benefits in advocacy planning, for example: when new situations arise, changes need to occur, when regulations are outdated or are having unintended consequences, or perhaps most notably when issues of inclusion, equity, discrimination, and diversity are exposed. Alinsky (1971) has been considered a controversial figure, but some of his work is still applicable in planning as he recommends working from inside the current political systems to conduct advocacy planning. He believes that decision-makers are most likely to be swayed by people they are already familiar with (Alinsky, 1971). Planners are more likely to be

seen as equals by decision-makers and, consequently, in a much better position to generate support for unfamiliar issues (Alinsky, 1971).

Advocacy planning can lead to constructive debates on the best course of action as both sides explore their own opinions and challenge the views of others (Gunton, 1984). Climate advocacy planning is a good parallel because, as noted previously, seaweed has many environmental benefits, and growing seaweed can help to mitigate the effects of human-induced climate change.

The decision for professional planners to advocate for specific causes is a contentious issue because it has been found that advocacy can be considered a display of bias within the planning world that challenges the “neutrality” role of planners (Mitchell & Graham, 2020). On the other hand, in the matter of effective action on climate change, planners are told it is their professional responsibility to address it and to ensure that practices and regulations are changed to better respond to this crisis (Canadian Institute of Planners, 2017b). Creating a policy that directly addresses climate action was, not long ago, considered controversial in some jurisdictions (Mitchell & Graham, 2020). However, few local governments in Canada would today take issue with policies and regulations to address climate action. The work of early advocacy planners changed the landscape on this issue: while seaweed aquaculture may not have the same profound impacts as addressing the climate crisis, the same approach to advocacy may be needed to enact the necessary changes in policies and regulations in the study area.

Examples of the impact of advocacy planning in other sectors of the profession can assist in defining approaches for improving seaweed aquaculture production within the central region of eastern Vancouver Island. Climate-related policies are often included in current community plans, and Mitchell & Graham (2020) feel that evidence-based advocacy for municipal action on climate change is the duty of planning professionals. However, their study of practicing planners' attitudes towards evidence-based advocacy planning amongst Canadian planning professionals found that institutional and behavioural

norms make advocacy planning an unpopular choice (Mitchell & Graham, 2020). Despite many planners personally viewing climate change as an urgent issue, city councillors will only address it if it is of equal concern to their constituents (Mitchell & Graham, 2020). The advice that Mitchell & Graham (2020) offer planners who are hoping to become better advocates for climate policy is to firstly familiarise themselves with the basic science of climate change and keep up to date with developments, and secondly, they recommend calling for better, down-scales, climate science from higher levels of government, such as flood maps.

It is not only climate policy where understanding the current knowledge of a subject within the planning community is the first step towards advocating for its inclusion. Warner & Rukus (2013) explored the topic of planner's role in creating family-friendly communities. They found a disconnect between the branding of a community as family-friendly and the policies councils put in place. The first step they recommended was to survey planners to gauge their awareness of planning for this sector of society (Warner & Rukus, 2013). Surveys regarding public attitudes to seaweed aquaculture have been conducted, and it has been established that very few people are aware of the practice in British Columbia (Flaherty et al., 2018). Surveys directed at planners specifically have not been completed but would be of use to future research.

Pothukuchi & Kaufman (2000) were not only some of the first planners to address the issue of food system planning within a modern planning context, but they also created a list of techniques that planners could use to strengthen food systems in their communities or in other words, advocate for their inclusion in policy. Their recommendations were also data-driven and suggested collecting data on community food systems to raise awareness of the issue and make it easier to understand the scope of the problem. Analysing connections between food and other planning concerns is an effective way to help planners understand how to integrate food system planning into other community goals (Pothukuchi & Kaufman, 2000).

Aside from speaking with practicing planners to gauge their understanding of issues and providing them with action items, the education of young planners and the public is vital to planning advocacy. Mitchell & Graham (2020) believe that planning educators have a responsibility to empower students to advocate for the public good, even if the action itself is initially met with resistance by the public. Buchan et al. (2019) concludes that planners can educate the public on the importance of food systems, what resources are available to them to increase their individual resilience, such as equipment or funding, and how these resources can be accessed.

While seaweed aquaculture is a narrower cause to advocate for than the topics discussed in this section, much of the advice can still be applicable. Learning about the industry and how it can positively affect the communities planners serve will be a beneficial first step. It will also be crucial to understand how the industry can achieve other community goals, such as climate action and improved local food systems.

2.5.2 Preserving access to traditional Indigenous harvesting sites

For-profit shellfish aquaculture and fishing has been successfully practiced by First Nations groups on Vancouver Island for many years. First Nations communities in BC traditionally harvest wild seaweed rather than cultivating it (Harper et al., 2018), but the popularity of seaweed aquaculture is increasing in these communities. For example, both Nuuchahnulth First Nations and Klahoose First Nation are actively engaged within the industry (Baker, 2021; Cascadia Seaweed, N.D.). At the Seaweed Days conference, 2021, it was clearly expressed that many of the First Nations communities on Vancouver Island would be interested in economic development involving seaweed aquaculture (Johnson, 2021). There is much emphasis on moving away from the colonial governance system currently in place within the fishing industry and moving towards one focused on reconciliation, equity, social justice, and environmental consciousness (Harper et al., 2018). It would be pertinent for seaweed aquaculture to develop a similar focus in its government systems as well. Canada's constitution protects

the rights of Indigenous people to harvest from traditional sites, but this can be difficult to achieve as indigenous harvest sites are often desirable by commercial operations as well (Frid et al., 2016). If the industry does expand on Vancouver Island, meaningful relationships with First Nations groups must be maintained to avoid future exploitation of Indigenous people.

Grey & Newman (2018) have identified that food sovereignty is of growing importance within Indigenous communities as traditional food sources gain popularity with non-indigenous people. The definition of food sovereignty as used by the organisation Food Secure Canada (n.d.) is “Food Sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems.” Food sovereignty is a way of achieving food security within a community by collaborating with producers and citizens who will work within the environmental constraints of an area and increase intergenerational knowledge to preserve existing food systems (Food Secure Canada, n.d.). The commercialisation of salmon fishing in BC has resulted in reduced food sovereignty for First Nations communities as they have inadequate access to a staple food source which is also key to many cultural practices (Grey & Newman, 2018). Any future policymaking surrounding foods traditionally used by Indigenous groups should be conscious of maintaining the food sovereignty of the Nations whose traditional lands and waters are used as cultivation or harvest sites (Grey & Newman, 2018).

Planners are adept at encouraging collaboration between different groups with opposing views on a subject matter. First Nations are one of the most important collaborative relationships to nurture when dealing with natural resource use matters.

3.0 Methodology

3.1 Research Questions

The research goal is to determine what practices planners need to employ to help communities establish a seaweed aquaculture industry. This research was conducted in order to make an informational document that planners can use to increase their understanding of how planning practices can influence the seaweed aquaculture industry. The research questions were as follows:

What benefits can the seaweed aquaculture industry offer coastal communities in BC? This question explores whether establishing seaweed aquaculture is a worthy pursuit for rural, coastal communities within BC. These types of communities tend to have limited resources, which means that understanding the industry's benefits is crucial as it will help decision-makers in these areas make an informed decision as to whether seaweed aquaculture is an industry they would like to support.

As there is very little research on this topic in a BC context, the benefits can be inferred from a literature review of the impact of seaweed aquaculture on communities in other parts of the world. These topics are also discussed with interview participants to establish if they have found any evidence that similar benefits are expected within BC communities. Further information on the interview process is provided below.

Are communities in the Central East Coast of Vancouver Island expected to be receptive to the seaweed aquaculture industry?

This question explores if communities in the Central East Coast of Vancouver Island would be a suitable place to grow the seaweed aquaculture industry in this region. Communities in this part of the region have historically partaken in the shellfish aquaculture industry, and the seaweed aquaculture industry may be an additional way to provide income in these locations.

This data will be gathered by way of a document analysis of zoning bylaws and official community plans used by communities along the Central East Coast of Vancouver Island. Further information on this process is provided in a later section.

What planning practices are required to establish a sustainable seaweed aquaculture industry in BC? This question explores what planning practices are currently helping or hindering the sustainable growth of the seaweed aquaculture in BC. Seaweed aquaculture is an emerging industry in BC, and it is expected to gain popularity rapidly. Understanding the impact of current planning practices on the industry and exploring improvements that could be made in the future will help planners facilitate the establishment of this industry in BC coastal communities.

This data gathering will be done by semi-structured interviews with seaweed aquaculture professionals and local government planners who work in communities who are interested in establishing the seaweed aquaculture industry. Further information on the interview process is provided below.

3.2 Data Collection

Two different forms of data collection were used in this study: Document Analysis and Semi-Structured Interviews.

3.2.1 Document Analysis

Planning Documents from the Central East Coast of Vancouver Island

A document analysis was conducted on Zoning Bylaws and Official Community Plans from the Central East Coast of Vancouver Island to gauge how supportive municipalities in this region are of seaweed aquaculture and the broader aquaculture industry. For this study, the Central East Coast of Vancouver Island is defined as any coastal community that lies within the Regional District of Nanaimo and the Comox Valley Regional District. This study area was selected as the communities here have a

long history of involvement in the aquaculture industry. However, seaweed aquaculture is not a well-established industry at the time of conducting the research. Other regions on Vancouver Island could also be characterised in this way. However, as the study aimed to take an in-depth regional exploration of the potential for this industry, other communities were excluded from this document analysis.

Planning Documents from Vancouver Island Communities Practicing Seaweed Aquaculture

The researcher intended to conduct a second document analysis of planning documents from Vancouver Island communities already practicing seaweed aquaculture. The purpose of this document analysis was to find examples of how the industry is already incorporated into the local planning documents and use these as examples to other communities who wish to do the same. For this document analysis, only references specifically to seaweed aquaculture and the processing of seaweed products are considered. The harvesting of wild seaweed is not the focus of this study; hence references to wild harvest sites are excluded. References to the processing of wild harvest seaweed are considered because the management of this process from a planning perspective is the same as for cultivated seaweed.

Regrettably, there was no mention of seaweed aquaculture or processing in any of the official community plans or agricultural plans for any of these communities on Vancouver Island. Klahoose First Nation and Nuuchahnulth First Nation were contacted by email to inquire whether seaweed aquaculture has been incorporated into any of their long-range community plans. Neither Nation replied to the researcher's emails to confirm whether or not this was an aspect of their long-range planning goals and the researcher was not able to obtain copies of relevant documents. For these reasons, the researcher was unable to conduct the second document analysis as initially planned.

3.2.2 Semi-Structured Interviews

Primary data for this study was collected during semi-structured interviews, resulting in qualitative data. Qualitative data was preferable for this study to gain insight into the opinions and perceptions of the interview participants.

Interview participants comprised of two different groups: Seaweed Aquaculture Professionals and Local Government Planners. Professionals who currently work in the seaweed aquaculture industry in BC were identified by searching relevant websites and through existing contacts in the seaweed aquaculture industry. Based on the current location of seaweed aquaculture sites, adjacent or proximate local governments were selected, and the planning contact was identified through publicly available information. There were no specific inclusion or exclusion criteria beyond engagement in the industry and/or planner employed by local government.

Semi-structured interviews were considered the best data collection method for local government planners and seaweed aquaculture professionals. As the seaweed aquaculture industry is still an emerging industry in BC, the researcher felt that planners may not want to partake in an interview because they do not know the subject area well. Using a more personal data collection method allowed the researcher to explain the value of participation even if an interviewee was unfamiliar with seaweed aquaculture. While all planners interviewed stated that they were not sure they would be helpful in the process, all the interviews resulted in data that furthered understanding this subject area. Seaweed aquaculture professionals were more receptive to the interview requests, but some were unsure how local government planning affected their work. Having the semi-structured interview format allowed the researcher to answer specific questions as to why the findings would help their industry. The researcher's presence in all interviews was also beneficial to encourage participants to elaborate on their answer and explore topics with them that might have been previously unidentified by the preliminary literature review.

Semi-Structured Interview Process

Ethical approval for this study was received from the Vancouver Island University Research and Ethics Board before contacting any interview participants.

A standard introductory email explaining the purpose of the study was sent to prospective participants' work email address to inquire whether they would like to partake in the study. The second round of emails was sent two weeks later to prospective participants who had not responded to the first email accepting or declining the invitation for an interview.

Those who expressed an interest in partaking in the study were sent an email to arrange an interview date. This email also included the consent form and a list of interview questions. All interview participants were requested to complete the consent form before the interview took place to allow them to review the form and ask any questions regarding the consent process without the time pressure of the interview. The interview questions were provided in advance to allow participants a chance to prepare. It was considered important to allow interview participants this time for preparation as it was expected that many of the planners would be unfamiliar with the industry and would benefit from the opportunity to consider what they would like to say. This preparation time would also create a more efficient interview which would be more likely to remain within the predicted time of 30 minutes.

The interviews took place on Zoom video call to adhere to the BC health guidelines surrounding the COVID-19 pandemic. It is felt that the virtual conferencing environment had minimal impact on the data gathered during the interviews, and had the interviews been conducted in person, there would be no difference in the quality of data gathered. Many participants appreciated the convenience of meeting on Zoom as it took less time out of their day.

The questions asked during the interview process were as follows:

What regulations are currently in place for the seaweed aquaculture industry which you feel are beneficial? This question aimed to identify what regulations surrounding the seaweed aquaculture industry support the industry in its efforts to expand on the Vancouver Island coastline. It also gave the researcher an understanding of whether the planners interviewed considered the seaweed aquaculture industry in any of their work.

What regulations are currently in place for the seaweed aquaculture industry which you feel should be improved, and why? This question aimed to identify regulations restricting the industry and what needs to be done in the future to remove these restrictions. The answers to this question were to be compared to the answer to the previous question to establish if different groups had conflicting opinions regarding the industry's current regulations.

What collaboration have you had with planners when setting up seaweed aquaculture? This question was primarily aimed at seaweed aquaculture professionals to understand if they have had any interactions with local government planners and if they had found working with the planners to be beneficial to their industry or not. The question also explored whether seaweed aquaculture professionals had any suggestions on how planners could help facilitate the industry's growth.

What collaboration have you had with seaweed industry professionals who are setting up or practicing seaweed aquaculture in the community you work in? This question was primarily aimed at planners to establish if they have had any interaction with the seaweed aquaculture professionals and if they viewed these interactions to have been successful. This question would also provide insight into how seaweed producers interact and whether collaboration was a valuable part of the growing industry.

What methods do you use to educate the community about seaweed aquaculture? This question was asked to planners and seaweed aquaculture professionals to establish how information regarding

the industry is communicated to the broader community. It also provided an opportunity to discuss what those messages included.

As a planner, what can you do to advocate for methods of increasing food system resiliency within your community? This question was only asked to planners in pursuance of understanding what they can advocate for within the confines of their role in local government. Food system resiliency is of increasing importance for many communities. Understanding what tools planners can employ to address this issue would be necessary for shaping the guidelines found within the book of best practices.

Other (participants will be offered the opportunity to elaborate on any of their responses) This was not a standalone question. Instead, interview participants were encouraged to elaborate on their answers as the interview progressed. Interviewees were also offered the opportunity at the end of the interview to provide a final comment on how they foresee planners and the seaweed aquaculture industry interacting in the future.

All interviews were transcribed using Otter.ai transcription software, and interviewees were given a chance to clarify, amend or redact any of the information provided. Interviewees were requested to return the approved transcript within two weeks of being sent the original copy. If the participant did not return the transcript within two weeks, they were sent a reminder email and allowed one further week to approve the transcript. After this time, the researcher assumed that no changes were required, and the transcript was uploaded to NVIVO for analysis.

3.3 Data Analysis

3.3.1 Document Analysis

Zoning Bylaws for each selected community were analysed to establish where the city already had zones that allowed for seaweed aquaculture and seaweed processing. As awareness of the industry is low in BC, the zoning bylaw was not required to state that seaweed aquaculture or seaweed

processing is a permissible land use. Zones that allowed for aquaculture or seafood processing and did not limit the use to a specific type of aquaculture or seafood were considered permissible for seaweed aquaculture and processing. If the community could accommodate one of these land uses, they would receive a score of one. If they could accommodate both land uses, the community would receive a score of two. If they could not accommodate seaweed aquaculture or seaweed processing, they would receive a score of zero.

Official Community Plans were analysed in NIVO to identify community objectives and plans related to the seaweed aquaculture industry. As none of the communities studied included specific objectives for the seaweed aquaculture industry, themes relating to the general aquaculture industry were identified. Eight themes were identified to establish in what capacity a community supported the aquaculture industry within its community plan. The community would receive a score of 1 for every theme they were supportive of within their OCP. Themes can be seen in Figure 4 which can be found in the findings section.

The scores of the Zoning Bylaw analysis and the OCP analysis were then combined to give a community's overall score. The maximum score possible was 10. This analysis determines how much support a community has for the aquaculture industry and, consequently, where is the most likely location to adopt the seaweed aquaculture industry on the Central East Coast of Vancouver Island.

3.3.2 Semi-Structured Interviews

All the interview transcripts were analysed in NVIVO to identify themes within the conversation. The themes identified then form the basis of the guidelines within the book of best practices. All transcripts were read, and the key points of each participant were summarised. Afterward, all summaries were re-evaluated to identify the key talking points. At first, the researcher identified 13

different themes, which were then combined and refined into nine different themes. More details surrounding the themes will be outlined in the findings section of this document.

The initial plan was to analyse the data to find common themes across all interview participants. However, the two groups of interviewees did not seem to share enough common knowledge to reach a consensus. When the two groups were analysed separately, interviewees mostly shared common responses with others from the same group. When analysing the groups separately, the results found help identify what changes are within the control of local government planners and which are under the jurisdiction of other areas of government.

3.4 Critique of Methodology

While the methodology used for this research was appropriate, some areas could be improved if the study was repeated. These areas of improvement have been presented in two subsections, each corresponding to the data collection method used.

3.4.1 Document Analysis

While the documents used in the study of local planning documents from the central east coast of Vancouver Island were readily available as they are all public documents, the documents themselves are not in a standard format. While the researcher located all references to aquaculture or seafood processing, there may have been helpful information in other parts of the documents which were not found due to the use of different wording.

3.4.2 Semi-Structured Interviews

Three main issues with the process used for the semi-structured interviews have been found and are listed below. If this research were to be repeated and these issues resolved, the resulting data would be of a higher quality than the data collected for this study.

Firstly, the skill of the researcher is imperative to the success of a semi-structured interview. While the researcher always acted professionally and followed the prepared interview guide, their ability to ask useful follow-up questions and encourage participants to elaborate on their answers improved throughout the data collection period. While it is not possible to ascertain how different an interview would have been had it been conducted by a more experienced researcher, there is the possibility that useful data is missing from the study.

Secondly, the interview participant selection criteria should have included provisions for more than one representative from a seaweed aquaculture company who wanted to participate in the study. The researcher chose to interview several participants from the same company because they all had different specialties. However, this decision could have generated results that are not representative of the opinions of seaweed aquaculture professionals as a whole.

Thirdly, only planners and seaweed aquaculture professionals from BC were interview participants. While the project's end goal is to produce a document applicable to BC, it could have been beneficial to interview planners from other parts of Canada that already have a more established seaweed aquaculture industry. The research could provide more insight into how planners can play a supportive role in the expansion of this industry.

4.0 Limitations

While this research was completed to the best of the researcher's ability, there are several limitations to this research that would benefit from further study in the future.

Firstly, because the industry is still very new on Vancouver Island, there was a limited pool of potential research participants, which was then made smaller due to the limited availability of these participants. The small sample size means there is limited ability to analyse the findings. It would be unwise to assume that the findings represent all seaweed aquaculture industry professionals or planners working in coastal communities on Vancouver Island. It is likely that if this research were to be conducted again in the future, there would be much higher awareness of the industry among planners and more interaction between seaweed aquaculture professionals and planners, resulting in more uptake for the interview process.

Secondly, as noted earlier in this study, there is no research regarding the impact of seaweed aquaculture on the environment within a BC setting. While the benefits that have been seen elsewhere in the world are expected to be true in the coastal waters of Vancouver Island as well, it would be beneficial to research the impacts of the industry more thoroughly. There is support for evidence-based seaweed aquaculture regulations from the seaweed aquaculture community. However, unless there is funding or desire to conduct this research, evidence-based regulations cannot be formed.

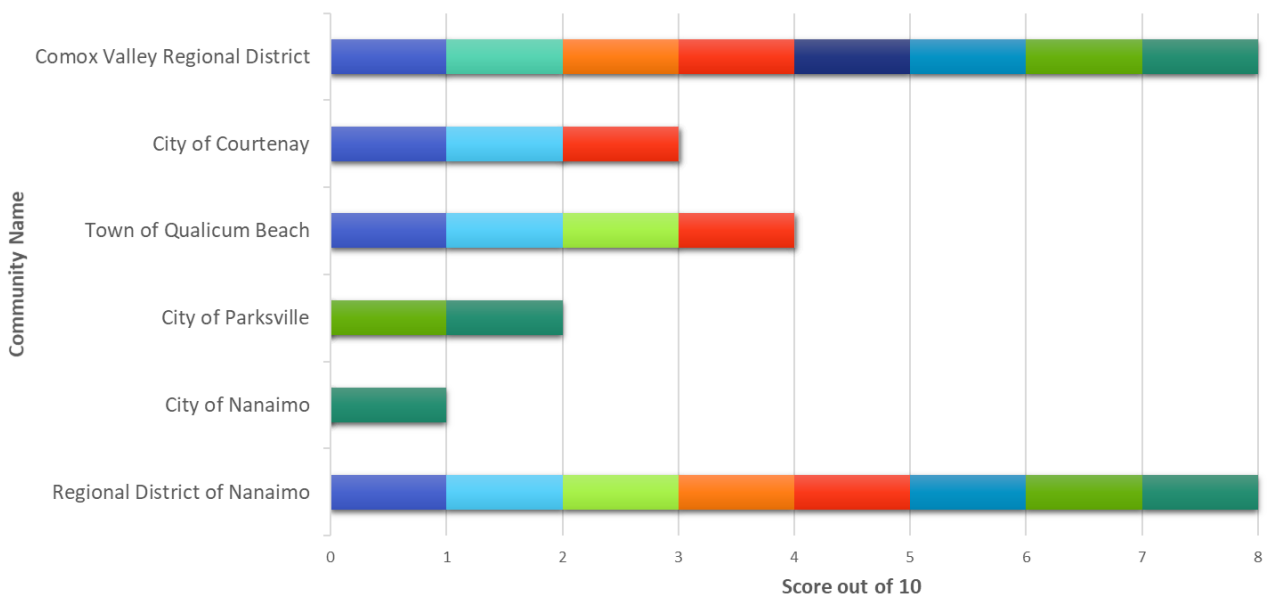
Thirdly, this research intended to create an entry-level document to be used by planners who are new to the concept of community planning with seaweed aquaculture in mind. While this is a valuable pursuit as the industry is growing in popularity on Vancouver Island, it may mean that the recommendations need to be finetuned before applying them to a community to ensure they achieve the desired effect.

Fourthly, the researcher intended to find out if there were any limitations to the seaweed aquaculture industry already known in BC. Regrettably, as there has been very little research on seaweed aquaculture in BC this information was not available. Some potential limitations of the industry were found during the interview process and have been discussed in the coming sections.

5.0 Findings

5.1 Document Analysis

The ten themes identified and used for the document analysis of Zoning Bylaws and OCPs of communities within the study area are presented below in Figure 4. For each theme the community addressed within their planning documentation, they earned one point, with a maximum of 10 points available. Figure 4 displays the results of this analysis.



Theme Legend

- OCP supportive of aquaculture for economic development
- OCP supportive of aquaculture for local food production
- OCP supportive of aquaculture tourism
- OCP supportive of collaboration with First Nations groups surrounding the aquaculture industry
- OCP supportive of environmentally conscious aquaculture
- OCP supportive of expansion of the aquaculture industry
- OCP supportive of public education initiatives regarding the impacts of aquaculture industry
- OCP supportive of zoning which is compatible with the aquaculture industry
- Zone permissible for seaweed aquaculture
- Zone permissible for seaweed processing

Figure 4: Document analysis results. A bar chart showing the score each community received as to whether their planning documentation addressed each of the themes laid out in the theme legend. The documents used for the Regional District of Nanaimo (RDN) OCP are a combination of OCPs adopted by the electoral areas within the RDN.

The results of the data analysis show that all the communities studied had some form of local planning bylaw that is supportive of the aquaculture industry. Both the Comox Valley Regional District and the Regional District of Nanaimo had significantly more policies and objectives in place that support the aquaculture industry than any of the urban municipalities. This result is not surprising as rural populations have typically been more reliant on resource-based industries than urban populations.

Out of the four communities that were supportive of expanding their aquaculture industries, all of them were hoping this would result in the area's economic development. Using aquaculture to increase local food production was also of high importance to these communities. To a lesser extent, it is expected that aquaculture will play a role in the growth of agritourism in the area. The Rural Comox Valley Regional District Official Community Plan included extensive information regarding the growth of aquaculture in the region and included goals that were not present within the other communities studied. Firstly, they intended to collaborate with the local First Nations communities on aquaculture pursuits to protect the marine environment and to secure the sustainable harvesting of its resources in the future. Secondly, they plan to engage in public education to increase public understanding of the aquaculture industry and how it may produce positive and negative effects when living in close proximity. The worst performing community using this analysis was the City of Nanaimo, as they only had zoning available for the processing of seaweed, not its cultivation. The City of Nanaimo OCP included no mention of the aquaculture industry. However, as the waterfront which the City of Nanaimo controls contains many busy transportation routes, it is understandable that the capacity to support aquaculture in this area is low.

5.2 Semi-structured Interviews

The data from the semi-structured interview questions was analysed, and 11 themes were identified, which are listed below. The identified themes are being used as a way to present the research findings and will go on to form the basis of the recommendations in a subsequent chapter.

Themes:

1. Advocacy
2. Agricultural Planning
3. First Nations Collaboration
4. Infrastructure
5. Official Communities Plans (OCP)
 - a. Agritourism
 - b. Food System Resilience
6. Seaweed Specific Regulations
7. Stakeholder Understanding
8. Workforce
9. Zoning

5.2.1 Advocacy

Advocacy of the seaweed aquaculture industry is not something that any of the planners interviewed partook in. One planner indicated that this is because they work in a small municipal government setting that does not allow them room to advocate for a specific industry as they must be perceived as supporting the community as a whole rather than one specific cause. Another planner stated that they had not yet been an advocate for the seaweed aquaculture industry because it has not

been relevant to their role so far. Instead of being an advocate, planners viewed themselves as having a facilitation role in assisting community members in navigating the bureaucracy of establishing seaweed aquaculture processing sites. While they did not view it as advocacy, planners suggested that seaweed aquaculture and increasing food system resiliency should be included in OCPs to make it easier for community members to establish initiatives on this topic.

Seaweed industry professionals thought that local governments could fulfill an essential role by advocating to provincial and federal governments to dedicate more resources to the seaweed aquaculture industry. In particular, they want higher levels of government to understand the importance of research in this emerging area as it can be environmentally beneficial and understand the need to redevelop the current regulation of the industry as it is unsuitable.

5.2.2 First Nations Collaboration

The interviews with seaweed aquaculture professionals revealed that collaboration with First Nations communities is a cornerstone to their success. Interview participants indicates that there has been a lot of interest from First Nations communities on Vancouver Island to be a part of the Seaweed Aquaculture industry. The interviews revealed that most government interactions seaweed professionals have had are with First Nations governments.

Consultation with First Nations is a vitally important part of establishing a seaweed aquaculture growth site. Not only is it necessary by legislation, but as it is the traditional lands of these communities, they have a good understanding of where a successful growth site would be in their waters. One industry professional felt that the government should dedicate more resources to expanding these collaborations between indigenous groups and seaweed farming companies because it often leads to very successful partnerships that benefit both parties.

For one Vancouver-Island-based company, their goal is to collaborate with First Nations groups through the application and installation process and then transfer technical knowledge to the community how to operate the farms. Once the Nation wishes to take complete control of the farm, the seaweed company becomes a purchaser of the crop.

5.2.3 Infrastructure

A lack of suitable infrastructure that allows the seaweed to be processed in a timely manner was highlighted by seaweed aquaculture professionals as one of the industry's most significant problems. There is a need to balance seaweed production with the ability to process it or transport it to somewhere it can be processed in a short time frame. Once seaweed has been removed from the ocean, its processing must begin within a few hours before the product begins to spoil.

One seaweed aquaculture company is already undertaking a capacity study of Vancouver Island to identify communities with potential for seaweed aquaculture through existing and disused infrastructure. The necessary infrastructure for seaweed aquaculture includes:

- Docks
- Industrial zones close to ports where seaweed can be processed
- Cranes to lift totes off boats
- Cold storage to elongate the window of time before the product spoils
- Processing buildings and tools
- Transportation routes from growth sites to processing sites

Seaweed aquaculture professionals identified that coastal communities that already practice another form of aquaculture or fishing are most easily adapted to the seaweed aquaculture industry. The Discovery Islands are currently going through a period of change because the salmon farms which used to employ much of the population have been forced to close. However, the infrastructure can be

easily transformed into seaweed aquaculture sites to allow a new source of income for these communities. Similarly, Ucluelet is a well-established fishing town where there is nervousness about declining fish stocks. Seaweed aquaculture professionals see this town as a good fit for the industry because they have in-use and disused processing facilities.

Both planners and seaweed aquaculture professionals indicated that the protection of processing facilities is vital for the growth of the industries, and local municipalities should review their policies and bylaws to avoid losing these valuable amenities.

The need for this infrastructure to serve more than the seaweed aquaculture industry was an important point highlighted by many interview participants. The seaweed aquaculture professionals acknowledged that the harvesting period for seaweed is a very short time frame in the spring. The planners stated that multiuse facilities would be best to avoid creating empty spaces for much of the year.

5.2.4 Official Community Plans (OCP)

Every planner interviewed mentioned OCPs as a way that local planners can best support the seaweed aquaculture industry. They stated that it is imperative that the OCP supports the marine industry and keeps areas designated for marine industrial use accessible to the water. The recent events of the COVID-19 pandemic have shown coastal communities that retaining their ocean-based industries is very important, and it would be unwise to focus solely on tourism. These planners also confirmed that having an OCP which is supportive of the expansion of this industry would make a rezoning application smoother if a community member wanted to build a new processing site or another associated facility.

Planners identified that the seaweed aquaculture industry also fit into other sections of the OCP. Many OCPs include a goal to increase food system resiliency or food security. Therefore, if the seaweed aquaculture industry were shown to align with this, the OCP would support it. As many of the planners

interviewed work in communities dependent on tourism, they acknowledged that agritourism is desirable for the community as an economic opportunity. If a seaweed aquaculture pursuit were to include agritourism, the OCP would support it.

Many of the seaweed aquaculture professionals interviewed were keen to present to local councils on the industry. Their involvement in the OCP review phase would be a beneficial course of action to integrate the full potential of the seaweed aquaculture industry.

Food System Resiliency Planning

All of the planners interviewed felt that their communities were interested in developing increased food system resiliency, particularly those working in more remote communities. While they acknowledged that food system planning is outside the traditional scope of local municipality planners, it is an issue they are increasingly helping to resolve. One municipality already ran initiatives such as a community garden and canning workshops, and they felt there was room for seaweed aquaculture to collaborate with these initiatives.

While there is interest in improving local food system resiliency within west coast communities, the lack of agricultural lands poses an issue. This lack of agricultural land has led to community interest in learning from indigenous food systems that rely less on land-based agriculture. The traditional indigenous food sources are also viewed as being more reliable in the event of an emergency that isolates a community from their current outside food sources.

Agricultural Plans have often neglected to include aquaculture in their scope. In recent years, the Alberni Clayoquot Regional District on Vancouver Island has produced an addendum to their agricultural plan to include marine food sources. One planner felt it was beneficial not to separate aquaculture and agriculture when making plans regarding food systems as both industries supply food

and impact each other. Including both sectors of food production could also be helpful when highlighting potential areas for collaboration, such as through agri-feed and fertilizer.

Incorporating First Nations food systems into future agricultural plans was viewed as a worthwhile pursuit by one of the planners interviewed, particularly in relation to seaweed aquaculture. The reasoning for this is that First Nations groups are actively involved in the seaweed aquaculture industry. They will be able to offer viewpoints and industry knowledge that may not be apparent to someone working in other areas of agriculture or aquaculture.

Many planners and seaweed industry professionals identified that food production must not be limited by introducing incompatible land uses or other bylaws that compete with food production. A primary problematic use identified was high-value housing where people may not want to neighbour a seaweed aquaculture growth site or processing site.

Agri-tourism

Both planners and seaweed industry professionals supported the agritourism opportunities associated with the seaweed aquaculture industry. They felt it offered a unique experience to tourists and the visibility of the industry makes towns still feel like a real community where local people live, rather than a resort experience. It was also generally agreed that the food products of the industry would be beneficial to local food and beverage producers to add to the unique experience of a place.

Some coastal communities have already included support for agritourism in their OCP as an economic opportunity focusing on marine-based food harvesting and First Nations initiatives. Other planners have supported seaweed aquaculture agritourism by ensuring the inclusion of local seaweed producers in agricultural shows which traditionally focused on land-based food production. Including seaweed aquaculture in these events is an excellent way to raise awareness of the industry and broaden understanding of the local food systems.

Seaweed producers viewed agritourism as an economic opportunity and as an educational tool to increase understanding of how the industry works and the associated benefits. Some professional seaweed farmers already have plans to implement boat tours to add value to their growth sites.

5.2.5 Seaweed Specific Regulations

All seaweed industry professionals supported the idea of seaweed farming having its own set of regulations and said the current ones were inappropriate, slow, and a barrier to growth. One interview participant even pointed out that seaweed is referred to as a marine plant in the regulations, whereas seaweed is, in fact, a macroalgae. Seaweed aquaculture currently uses the same regulations as shellfish aquaculture, which is not appropriate as the environmental impact of seaweed farming is very different. There was support for constantly evaluating the regulations to ensure they are based on scientific evidence. An interview participant suggested that the scale of the farm could impact how it is regulated because there is lots of research to suggest seaweed cultivation has positive environmental benefits. Allowing small farms to have a less strenuous application process could help small businesses start and support local government climate goals.

While most industry professionals did not have an issue with the intent of the regulations and support appropriate environmental checks and consultation with stakeholders, the process itself needs to be smoother. The application process is widely agreed to be intense because it considers many different stakeholders and a thorough environmental assessment. However, many different government departments conduct a review of the application, and collaboration between these departments is lacking, resulting in applicants having to provide information multiple times. All seaweed industry professionals agreed that the process should be streamlined and completed in a timelier manner. Applying for a new aquaculture tenure takes at least two years, whereas amending a pre-existing aquaculture tenure to include seaweed takes a shorter time frame. This long time frame could result in new farmers being heavily disadvantaged and larger companies monopolising the market.

Many seaweed aquaculture professionals stated that the complexity of the application does not align with the complexity of seaweed farming. Seaweed farming itself is not difficult, and most communities can learn to do it very quickly. It is a valuable tool that would allow coastal communities to increase their income, but the application process is a barrier to many.

All planners interviewed were not aware of the specific seaweed regulations as these are handled at a provincial and federal level outside of their jurisdiction. However, one planner identified that they have seaweed aquaculture in their community, protected under the right to farm legislation.

5.2.6 Stakeholder Understanding

All of the seaweed aquaculture professionals interviewed supported public education regarding the industry to increase stakeholder understanding of the industry's low impact on their daily lives. One seaweed company is actively speaking at local council meetings to raise awareness to local governments of how the industry can improve their local economy and address many of the climate goals that municipalities have. Benefits of the industry highlighted by interview participants include:

- Food security
- Climate action
- Indigenous Reconciliation
- Jobs for coastal communities
- Rural development

Planners indicated that getting approval from the public for new food production sites can be difficult as they do not want anything to impact their lifestyle. However, they also acknowledged that to maintain sustainable food systems on Vancouver Island, we need to accept some of the less pleasant aspects of the food production industry and helping landowners to understand this is vital.

This study found that new aquaculture tenures need considerably more stakeholder involvement than pre-existing tenures and seaweed aquaculture professionals are concerned that the amount of stakeholder opposition may impede the growth of the industry in some locations. For this reason, the expansion of the industry has been focused on the West Coast of Vancouver Island and the Discovery Islands because aquaculture and other marine industries are an established part of the community lifestyle. It is feasible to cultivate seaweed in the waters of the Salish Sea as well, but there runs more risk of opposition by other stakeholders, such as property owners who overlook the farms. One interview participant suggested setting up a seaweed community garden to educate people on the benefits of seaweed and its uses could lead to wider acceptance.

Both groups interviewed confirmed that there had not been much interaction between the seaweed industry professionals and local government planners. However, the seaweed aquaculture professionals explained that this is because most of their work has been with First Nations groups. They have not set up a seaweed aquaculture site on a new aquaculture tenure that needs approval from a local municipality. However, seaweed aquaculture industry professionals do want local government support for their industry and have been partaking in positive conversations with economic development branches of local governments.

One seaweed aquaculture professional indicates that they would like to see more municipalities on Vancouver Island offer opportunities for stakeholders, particularly young people, to become involved in the industry. They drew attention to a project called Community Kelp, a kelp garden in Vancouver used to educate and engage the public on the potential for kelp cultivation to mitigate ocean acidification. CityStudio Vancouver implemented the project, a program that brings together students and city staff to find innovative solutions to Vancouver's problems. The interviewee expressed a desire for municipalities to find ways to create similar collaborations with youth on Vancouver Island.

5.2.7 Workforce

Both planners and seaweed aquaculture professionals supported the industry's growth in areas with a pre-existing aquaculture industry and a knowledgeable workforce who can quickly adapt to seaweed aquaculture. Focusing cultivation and processing sites in these areas may be a way to ensure that coastal communities do not go into decline as fishing becomes a less viable option, either due to reduced stocks or the enforced closure of salmon farms.

Not only will there be more jobs created cultivating the seaweed, but the wider industry will also offer employment. Keeping processing sites within the coastal communities and offering agritourism opportunities will also generate job creation.

One issue which a seaweed industry professional highlighted is that the jobs created will be seasonal. Despite this, workforce development plans are already in progress with the BC government to support the industry's growth.

5.2.8 Zoning Bylaws

All planners identified that making appropriate zoning bylaws is their best way of influencing the seaweed aquaculture industry. Seaweed aquaculture professionals also agreed that zoning that allows seaweed processing is one of the best ways for local municipalities to support the industry.

Some of the planners interviewed are already in the process of updating their zoning bylaws to allow a broader range of aquaculture processing activities. One planner said that many of the lots where aquaculture processing took place in previous decades were rezoned to accommodate the hospitality industry and are consequently now a non-conforming land use. However, this municipality is now reinstating industrial zoning to remove this non-conforming land use status and preserve these facilities for future use.

Another planner advocated for a similar course of action to be taken in their communities. They recently received an inquiry about a seaweed processing site, but the zoning for the location was inadequate. They were able to offer a temporary use permit while the zoning amendment is processed; however, as the community member did not own the land the processing site was on, they decided not to take this course of action. The planner stated that updating bylaws to include seaweed aquaculture would take the onus off the landowner of applying for rezoning. Many seaweed aquaculture businesses are new and would have to rent their processing sites, so they must convince the landowner that the rezoning process is worth pursuing. Having the correct zoning would allow for more opportunities for seaweed processing businesses to grow.

One seaweed aquaculture industry professional highlighted that it is not just the processing sites that are incorrectly zoned, but water zones can also restrict the growth of the aquaculture industry. They suggested that water zones should allow for seaweed aquaculture or aquaculture in general so that it can include multi-trophic aquaculture as well.

6.0 Recommendations

Below outlines the recommendations for planners facilitating their community in establishing or expanding the seaweed aquaculture in their region. These recommendations have been created by analysing the current research on the topic laid out in the literature review and analysing the data collected through document analysis and interviews as outlined in the findings section of this study. The themes identified in the interview data have formed the basis of the recommendations below. While planners generally agreed that while working in a small municipality, they cannot advocate for seaweed aquaculture, following these guidelines would be a suitable way to support this industry if the community wishes to establish this industry.

6.1 Official Community Plan (OCP)

An OCP is a plan for a community with which all future development must be in alignment. As stated by the local government planners interviewed in this study, one of the best ways for planners to support the seaweed aquaculture industry is to include it in the OCP. As seaweed aquaculture can help resolve many of the wicked problems facing communities today, there are ample opportunities to include this industry. Below includes information regarding how seaweed aquaculture could be incorporated into multiple sections of an OCP to help the community reach its goals. Examples of language used in OCPs which are supportive of the seaweed aquaculture industry can be found in Appendix E.

6.1.1 Food system resiliency

As outlined in the literature review, food security in Canada is a growing issue, and the food system resiliency of Vancouver Island is low as most of the food eaten here is imported from outside of the region. All planners interviewed agreed that food system resiliency is of growing concern amongst the communities they work in, and efforts to improve their resiliency are often met with public

approval. As seaweed aquaculture offers an opportunity for a food source that can be entirely grown and processed on Vancouver Island, supporting it in an OCP would allow a community to use this industry to increase their food system resiliency.

For example, The Town of Qualicum Beach is not currently home to any seaweed aquaculture producers at the time of writing. However, their OCP included a vision for sustainable food systems, which seaweed aquaculture can help to support:

“The vision for a sustainable Qualicum Beach has been defined in eight fundamental components that will enable and sustain the future of a vibrant Qualicum Beach: ...
4. Sustainable Food Systems” (Town of Qualicum Beach, 2018).

Many communities are also concerned about climate change impacting their food supplies. The Regional District of Nanaimo Electoral area H has created climate change policies targeted at protecting and increasing opportunities for local food systems:

“Climate Change Policies: ...
9. ability of local food are encouraged, and proposals that would reduce the future potential for local food production are discouraged.” (Comox Valley Regional District, 2014)

As suggested by an interview participant, when discussing food system resiliency from a planning perspective, it can be beneficial not to differentiate between aquaculture and agriculture as both are essential food production methods in coastal communities and the practices have a considerable influence over each other. If a planner is working within a community that practices both aquaculture and agriculture, they should ensure that both food production methods are included

together in the OCP wherever it is appropriate to draw attention to where the industries overlap, such as using seaweed for agri-feed and fertilizer. Local governments can also lobby higher levels of government to provide better policies and solutions for linking the two food productions methods. For example, the OCPs of rural communities are reviewed by provincial ministries, such as the Ministry of Agriculture, Food and Fisheries. Increasing awareness within the local and provincial government will not only will this raise the profile of seaweed aquaculture as an important part of the food system in coastal communities, but it will also highlight the links between the agriculture and aquaculture sectors. Understanding these links will result in a food system that is less reliant on outside input and provide policy developments which is more suitable for seaweed producers.

6.1.2 Climate Goals

Climate change is expected to have a life-changing impact on coastal communities. The environmental benefits of seaweed aquaculture may be useful in helping communities to achieve their climate goals. The environmental benefits of seaweed aquaculture have been outlined in the literature review, and the seaweed aquaculture professionals consulted believe there to be similar effects in BC waters. There is a desire from many professionals to create regulations for the industry based on scientific evidence. The seaweed aquaculture professionals interviewed in this process were keen to promote the environmental benefits of the practice to local and higher levels of government. While an environmental assessment of a site is vital before beginning to cultivate seaweed, including it in the OCP is a way to allow room for this method of climate action.

6.1.3 Economic Development

Economic development is of high importance to many coastal communities, particularly those in rural areas. The planners interviewed in this research indicated concern within their communities regarding their economic future as fishing and salmon farming is becoming a less reliable source of income. As many communities on the Central East Coast of Vancouver Island already partake in the

aquaculture industry, including seaweed aquaculture in long-range planning would be an easy transition for these communities as there is already the community knowledge and desire to expand the aquaculture industry. There are several ways in which seaweed aquaculture can contribute to a community's economic development.

Seaweed Cultivation

Include in the OCP a goal to increase or establish seaweed growth sites. Disused aquaculture sites should be a priority for becoming seaweed aquaculture sites rather than removing the infrastructure because it is a faster process to amend a current aquaculture tenure rather than start a new one. Expanding the use of active aquaculture sites to include seaweed and the current aquaculture use will allow community members who own these sites to produce more food within the same area and diversify their income.

The Town of Qualicum beach has expressed a desire to increase employment in the food and seafood industry amongst other sectors. As long as seaweed cultivation increases employment opportunities for local people it will be in line with the OCP.

“Section 3.3.6 - Economic Prosperity, Vision:

The need to travel outside the community is reduced by a range of local jobs for all ages by development of sectors such as:

- Agriculture and food industries;
- Seafood industry;” (Town of Qualicum Beach, 2018).

Seaweed Processing

Ensuring that facilities for processing the seaweed are available near the growth site is vital for the success of the seaweed aquaculture industry. Stating in the OCP that these facilities should be protected, and development of these facilities is encouraged will retain the facilities for future use and allow the development of new facilities. Not only is it logistically practical for the processing site to be in the same community as the cultivation site due to how rapidly seaweed can spoil. Having processing sites within the community will provide another opportunity for businesses and job creation.

An example of wording which is inclusive to the introduction of seaweed processing in an OCP comes from the Comox Valley Regional District:

“18. Economy and industry – policies (agriculture & aquaculture)

(2) Encourage the Comox Valley Economic Development Society to attract businesses of a scale and nature that complement and strengthen the agriculture and aquaculture industries in the rural areas.” (Comox Valley Regional District, 2014)

Agritourism

In recent decades many traditional fishing communities have invested in becoming tourist destinations to diversify and grow their economy. Seaweed aquaculture can assist with goals to increase tourism by offering tours and product tastings. Some OCPs on Vancouver Island already indicate a desire to expand the agritourism sector of marine industries as an economic opportunity, for example the Town of Qualicum Beach. These OCPs could be used as an example by other municipalities as to how to include agritourism in their own OCP.

“Section 3.3.4 – Sustainable Food Systems, Vision:

Tourism agencies and initiatives help to integrate the local food economy into the tourism experience in Qualicum Beach (e.g. agritourism). High-value and gourmet food are connected to the brand experience of Qualicum Beach.” (Town of Qualicum Beach, 2018)

6.2 Zoning

After including seaweed aquaculture in the OCP for a community, it is essential to look at the zoning bylaw to ensure the inclusion of land uses required for a thriving seaweed aquaculture industry.

Firstly, a planner should review the zoning of lots that currently include facilities that support the seaweed aquaculture industry. The purpose of doing this is to find out if any of the facilities are currently a non-conforming use. Any facilities which are of non-conforming use should be prioritised for re-zoning to ensure the preservation of the land use even if the landowner changes.

Secondly, the zoning bylaw should be updated to allow for processing seaweed in locations easily accessible from the seaweed cultivation site. Many zoning bylaws in small communities are several decades old because the community does not have the resources to rewrite them regularly. A review of the current zoning bylaw should be conducted to find zones that allow for activities similar to aquaculture processing, such as fish processing. If a complete rewrite of the zoning bylaw is not feasible, these zones could be prioritised for rewriting to allow seaweed processing sites. If a more extensive rezoning process is possible, it is recommended to rezone areas near docks and ports to allow seaweed processing.

The Comox Valley Regional District zoning bylaw includes two zones which are already suitable for seaweed processing, and they do not limit the type of seafood which can be processed on the lot:

“910 – Seafood Processing One (SP-1)

1. Principal Use

- i) On any lot:
 - a) Seafood processing and sales

911 – Seafood Processing Aquaculture Facility One (SPAF-1)

1. Principal Use

i) On any lot:

- a) Seafood processing
- b) Seafood retail sales” (Comox Valley Regional District, 2019)

The third recommendation is that all ocean areas that fall into the municipality’s jurisdiction be zoned to allow aquaculture. If desired, this zoning could be for seaweed aquaculture only, or it could permit all types of aquaculture and allow for multiple types of aquaculture to operate alongside each other. Having multiple types of aquaculture alongside each other can be environmentally beneficial as the seaweed can mitigate the adverse environmental effects caused by shellfish and finfish aquaculture. An instance of zoning inclusive to all types of aquaculture can be found in the City of Parksville:

“252 – Water (WX-1)

This zone intended to permit marine related uses over the surface of the water and foreshore.

252.1 Permitted Land Uses:

Aquaculture...” (City of Parksville, 2015)

More examples of Zoning Bylaws which are inclusive and exclusive to the cultivation and processing of seaweed can be found in Appendices A, B, C, and D.

6.3 Infrastructure

Available infrastructure for processing is one of the main factors limiting the expansion of the seaweed aquaculture industry on Vancouver Island. If a municipality wishes to support the industry, a good first step would be to create inventory of the infrastructure, both active and disused, within the community, which could benefit the seaweed aquaculture industry. This inventory will draw attention to the importance of the facilities to help protect them from future development. Protecting from future

development does not mean that the facility must always stay the same. However, it is important to ensure the land is not used in a way that will prevent seaweed processing within the necessary time frame.

Some communities do not have the capacity to process the seaweed themselves. In these cases, the community's capacity for seaweed cultivation will depend on how quickly the seaweed can be transported from the cultivation site to the processing site. It would be beneficial to evaluate these transportation routes and their reliability before facilitating a community in establishing the seaweed growth sites.

There are many communities on Vancouver Island that are already heavily involved with the aquaculture industry. Seaweed aquaculture would be a natural fit for these communities, and planners working there should make preserving infrastructure a top priority in their communities.

The City of Courtenay OCP included policies regarding the expansion of local food processing facilities. These facilities could include infrastructure which is appropriate for processing and transporting seaweed grown in Courtenay and the surrounding smaller communities.

“Objective 7: ... Policies: ...

The City will support food security actions within the community including ensuring that sufficient land and incentives exist to encourage the growth of local food processing facilities and industries, including those for seafood, recognizing that the seafood industry is an important part of the regional economy.” (City of Courtenay, 2016)

6.4 First Nations

First Nations groups on Vancouver Island are heavily involved with the seaweed aquaculture industry. The only government interaction most of the seaweed aquaculture professionals interviewed

have experienced is with First Nations governments. Including seaweed aquaculture in broader agricultural plans introduces a fantastic opportunity to open the conversation with these First Nations groups and start incorporating these traditional food sources into the wider food system of an area. If there is a First Nation in close proximity to the municipality, an invitation should be extended to them to participate in creating all agricultural plans.

The Comox Valley Regional District OCP has already indicated the importance of building community partnerships with their neighbouring K'ómoks First Nation as a key player in their local aquaculture industry:

“73. Community partnerships ...

(5) Build alliances by fostering regional district communication with K'ómoks First Nation, the BC Shellfish Growers Association and other stakeholders from the aquaculture industry, and the Islands Trust.” (Comox Valley Regional District, 2019)

6.5 Stakeholder Understanding

Both planners and seaweed aquaculture professionals indicated that a lack of public understanding regarding the practice might limit the growth of the industry as people are unsure of the impact it will have on their lives. It is recommended to invite local seaweed aquaculture professionals to participate in community engagement events regarding local food production, climate change, and economic development to help community members understand the benefits of the industry in resolving these issues. The involvement of the seaweed aquaculture professionals can be in a formal capacity, such as an OCP review or a zoning amendment, or for public education purposes, such as including a seaweed aquaculture company in a local agricultural show.

The Comox Valley Regional District rural OCP includes two valuable sections on public awareness regarding the aquaculture industry:

“18. Economy and industry – policies (agriculture & aquaculture) ...

(5) Encourage and facilitate where possible public education initiatives that convey the impacts of living within working agricultural and aquaculture landscapes in order to advise of possible noise, odour, dust and other activities associated with active farming operations.

73. Community partnerships ...

(7) Improve public awareness of the importance of the aquaculture industry, particularly among people living in close proximity to or within areas designated agricultural area and rural area and the foreshore of the marine environment by: supporting policies that protect land designated agricultural area, the working landscapes of the rural area, and the water quality of the marine environment for current and future food production through partnerships.’ (Comox Valley Regional District, 2019)

6.6 Summary of Recommendations

1. Include seaweed aquaculture in the following section of a community’s OCP:
 - a. Food security
 - b. Climate Goals
 - c. Economic Development
2. Amend zoning bylaw to:
 - a. Rezone lots with seaweed aquaculture infrastructure to make the use conforming status.
 - b. Allow for seaweed processing close to ports and docks.
 - c. Include waterfront zones where seaweed aquaculture is permissible
3. Create an inventory of the active and disused infrastructure which supports the seaweed aquaculture industry.

4. Include local First Nations who are practicing seaweed aquaculture in local agricultural or food plans.
5. Invite local seaweed producers to participate in public engagement activities to increase awareness of the industry and associated impacts on the entire community.

7.0 Conclusion

Three research questions were explored over the course of this study, and a summary of the findings are presented below. The questions are as follows:

1. What benefits can the seaweed aquaculture industry offer coastal communities in BC?
2. Are communities in the Central East Coast of Vancouver Island expected to be receptive to the seaweed aquaculture industry?
3. What planning practices are required to establish a sustainable seaweed aquaculture industry in BC?

The literature review indicated that there had been extensive work on the benefits of seaweed aquaculture worldwide. At the time of writing, there has been no research conducted in BC to determine whether the same results are seen in this location. Semi-structured interviews with seaweed aquaculture professionals in BC are confident that establishing seaweed aquaculture can bring the same economic, environmental, and food security benefits seen in other parts of the globe. More research explicitly targeted at BC would be beneficial for making evidence-based policies regarding the industry.

The document analysis revealed a significant desire from rural communities within the Central East Coast of Vancouver Island to expand their aquaculture industries. The successful adoption of seaweed aquaculture has occurred in other parts of Vancouver Island, including the west coast and the Discovery Islands. From this evidence, it can reasonably be expected that the industry would be a suitable economic pursuit on the central east coast. Much of the infrastructure and knowledge required to operate seaweed aquaculture effectively is the same as other aquaculture pursuits, and communities have been shown to adapt to cultivating seaweed readily.

Through semi-structured interviews, the researcher found that the two main ways planners can aid the seaweed aquaculture industry are appropriate Zoning Bylaws that allow for the processing and cultivation of seaweed and, secondly, OCPs that support the expansion of the seaweed aquaculture industry. There are also steps planners can take to raise awareness of the practice amongst community members and preserve their beneficial infrastructure.

This study will be useful to planners working in rural coastal communities in BC, particularly those who already have an established finfish or shellfish aquaculture industry. These communities can quickly adapt to the industry, which could supplement income or replace the previous forms of aquaculture that are no longer viable in the area. While planners cannot advocate for the industry specifically, they can allow room for it in planning bylaws should community members decide to establish this industry. Planners can also collaborate with seaweed aquaculture professionals to raise awareness of the industry so community members understand how it could impact them.

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Appendix A, Examples of Beneficial Zoning Bylaws for Seaweed

Aquaculture Cultivation

The following zones are beneficial for seaweed aquaculture because they do not limit the type of aquaculture. These zones could be used for marine plants, shellfish, or finfish. It may not be beneficial to zone exclusively for seaweed aquaculture because this would remove the possibility for multi-trophic aquaculture which would bring additional economic and food security benefits.

Rural Comox Valley Regional District Zoning Bylaw, No. 520

Excerpt from 801 – Rural Eight (RU-8)

1. Principal Use

i) On any lot:

f) Aquaculture

City of Parksville Zoning and Development Bylaw, No. 2000

Excerpt from 252 – Water (WX-1)

This zone intended to permit marine related uses over the surface of the water and foreshore.

252.1 Permitted Land Uses:

Aquaculture...

Regional District of Nanaimo, Zoning Bylaw, No. 500

Excerpt from Resource Management 1-9 (RM1-RM9)

Permitted Uses:

... Aquaculture

Excerpt from Rural 1-9 (RU1-RU9)

Permitted Uses:

... Aquaculture

Excerpt from Water 1 (WA1)

Permitted Uses:

Aquaculture

Boat Ramp

Appendix B, Examples of Inappropriate Zoning Bylaws for Seaweed Aquaculture Cultivation

The following zones are not beneficial for seaweed aquaculture because they limit the type of aquaculture which can be performed there.

Rural Comox Valley Regional District Zoning Bylaw, No. 520

Excerpt from 807 – Aquaculture (AQ)

1. Principal Use

i) On any lot:

a) Shellfish aquaculture

This zone is not beneficial for seaweed aquaculture as it only allows for shellfish aquaculture and other types of aquaculture could not be carried out on this lot.

District of Ucluelet Zoning Bylaw, No. 1160

Excerpt from 303 - Permitted and Prohibited Uses

303.4 Without limiting the generality of Subsection 303.1, the following uses are prohibited in all

Marine Zones (M-1 through M-5):

(1) Commercial or recreational aquaculture;

Appendix C, Examples of Beneficial Zoning Bylaws for Seaweed

Processing

The following zones include permission for seafood processing or sales. Permission for seafood processing and sales is beneficial to the seaweed aquaculture industry as it does not limit the use of specific seafood types. Therefore, the lot can accommodate seaweed processing and sales, and facilities can be shared amongst processors if necessary.

Rural Comox Valley Regional District Zoning Bylaw, No. 520, 2019

Excerpt from 910 – Seafood Processing One (SP-1)

1. Principal Use

i) On any lot:

- a) Seafood processing and sales

Excerpt from 911 – Seafood Processing Aquaculture Facility One (SPAF-1)

1. Principal Use

i) On any lot:

- a) Seafood processing
- b) Seafood retail sales

City of Parksville Zoning and Development Bylaw, No. 2000

Excerpt from 206 – Industrial (I-1)

This zone is intended to provide land for a diversity of light and medium industry uses.

206.1 Permitted Land Uses

Seafood Processing ... subject to all processing activity being fully contained within a building.

206.9 Conditions of Use

Notwithstanding Section 206.1 no seafood processing which creates noxious or offensive odours shall be permitted.

City of Nanaimo, Zoning Bylaw No. 4500

Excerpt from Part 13 – Industrial

I1 - This zone provides for clean industrial uses, as well as commercial uses which require large lots.

13.2.3 Notwithstanding Subsection 13.2.1, the following uses shall be permitted on a site specific basis:

... Seafood Processing

I4 - This zone provides for heavy industrial development that is not compatible with residential uses.

Permitted uses:

... Seafood Processing

Regional District of Nanaimo, Zoning Bylaw, No. 500

Excerpt from Industrial 5 (IN5)

Permitted Uses:

a) Heavy Industry

Heavy industry means the use of land, buildings or structures for the storage, collection, processing, repairing, salvage or recycling of a product, article, substance, material, fabric or compound and includes a vehicle wrecking yard and seafood processing, but specifically excludes a waste disposal site.

Appendix D, Examples of Inappropriate Zoning Bylaws for

Seaweed Processing

These zones accommodate other forms of seafood production well but do not include seaweed.

Therefore, the lot would have to go through the process of rezoning to be beneficial for the seaweed producers, which would inhibit the establishment of the industry.

District of Tofino, Zoning Bylaw 770

Excerpt from Industrial 5 (IN5)

This District provides for the development of heavy industrial uses.

34.1 Uses Permitted:

1. Fish, meat and poultry processing;

Excerpt from Waterfront Commercial District (W1)

This District provides for the accommodation of a broad range of commercial enterprises primarily oriented to water users and water traffic.

37.1 Uses Permitted:

7. Retail sale of live or fresh fish including shellfish;

Excerpt from Waterfront Industrial District (W2)

This District provides for the accommodation of industries that are related to the fishing industry,
marine transportation, shipbuilding and maintenance.

38.1 Uses Permitted:

6. Fish products industry

District of Ucluelet Zoning Bylaw, No. 1160

Excerpt from Marine Zones M-1 to M-4

Permitted Uses, (1) Principal:

- (b) Fish Buying & Selling Stations

Excerpt from Tourist Commercial Waterfront (CS-6)

Permitted Uses, (1) Principal:

- (j) Fish Buying and Selling Station

Appendix E, Examples of Official Community Plan (OCP)

Language which is Supportive of Seaweed Aquaculture

Many OCPs that are in use by communities on Vancouver Island already include language inclusive of all types of aquacultures and do not limit themselves to ones that are already practiced by the community.

Below are excerpts from these OCPs, which show language inclusive to seaweed aquaculture.

Rural Comox Valley Official Community Plan

Excerpt from 17. Economy and industry – objectives (agriculture & aquaculture)

- (2) To support people wanting to pursue a career and lifestyle in agriculture and/or aquaculture by removing barriers and supporting intact farm and aquaculture operations.
- (3) To promote and strengthen the long-term viability of renewable resource-based uses in the Comox Valley, including agriculture, aquaculture industries and forestry.
- (14) To permit a wide range of employment uses including those in the agricultural/aquaculture sector...

Excerpt from 18. Economy and industry – policies (agriculture & aquaculture)

- (1) Build strong alliances by fostering communication with the agriculture and aquaculture industries, the farmer`s institute and the farmer`s market.
- (2) Encourage the Comox Valley Economic Development Society to attract businesses of a scale and nature that complement and strengthen the agriculture and aquaculture industries in the rural areas.

- (3) Liaise with improvement districts, agencies and ministries to effectively address the provision of infrastructure and services that the agriculture and aquaculture industries require.
- (5) Encourage and facilitate where possible public education initiatives that convey the impacts of living within working agricultural and aquaculture landscapes in order to advise of possible noise, odour, dust and other activities associated with active farming operations.
- (8) Recognize that the sustainability and productivity of the marine environment for shellfish and aquaculture protection and for active harvesting is critical to K'ómoks First Nation and other aquaculture food producers. Work with K'ómoks First Nation, senior government, the Islands Trust, non-government organizations and local residents to protect the marine environment shellfish resources and to secure the sustainable harvesting of its resources.
- (11) Maintain effective communication with stakeholders from agriculture and aquaculture industries in order to support local agriculture and protect lands designated ALR and suitable non-ALR lands for the purpose of agricultural production.
- (12) Strengthen the retention and expansion of agriculture and aquaculture industries and small-scale agriculture and aquaculture operations with due regard to the water quality of the marine environment.
- (13) Encourage the establishment of value-added processing structures or uses for agriculture and aquaculture industries in locations where potential land use conflicts can be mitigated, and with due regard to the water quality of the marine environment.

Excerpt from 47. Rural settlement areas – policies (industrial)

- (1) Consider zoning amendments and temporary use permits for industrial uses such as ..., agriculture and aquaculture, ...

Excerpt from 49. Rural settlement areas – policies (industrial - agriculture)

- (5) Support limited on-site sales of aquaculture products that meet legislative requirements in order to promote economic activities.

Excerpt from 50. Rural settlement areas – policies (industrial - upland aquaculture)

- (2) Promote establishment of aquaculture industries and related uses such as small-scale aquaculture operations, food processing establishments, distribution centres, farmers' markets and research facilities
- (5) Support limited on-site sales of aquaculture products that meet legislative requirements in order to promote economic activities.

Excerpt from 57. Agricultural areas – objectives

- (2) To promote agriculture and aquaculture as an important economic sector of the Comox Valley.

Excerpt from 58. Agricultural areas – policies (general)

- (12) Require an applicant proposing to subdivide land in the agricultural area to demonstrate how the proposal will benefit the agriculture and aquaculture industries

- (15) Permit food processing structures and uses supporting aquaculture industries on lands designated agricultural area when the requirements of the agricultural land reserve use, subdivision and procedure regulation are met.

Excerpt from 70. Coastal areas – policies

- (1) Permit industrial marine and aquaculture uses in the coastal area designation, except for areas within the K'ómoks Estuary where they are prohibited.

- (2) Notwithstanding above sub-section (1) sustainability and productivity of the K'ómoks Estuary is recognized as being critical for harvesting of aquaculture to K'ómoks First Nation, and it is recognized that the KFN may choose to proceed with aquaculture activities within the estuary at any time.

- (5) Support dock-side sales and limited on-site sales of aquaculture products that meet legislative requirements to promote economic activities.

- (6) Work with aquaculture industry stakeholders and small-scale aquaculture operations to support water flow into fish-bearing river systems of the Comox Valley.

Excerpt from 73. Community partnerships

- (5) Build alliances by fostering regional district communication with K'ómoks First Nation, the BC Shellfish Growers Association and other stakeholders from the aquaculture industry, and the Islands Trust.

- (7) Improve public awareness of the importance of the aquaculture industry, particularly among people living in close proximity to or within areas designated agricultural area and rural area and the foreshore of the marine environment by: supporting policies that protect land designated agricultural area, the working landscapes of the rural area, and the water quality of the marine environment for current and future food production through partnerships.

- (18) Continue to work in partnership with provincial agencies and the agriculture and aquaculture industries to create a transportation network of land, rail, sea and air that supports food production and distribution of Comox Valley products.

- (22) Liaise with improvement districts, agencies and ministries to effectively address the provision of infrastructure and services that the agriculture and aquaculture industries require.

City of Courtenay Official Community Plan

Excerpt from 4.5. Agricultural

4.5.3 Policies

- 2) The City supports expanding the processing of locally produced agricultural products;

Excerpt from 10. Industrial Development

Encourage the development of value-added industry in forestry and aquaculture.

Excerpt from Objective 7:

Policies:

- 1) The City will support food security actions within the community including ensuring that sufficient land and incentives exist to encourage the growth of local food processing facilities and industries, including those for seafood, recognizing that the seafood industry is an important part of the regional economy.

Town of Qualicum Beach Official Community Plan

Excerpt from Section 3.3 – Visionary Principles

The vision for a sustainable Qualicum Beach has been defined in eight fundamental components that will enable and sustain the future of a vibrant Qualicum Beach: ...

4. Sustainable Food Systems

Excerpt from Section 3.3.4 – Sustainable Food Systems

Vision:

Tourism agencies and initiatives help to integrate the local food economy into the tourism experience in Qualicum Beach (e.g. agritourism). High-value and gourmet food are connected to the brand experience of Qualicum Beach

Excerpt from Section 3.3.6 - Economic Prosperity

Vision:

The need to travel outside the community is reduced by a range of local jobs for all ages by development of sectors such as:

- Agriculture and food industries;
- Seafood industry;

Regional District of Nanaimo, Electoral Area E - Nanoose, Fairwinds & Red Gap, Official Community

Plan

Excerpt from 2.2 – Coastal Zone

Objectives:

3. Support the development of shellfish aquaculture in Nanoose Bay in a manner that does not conflict with residential and recreational uses of the coastal zone and harbour.

Regional District of Nanaimo, Electoral Area H - Deep Bay, Bowser & Qualicum Bay, Official

Community Plan

Excerpt from RGS Goal 5: Enhance Rural Integrity

This OCP seeks to enhance rural integrity by supporting agricultural, aquaculture, forestry and small-scale economic and tourism opportunities in the residential areas outside Village Centres.

Excerpt from 2.5 Climate Change and Energy

Climate Change Policies:

9. Agricultural land and aquaculture areas are recognized as necessary for current and future local food production. Proposals to increase production and availability of local food are encouraged, and proposals that would reduce the future potential for local food production are discouraged.

Excerpt from 3.1 Agriculture and Aquaculture

Objectives:

2. Support the aquaculture industry by protecting marine water quality and supporting associated landbased activities in suitable locations.
3. Recognize and protect the needs and activities of agricultural and aquaculture operations when considering residential uses on adjacent lands and vice versa.

Excerpt from 4.6 Marine Transportation

Marine Transportation Policies:

1. The Regional District encourages the tourist, recreational, fishing and aquaculture industries to continue their use of Deep Bay Harbour.

Excerpt from 5.8 Deep Bay

Objectives:

1. Support a diversity of businesses related to the marine, aquaculture and tourism industries.
3. Encourage commercial development of the area near the Deep Bay Harbour in a way that compliments and supports marine, aquaculture, and tourism activities, or provides services for local residents, while supporting Bowser Village Centre as the commercial and service centre for the area.

Deep Bay Policies:

1. Redevelopment in the existing Tourist Commercial designation in the Deep Bay area is encouraged where it compliments and supports the marine, aquaculture and tourism industries centred around the harbour, and where sufficient off-street parking is provided.
2. Rezoning proposals for tourist commercial use in the Rural Residential or Rural designations near the Deep Bay Harbour may be supported if the proposal compliments and supports the marine, aquaculture or tourism industries.

Service Commercial Policies for Deep Bay Southwest:

17. In Deep Bay Southwest, service commercial uses that complement and enhance the aquaculture industry, aquaculture research, and marine tourism and business are supported.

The following excerpts have been included because removing the word 'shellfish' would make these sections of the OCP supportive of seaweed aquaculture as well as the pre-existing shellfish aquaculture.

Excerpt from RGS Goal 8: Enhance Food Security

This OCP recognizes the value of agricultural land for land-based farming, and marine areas for ~~shellfish~~ aquaculture, for present and future food production. It also recognizes the unique position of this area to grow an economy related to aquaculture and processing.

Excerpt from 2.4 Marine Environment

Objectives:

3. Support the development of ~~shellfish~~ aquaculture.

Marine Environment Policies:

3. The Plan recognizes the existing shellfish aquaculture leases. All water lots leased for shellfish aquaculture purposes shall be zoned accordingly.

Excerpt from 5.3 Rural

Rural Policies:

6. ... This Plan does support rezoning for additional light industrial use, or “service commercial” use in the Rural designation provided it is a value-added ~~shellfish~~ aquaculture use or small scale and suitable to the location

Appendix F, Guidebook: Planning for Seaweed Aquaculture

Guidebook begins on next page.

Planning for Seaweed Aquaculture

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This guidebook has been produced as part of a Major Project submitted in partial fulfillment of the requirements for the Degree of Master of Community Planning at Vancouver Island University.

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What is seaweed aquaculture?

Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Seaweed cultivation is widespread in coastal Asian countries and is gaining popularity worldwide. Not only does seaweed aquaculture provide food and economic development, but it also has numerous environmental benefits, including habitat restoration and carbon sequestration.



Why is Seaweed Aquaculture important to Vancouver Island?

Aquaculture is a significant industry in many Vancouver Island communities. Historically, these communities have focused on cultivating shellfish species, e.g. oysters, as well as finfish species, e.g. salmon. Recently seaweed aquaculture has also been adopted by Vancouver Island's coastal communities.

Communities that rely on fish for the majority of their income are increasingly concerned about the longevity of this industry due to declining fish stocks and the closure of salmon farms. Seaweed could offer an alternative economic pursuit that allows people to continue to find employment in their home communities.

Some First Nations communities on Vancouver Island have successfully adopted seaweed aquaculture in their traditional territories. Introducing this industry provides an opportunity for members of these Nations to access employment in their home community.

Vancouver Island has a thriving tourism industry, and seaweed aquaculture can fit nicely alongside this industry. The busy season for seaweed aquaculture comes before the high tourist season, which means that seaweed aquaculture can provide employment during previously unprofitable times.



How can planners support the Seaweed Aquaculture industry?

Seaweed aquaculture has the potential to be beneficial for many coastal communities on Vancouver Island. There are several ways planners can help support the expanding seaweed aquaculture industry.

- Official Community Plans (OCP)
- Zoning Bylaw
- Infrastructure inventory
- Include First Nations who practice seaweed aquaculture in local food plans
- Invite local seaweed producers to community engagement events

Primarily, planners can create Official Community Plans (OCP) and Zoning Bylaws that support the industry. Examples of language can be found later in this guidebook.

Official Community Plan

An OCP promoting the aquaculture industry's growth, economic development, improved food security, and climate action all support the seaweed aquaculture industry. Including mention of agriculture and aquaculture pursuits in the OCP will help to draw connections between the two food-producing industries, for example agri-feed and fertilizer.

Zoning Bylaw

Zoning Bylaws need to be more precise than OCPs. To successfully establish the seaweed aquaculture industry, Zoning Bylaws must provide zones for seaweed growth and processing as it spoils very quickly once removed from the ocean. Allowing the sale of seaweed products from the processing site would be ideal. This additional use would allow small businesses to provide further employment and retain maximum profits within the community.



Infrastructure inventory

Outside of these legal documents, there is crucial work planners can do. Many communities already have much of the valuable infrastructure for the seaweed aquaculture industry. Planners can create an inventory of all their active and disused infrastructure to ensure protection from development which would remove this use. Vital infrastructure for the seaweed aquaculture industry which is a non-conforming use should be re-zoned to ensure preservation of this infrastructure.

First Nations

First Nations groups on Vancouver Island are heavily involved with the seaweed aquaculture industry. Often, the only government interaction seaweed professionals have had is with First Nations governments. Planners should include First Nations who are practicing seaweed aquaculture in local agricultural or food plans. Including First Nations groups in these plans will better the understanding of this aspect of the local food system and help build relationships between local governments and neighbouring First Nations.

Local seaweed producers

There is little public understanding of the impacts of the seaweed aquaculture industry. Planners can invite local seaweed producers to participate in public engagement to increase awareness of the industry and potential community impacts. There is often concern that seaweed aquaculture sites will disrupt ocean views. However, the visual impact of these farms is very minimal. The positive impacts the industry can bring to a community far exceed the negatives.



Zoning Bylaw Examples

Seaweed Cultivation

Regional District of Nanaimo, Zoning Bylaw, No. 500, Excerpt from Water 1 (WAI)

Permitted Uses:

- Aquaculture
- Boat Ramp

This zone is beneficial for seaweed aquaculture because it does not limit the type of aquaculture conducted on the lot. These zones can be used to cultivate marine plants, shellfish, or finfish. It may not be beneficial to zone exclusively for seaweed aquaculture because this would remove the possibility of cultivating several different aquatic species on one site, known as multi-trophic aquaculture. Growing multiple species on one lot can bring additional economic and food security benefits.

Seaweed Processing

Rural Comox Valley Regional District Zoning Bylaw, No. 520, 2019, Excerpt from 910 – Seafood Processing One (SP-1)

Principal Use

On any lot:

- Seafood processing and sales

This zone would be beneficial for seaweed processing after harvesting as it does not limit the seafood processing to a specific product. Allowing for different types of seafood processing means that facilities can be shared amongst different producers. It would benefit small businesses to sell their products to maximize profits. Therefore, allowing the sale of seafood on the same lot as processing will permit this activity.



OCP Language Examples

Establish or grow aquaculture industry

In communities who wish to establish or grow their aquaculture industry, the OCP wording should not limit itself to the pre-existing aquaculture practices. If a community only wishes to introduce seaweed aquaculture, this can also be specified. For example:

"Promote establishment and retention of (seaweed) aquaculture industries."

"Promote (seaweed) aquaculture as an important economic sector of *Community Name*."

Public understanding

Public understanding is vital for the successful integration of the seaweed aquaculture industry into a community, and OCPs can include statements, such as the following, to encourage public education around this topic. For example:

"Improve public awareness of the importance of the aquaculture industry, particularly among people living in close proximity to or within areas designated agricultural area and rural area and the foreshore of the marine environment."

Local food production

If the community wishes to encourage local food production in general and not limit themselves to the aquaculture industry specifically. In that case, the below wording can be used. Local food production has benefits, including increased food security, resiliency, and economic development. Seaweed aquaculture is a form of local food production and will be permissible under this wording. For example:

"Agricultural land and aquaculture areas are recognized as necessary for current and future local food production. Proposals to increase production and availability of local food are encouraged, and proposals that would reduce the future potential for local food production are discouraged."

"*Community Name* will support food security actions within the community including ensuring that sufficient locations and incentives exist to encourage the growth of local food processing facilities and industries, including those for seafood, recognizing that the seafood industry is an important part of the regional economy."



Value-added Tourism

Tourism can be paired well with the seaweed aquaculture industry as the busy seasons for both industries do not coincide. Encouraging seaweed aquaculture professionals to also participate in value-added tourism activities would benefit the economic development of coastal communities. For example:

"Encourage the development of value-added industry in aquaculture."

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