

# **Food Sovereignty and Community Development: Shellfish Aquaculture in the Nanwakolas First Nations**

**by  
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# Approval

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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:

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## Abstract

Aquaculture is promoted by governments and industry as a solution to the impending crisis of a growing and hungry world population, although technological solutions to food shortages have historically had social consequences. In partnership with the Nanwakolas Council, we researched the social and economic impacts of land-based aquaculture development with a focus on a potential shellfish hatchery. The two aims of the project were 1) to develop a Sustainability Assessment tool that the community could use to assess such projects and 2) to investigate the likely impacts of a potential shellfish hatchery in relation to food systems. First, we found that the Nanwakolas' existing Community Wellbeing Wheel could be developed into a Sustainability Assessment framework by testing it with a community dialogue about a potential shellfish hatchery. We identified gaps in the first iteration of the framework as recommended improvements in several sustainability dimensions, along with the proposed new sustainability dimension of Community Capacity. Next, we explored a shellfish hatchery from the perspective of food sovereignty using the Nyéléni conference principles as an analytical framework to analyze interview and dialogue responses. We isolated some of the strengths and weaknesses of a shellfish hatchery for Nanwakolas food sovereignty, particularly highlighting ways in which this non-traditional method of food production might build sovereignty and resource governance capacity. Additionally, our results indicate that a discussion between consumption vs. commodification of community food resources over-simplifies the possible paths to food sovereignty, as defining production can itself help build food sovereignty. Lastly, we found Community Capacity to be an underlying limit to food sovereignty, but also something that the Community Wellbeing Wheel could specifically address through future community dialogue.

**Keywords:** Land-based Aquaculture, Shellfish Aquaculture, Blue Revolution, Sustainable Community Development, First Nations, Food Sovereignty

## **Dedication**

To my parents, for never doubting that moving around the country in search of education is a worthwhile pursuit.

To my colleagues in REM, whose engaging conversations always helped to connect what sometimes seemed like esoteric academic pursuits to matters in the real-world.

And to Aly, whose empathy, curiosity and laughter sustained me through this challenging pursuit.

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I am so thankful that Dr. Evelyn Pinkerton was able to join my project as a supervisor for her thought-provoking questions and deep knowledge of indigenous resource management issues in British Columbia. Her guidance encouraged my approach and instilled confidence that my findings might contribute meaningfully to indigenous communities.

The broader research project of which I was a part could not have occurred without the creativity and vision of Chris Roberts at the N<sub>a</sub>nwa<sub>k</sub>olas Council. His connections with the members, his generosity with his time and his vision for the future of the N<sub>a</sub>nwa<sub>k</sub>olas communities catalyzed our research partnership. I would also like to thank our key informants and dialogue participants for their willingness to share with us. I look forward to engaging further with the N<sub>a</sub>nwa<sub>k</sub>olas Council to bring the findings of our research partnership toward meaningful outcomes. I would like to acknowledge my gratitude for financial support of this project from the N<sub>a</sub>nwa<sub>k</sub>olas Council, MITACS, and the Social Sciences and Humanities Research Council.

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## List of Acronyms

LBA	Land-based Aquaculture
RAS	Recirculating Aquaculture Systems
SCD	Sustainable Community Development
CWCSP	Community Wellbeing and Capacity Strengthening Plan
CCF	Community Capital Framework
CCS	Community Capital Scan
CWBW	Community Wellbeing Wheel
CWB	Community Wellbeing
MFN	(Nanwakolas) Member First Nations

# Chapter 1.

## Introduction

### 1.1 Can Aquaculture Sustainably Feed the Future?

Aquaculture is emerging as one solution to the impending crisis of a growing world population facing food shortages, but technological solutions to hunger have historically had social consequences. The United Nations predicts that the global population will reach 9.7 billion by 2050 (UNDESA, 2015). Rising incomes and standards of living have contributed to an increase in per capita annual fish consumption (from 9.9kg in the 1960s to 19.2kg in 2012, global average): a trend which is expected to continue. The UN Food and Agriculture Organization asserts in their annual report *The State of World Fisheries and Aquaculture* that the future population will require more fish to ensure food security; meanwhile, the fraction of assessed stocks fished within biologically sustainable levels has exhibited a decreasing trend, declining from 90 percent in 1974 to 71.2 percent in 2011 (*The State of World Fisheries and Aquaculture*, 2014). Scholars, policy-makers and industry analysts expect a “blue revolution” – a growth aquaculture production as a solution to these concomitant challenges (Kobayashi et al., 2015). However, technological and production-oriented solutions to hunger through history have sometimes disadvantaged the very communities in which production is based. The green revolution left a legacy of inequality and environmental degradation in the developing countries it aimed to feed (Horlings & Marsden, 2011).

A growing and global aquaculture industry has emerged in recent years. Besides isolated societies through history, fish and shellfish have remained a food that is predominantly wild-caught as opposed to domesticated and cultivated (Rabanal, 1988). The balance has shifted in the last half-century as aquaculture production has increased significantly to supplement demand for seafood protein (B. Costa-Pierce, 2010). *The State of World Fisheries and Aquaculture* (2014) provides an overview on the growth over time of the aquaculture industry. The global trend indicates that capture fisheries have produced relatively consistent amounts while aquaculture adds increasingly more to the total amount of seafood annually. In 2012, 42.2 % of the total fish produced came from aquaculture, compared with 25.7% in 2000 and 13.4% in 1990. The global

distribution of aquaculture production is not even; for example, China alone produced 61.7% by volume in 2012, and the top 15 producing countries accounted for 92.7% of all production.

Many modern conventional forms of aquaculture have raised issues of social and environmental sustainability. Feed for higher trophic level species often comes from wild forage fish that subsistence fisherpeople may depend on creating scarcity for coastal populations who cannot compete with global purchasers (Alder, Campbell, Karpouzi, Kaschner, & Pauly, 2008; BA Costa-Pierce, 2012; Metian, 2009; Naylor et al., 2009). The large capital investment associated with aquaculture frequently requires backing from multinational corporations that do not necessarily distribute economic benefits to local communities (Primavera, 2006; Volpe & Shaw, 2008). One of the most prevalent forms of aquaculture in North America is raising high trophic-level fish (which typically fetch the highest market prices) in marine net-pens. Such operations have been shown to result in sea lice infestations, fish escapes and waste leakage into surrounding marine ecosystems leading to eutrophication (Diana, 2009; Frazer, 2009; Glover et al., 2013; Krkosek et al., 2007; Volpe & Shaw, 2008).

Innovations in technology and practice have the potential to initiate a shift towards a sustainable course for aquaculture. Integrated Multitrophic Aquaculture is an ecological engineering innovation which integrates multiple trophic levels within a single aquaculture system. By cultivating various extractive species (e.g. seaweed, suspension feeding bivalves) in proximity to carnivorous finfish, both the ecological and economic sustainability of aquaculture can be addressed. The bioremediative services of the lower trophic level species alleviate the burden of fish waste while the marketable output of an aquaculture operation is diversified (Troell et al., 2009). Land-based Aquaculture (LBA) is an emergent point of interest for both research and industry, particularly Recirculating Aquaculture Systems (RAS). RASs offer several advantages in sustainability as they consume very little water, do not require pesticides or antibiotics and can be in a variety of locations (e.g. see Martins et al., 2010; Summerfelt, Wilton, Roberts, Rimmer, & Fonkalsrud, 2004). Aquaponics combines the approach of multiple trophic levels with recirculating aquaculture by hydroponically growing plants in effluent from fish tanks (Love et al., 2014; Rakocy, 2012). Innovations in sustainable aquaculture are reviewed in greater detail in the literature review.

## 1.2 The Non-Technical Knowledge Gap in Aquaculture Research: Considering Food Systems

Research and innovation in sustainable aquaculture has primarily focused on technical and biological advancements in production as opposed to the social and economic systems within which production is embedded. History illustrates the hazards of technological solutions for food shortages which occur in the absence of coincident social change and consideration. The Green Revolution was a revolution in food production in the mid-20<sup>th</sup> century which significantly increased food supply using fertilizers, pesticides and high-yield crop varieties. But the era resulted in a concentration around agro-industrial systems and left a legacy of inequitable distribution and access, particularly in the developing world (Brummett, Lazard, & Moehl, 2008; Horlings & Marsden, 2011). The terminology of the “Blue Revolution” is emerging within sustainable aquaculture literature to compare the potential productivity gains from aquaculture innovation to the Green Revolution (e.g. see Klinger & Naylor, 2012; Kobayashi et al., 2015; Metian, 2009; “The blue revolution: A new way to feed the world,” 2003). The comparison stresses the importance of considering the socio-economic dimensions of aquaculture as the industry develops. Jennifer Silver highlights the way that aquaculture has been promoted in sustainable development discourses by industry and governments as an efficient and uncomplicated solution to feed and employ coastal communities while reducing pressure on wild-growing fish stocks. Her particular analysis challenges this assertion in the case of shellfish aquaculture in BC, where increased aquaculture production has not had clear benefits for coastal communities (Silver, 2013). Martins and colleagues (2010) conclude a technical review of LBA developments in Europe by acknowledging that many of the engineering advancements need to be understood in the context of the communities and societies that will use them.

A food systems approach encourages looking broadly at food and food shortage as a complex interconnection of issues in place-based contexts and includes the rights-based approach of *food sovereignty* (Koc, Sumner, & Winson, 2017). Conventional neoliberal approaches to hunger and food insecurity after World War II focused primarily on increasing quantity through technological advancements in production (Clapp, 2014). In 1981, Amartya Sen illustrated that hunger was deeply related to people’s ability to access food, or, to produce, buy or trade for it (1981). Modern definitions of food

security contain the language of access. The UNFAO states that “food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (UNFAO, 2001). In the book “Critical perspectives in food studies” Koc and colleagues comprehensively cross disciplines and consider social factors in food systems by highlighting the flaws of the predominant disciplinary approach (Koc et al., 2017). For instance, studies of nutrition focus on the role of particular macro- or micronutrients but might not encompass the relationship between malnutrition and poverty. Agricultural economics focuses on optimizing production but may ignore the simultaneity of surplus and hunger crises around the world. These are two among many examples which illustrate the need for well-rounded food systems research and in particular the tendency for research to be siloed in one discipline and ignore the potential social context within which a food system is situated. Food sovereignty is one emergent discourse of food systems change which focuses on a rights-based approach to food insecurity. Desmarais and Wittman suggest that food sovereignty “is much more encompassing than food security and the right to food because it places questions of what food is produced, where, how, by whom, and at what scale at the centre of public debate, and also raises similar questions about food consumption and distribution” (A. A. Desmarais & Wittman, 2013). A food sovereignty approach could contribute to the non-technical knowledge gap in LBA development and frame an enquiry into the socio-economic aspects of the blue revolution.

### **1.3 Project Organization**

Our project is an engagement with the N̄anwaḱolas Council based in Campbell River, BC. The six Member First Nations (MFNs) are Mamalilikulla Nation, Tlowitsis Nation, Da'naxda'xw Awaetlatla First Nation, We Wai Kum First Nation, Kwiakah First Nation, and K'ómoks First Nation have traditional territories located on northern Vancouver Island and the adjacent South-Central coast area. The council sought to research the social and community impacts of potential LBA development in their communities. The N̄anwaḱolas Council's Economic Development branch expressed interest in LBA to be leaders in sustainable resource management within their traditional territories, to broaden their role with the regional aquaculture industry and to build community capacity and prosperity.

We are a group of researchers from Simon Fraser University's Centre for Sustainable Development in the research partnership *Rethinking Seafood Production: Developing Sustainable Communities with Land-Raised Fish*. I was one of three research interns on the project who each approached Land-based Aquaculture from a unique analytical theme. The three research themes were Regulation, Social Entrepreneurship and Food Systems (my research focus is the latter). Together, the three of us under the direction of Dr. Mark Roseland additionally contributed to an overarching Sustainable Community Development research goal by developing a community planning tool and using dialogues surrounding Aquaculture as our preliminary trial of that tool. The specific Food Systems research questions and broader Sustainable Community Development research questions which I approach in this thesis are shown below:

### **1.3.1 Research Questions**

**Research Question 1: (Group Question): Can a N̄anwak̄olas community planning tool be created to facilitate dialogue around aquaculture and other community projects?**

Question 1-1: (My question) Can a framework which reflects the N̄anwak̄olas' community development objectives be created with distinct nested subcomponents?

**Research Question 2: (My questions) How can a food sovereignty approach guide the development of land-based aquaculture with the N̄anwak̄olas?**

Question 2-1: What features of shellfish LBA align with or are incongruent with a food sovereignty approach?

Question 2-2: What does a non-traditional food production, in this case LBA, offer First Nations in their pursuit of self-determination through food sovereignty?

Question 2-3: How do communities navigate the decision to commodify or consume locally produced food resources?

My thesis reflects some of the work executed by the entire research group as well as my individual food systems research focus, all within the scope of land-based shellfish aquaculture. I explore Research Question 1 (Group Question) by exploring the



development of a dialogue-support tool as well as my individual Food Systems research focus (Research Question 2) through a food sovereignty approach. While the initial scope of the research partnership broadly considered all possibilities for land-based aquaculture, continued conversations with Nanwakolas members and leadership suggested an interest in shellfish over finfish (specific participant responses which illustrate this preference can be found in section 5.2.1). The scope of this thesis reflects that interest by drawing results from a community dialogue about shellfish aquaculture for Research Question 1 and focusing on a hypothetical regional land-based shellfish hatchery for Research Question 2.

### 1.3.2 Thesis Structure

Subsequent sections of this paper are organized as follows: **Chapter 2.**

**Literature Review** begins with an overview of land-based aquaculture. Following that, I explore the literature relevant to Sustainable Community Development Frameworks as well as the Food Sovereignty literature to establish the theoretical basis for later analysis. The Chapter concludes with a summary table of the criteria derived from the reviewed literature against which I later assess the results in Chapter 6. In **Chapter 3.**

**Methods** I explain the methodology used for this analysis including the interviews and dialogue sessions; the process of developing, testing and revising a Nanwakolas Dialogue Support framework and the use of an analytical food sovereignty framework from the literature. **Chapter 4.**

**Study community Description: The Nanwakolas Council** introduces the Nanwakolas Council and its member Nations in greater detail as well as further describes the council's interest in researching LBA. In **Chapter 5**

**Results** I present the results of developing, testing and revising a framework with the Nanwakolas based on their existing Community Wellbeing Wheel. I then present the results of the interviews and dialogue using an analytical food sovereignty frame. Additionally, I present responses according to the additional themes of Indigenous Food Sovereignty and Consumption vs. Commodification. In **Chapter 6**

**Findings & Discussion** I first present the table of my summarized findings framed according to the table of criteria derived from the literature. I discuss the results of the framework development process based on the CWBW's suitability as a dialogue support framework. I then discuss the results of the food sovereignty analysis in reference to the criteria derived from the literature review. I discuss limitations to both the framework development and the food sovereignty analysis and comment on broader connections to other research as well as future steps for the research. The theme of Community Capacity which emerged throughout our research is explored. Finally, I recap the main findings of this study and highlight recommended courses of action for the Nānwakolas based on our findings.

## Chapter 2.

### Literature Review

#### 2.1 Land-Based Aquaculture Overview

Land-Based Aquaculture is an emergent seafood production method which cultures seafood in contained systems. LBA systems have been adopted in the last 30 years for hatcheries and juvenile production and increasingly for full growout to market size in recent years (Murray, Bostock, & Fletcher, 2014). The common form of LBA is flow-through systems in which water is taken from a natural source, used, treated and released as effluent. Recirculating Aquaculture Systems (RAS) are a more recent innovation in LBA in which effluent is contained, treated and reused.

The following is a brief overview of the technical aspects of RAS and the associated benefits. Large solid particles of feed and feces are concentrated and removed either by settling or mechanical filtration, while finer particles are removed by foam fractionation or ozonation (see Timmons, 2002 for a review of solids removal). Ammonia is the soluble by-product of fish metabolism which is of primary concern as it is relatively toxic to fish even at low levels. RAS systems employ a biofilter, or a culture of beneficial bacteria which oxidize ammonia to nitrite (another toxic substance) and further nitrite to nitrate (relatively more tolerable substance), (Gutierrez-Wing & Malone, 2006; Schreier, Mirzoyan, & Saito, 2010). Finally, denitrifying bacteria metabolize nitrate to elemental nitrogen which is off-gassed (Martins et al., 2010). Fish and bacterial metabolism also strip dissolved oxygen from water and increase carbon dioxide concentrations. Most operations force air through wastewater to degas carbon dioxide and restore dissolved oxygen (Michael B. Timmons, 2002). RASs offer many advantages in terms of water and land use. First, a RAS is contained from interfering with the natural environment (Martins et al., 2010). Second, recycling water allows RASs to use as little as 50 liters water per kilogram of seafood (including water used for feed), whereas traditional flowthrough aquaculture can require as much as 45,000 liters/kilogram (Verdegem, Bosma, & Verreth, 2006). Additionally, because of low water requirements RASs can be located on land that would be undesirable for other food production such as deserts (Singer, Parnes, Gross, Sagi, & Brenner, 2008), post-mining lands (Miller, 2008) and urban settings (Zohar et al., 2005). Finally, the high level of

control and sanitation from RAS' contained nature means that no pesticides or antibiotics are needed (Summerfelt et al., 2004; Zhang et al., 2011).

The main constraints on any LBA are high costs of labour and energy. To date, the majority of systems have been established for small scale production (<50MT/year) for both hatchery production and growout around the world (Ayer & Tyedmers, 2008; M.B. Timmons & Ebeling, 2007). High start-up costs and uncertain profitability have discouraged investment. As a result, few large facilities have been established that can take advantage of economies of scale in labour and infrastructure. RASs offer several potential economic advantages however including higher stocking densities, year-round production and reduced water costs (Engle & Leung, 2006), although a high energy requirement is a significant economic impediment. The recirculation and filtration systems require a large amount of electricity and thus require more operational energy than most other aquaculture systems (Ayer & Tyedmers, 2008; Pelletier et al., 2011).

### **2.1.1 Land-Based Shellfish Aquaculture**

While the initial focus of LBA was predominantly on high-value finfish, research is illustrating the benefits of culturing shellfish (mollusks and crustaceans that are of culinary interest) in LBA hatcheries and full growout. The high capital investment required for raising seafood on land (particularly with RAS) is likely what led investors to favour culturing high value finfish. However, Allison et al. (2011) review the anticipated changes that a changing climate will have on molluscan aquaculture and offer several insights: “given the unpredictable nature of climate change impacts, we can foresee a shift toward adoption of more ‘climate-proof’ closed or recirculation systems in aquaculture — akin to intensive poultry production — where the environment is under more direct human control.” While shellfish hatchery and nursery systems have always been land-based, they typically employ flow-through technology (Helm, Bourne, & Lovatelli, 2004). RAS shellfish hatcheries are desirable for the control offered as well as reduced water requirements. The seawater and energy requirements could be reduced considerably if a RAS system were employed. Furthermore, complete control over critical parameters (temperature, salinity, pH) can be attained. Frias and Segovia (2010) suggest that there is a crisis in global shellfish seed production partially due to high mortalities at all life-stages and that the control that RAS offers will attract investment for this reason. To date, no commercial RAS shellfish hatcheries exist but research has

illustrated that RAS might be an efficient tool to manipulate the parameters for successful juvenile production (e.g. see Frias & Segovia, 2010; Jones, Mair, & Neves, 2005; Kamermans et al., 2016). The economic viability of these systems will be tested as early adopters move to commercialize this research.

In addition to hatcheries, RASs are gaining interest for full growout. Shrimp culture in RAS systems has been relatively well characterized, (e.g. see. Beardsley, Moss, Malfatti, & Azam, 2011; Brown, Briones, Diana, & Raskin, 2013; Van Khoi & Fotedar, 2011) and preliminary economic analyses have illustrated that high stocking density and the potential for multiple crops per year make RAS shrimp culture a viable alternative to traditional earthenware pond culture. The two kinds of molluscs which have been cultured in RAS systems to full growout are oysters (Miranda, Lizarraga-Armenta, Rivas-Vega, López-Elías, & Nieves-Soto, 2010) and abalone (Jarayabhand, Kruiroongroj, & Chaisanit, 2010). Experimental commercial enterprises exist for both species.

Feed becomes a critical consideration in the adoption of RAS shellfish aquaculture because conventional ocean-based marine mollusc aquaculture does not require feed inputs as the animals obtain their nutrients from suspended organic detritus and microorganisms (Hawkins et al., 1998). Culturing of algae as feed is the approach which has functioned for hatcheries for decades. The approach has been expanded and tested in experimental growout (Miranda et al., 2010). Wang (2003) investigated whether the waste of tilapia could serve as the feed for oysters in a co-culture recirculating system. They found that the oyster *C. gigas* was able to utilize particulate matter from tilapia waste as food and convert it to biomass. Unlike other molluscs, abalone are not filter feeders and require a diet of kelp, which have been successfully grown in recirculating coculture systems (Butterworth, 2010; Robertson-Andersson, 2006).

## **2.2 Sustainable Community Development**

Sustainable Community Development (SCD) must be understood through the broader approach of *Sustainable Development*, a term that first appeared in the World Commission on Environment and Development's report *Our Common Future*. The definition from this report remains widely accepted: "development that meets the needs of the present without compromising the ability of future generations to meet their own

needs” (*Our Common Future (The Brundtland Report)*., 1987). While the term garners criticism when conflated with sustainable growth (an oxymoron), sustainable development necessarily requires working within natural confines. Roseland (2012) draws a critical distinction by describing growth as the quantitative increases in such measures as size, population, income and production and describing development as the qualitative changes in health, knowledge, and quality of life. The influential Indian economist and philosopher Amartya Sen has particularly shaped the global approach to development through his approach of “capability expansion”. Here, a person’s capability to have a good life is conceived of as a set of valuable ‘beings and doings’ such as being in good health or having the ability to transform resources into valuable activities. The approach serves as a broader, deeper alternative to narrow economic metrics such as growth in GDP per capita. Focusing the goals of sustainable development through expanding capabilities instead understands ‘poverty’ as deprivation in the capability to live a good life (Sen, 1990). An articulation of the Sustainable Development by Agyeman and Evans in 2003 incorporates a key social justice component by identifying “the need to ensure a better quality of life for all, now and into the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems” (Agyeman & Evans, 2003).

Sustainable Community Development focuses the principles of Sustainable Development around the community scale. While sustainable development is a useful notion to guide a collective global path forward, it does not necessarily provide replicable and actionable strategies as sustainability will be operationalized differently around the world. SCD answers this call by considering sustainable development at the local community scale as a unit within which citizens and their governments can mobilize for positive change and by building a body of theory and practice of ongoing sustainable development efforts in communities around the world (Roseland & Spiliotopoulou, 2016).

A more recently emerged but parallel focus of development theory and practice is on Community Wellbeing. Studies of wellbeing have focused on individual, community and national scales but typically only vaguely define wellbeing (e.g. Christakopoulou, Dawson, & Gari, 2001; Morton & Edwards, 2012; Sirgy, Widgery, Lee, & Yu, 2010) and instead refer wellbeing in terms of the dimensions which comprise it. McCrea et al. conducted a review of studies which have attempted to measure wellbeing at the

community scale and conceptualized Community Wellbeing as a *state*: “an evaluation of all the important aspects of that place in relation to some expectations or standards at a point in time.” Their results suggest that when wellbeing is considered in a specific place, the expectations of wellbeing are likely to be diverse as a reflection of the diversity in needs, values and norms of different communities. The authors therefore suggest that measurement of wellbeing must be broad and comprehensive to accommodate for diversity and not rely only on commonly applied economic measures as indicators. (McCrea, Walton, & Leonard, 2014). Community Wellbeing is positioned as a unique set of criteria for a community to evaluate their state over time to inform the development processes most suitable to achieve local needs. The term Community Wellbeing has been used often in the context of indigenous communities to deeply discuss community health and development aspirations that are framed with explicit recognition of capacity limitations and effects of intergenerational trauma (e.g. see Atkinson, Nelson, & Atkinson, 2010). The department of the Canadian government responsible for indigenous affairs has been using Community Wellbeing Indices to monitor development and score indigenous communities for decades, but the reports do not suggest that the indicators are locally responsive (see Strategic Research Directorate Aboriginal Affairs and Northern Development Canada, 2015).

Sustainable Community Development and Community Wellbeing take a holistic approach to community development which might facilitate addressing non-technical knowledge gaps in LBA research. In SCD all forms of community assets (natural, physical, cultural, economic, human, social) are considered and ideally enhanced (Roseland, 2012). Based on the historic precedent of the green revolution, a risk of the blue revolution is that production-focused industry development will occur while neglecting the very communities in which production occurs. Place-based approaches which recognize a breadth of community values enables communities to be at the front of development decisions in the Blue Revolution.

### **2.2.1 Frameworks for Community Development**

Sustainable development practitioners rely on tools to formally conceptualize and measure sustainability (Bird, 2015). Sustainability Assessment tools are increasingly recognized as key instruments in taking real strides towards sustainability (Joss, Tomozeiu, & Cowley, 2012). These tools enable decision-makers to compare project

proposals in the planning stages and ensure that outcomes of initiatives are optimally contributing to sustainability throughout project life. Sustainability Assessment tools can be quantitative monitoring assessment tools or be designed with a participatory nature to generate dialogue and engage stakeholders in social learning (Pope, Annandale, & Morrison-Saunders, 2004). Most tools are based on *multi-criteria frameworks*, which start with the key dimensions or domains of sustainability and then identify distinct subcomponents of each dimension (Maclaren, 1996). The importance of nested subcomponents in these frameworks is that these subcomponents provide distinct focal points to be measured in quantitative tools or to serve as the basis of dialogue questions in qualitative engagement tools.

Interactions among key dimensions are a critical challenge in conceptualizing and measuring sustainability through frameworks. No development initiative transpires in a purely siloed fashion but rather interacts both positively and negatively with multiple categories of any sustainability framework. Policy makers are challenged to seek solutions which mutually reinforce between categories and minimize trade-offs. Researchers have made various efforts to address these interactions. For instance, Nilsson and colleagues propose a method to rank interactions between the Sustainable Development Goals between *indivisible* (achievement of one goal is inextricably linked to the achievement of another goal) and *cancelling* (achieving one goal makes it impossible to reach another goal) (Nilsson, Griggs, & Visback, 2016). Currently no clear methodologies for considering interaction effects exist; continued research as these frameworks are used will deepen the understanding and contribute to best practices.

This project deals with two tools for assessing sustainable community development: The *Community Capital Framework* (CCF) used by Simon Fraser University's Centre for Sustainable Development and the *Community Wellbeing Wheel* (CWBW) used by the Nanwakolas Council.

### **2.2.2 Community Capital Framework**

The Community Capital Framework (CCF) is a comprehensive multi-criteria framework which allows quantitative and qualitative sustainability assessment. In the CCF, six forms of capital (natural, physical, economic, human, social, cultural) are used to conceptualize and frame local assets (Roseland, 2012) (Figure 2.1).





**Figure 2.1: Community Capital Framework illustrating six capitals**

The term *capital* is borrowed from economics to suggest that the different dimensions of sustainability are assets which provide value through use (Flora, 2004). The graphical presentation of the capitals allows users to understand how an investment in one capital might positively or negatively impact other capitals. Six different capitals make up the different sustainability dimensions of the CCF; each capital contains distinct nested subcomponents referred to as stocks. The CCF is has been developed to two distinct tools: *Community Capital Balance Sheet* and *Community Capital Scan*. The Balance Sheet is a rigorous baseline assessment tool to quantitatively monitor individual *stocks* which comprise each capital (e.g. Natural Capital includes Air, Water, Soil, etc.). Specific *indicators* are determined for each stock and monitored over time. Users perform baseline assessments as well as follow up assessments to gauge the impact of projects and developments through time. The CC Scan is a qualitative tool to gain input from a group of participants and generate discussion on the effect that a project or development might have on each of the capitals. The Scan enables community members and decision-makers to ask the question *How might this particular project impact our community?* by considering the six capitals. The Scan is intended to be

performed early in the project life to highlight changes that better satisfy the community's goals. Instead of specific measurable indicators as in the CC Balance Sheet, each stock in the Scan has *dialogue criteria* to guide what a scan participant might look for when evaluating it. Participants provide feedback on stocks with qualitative feedback and by assigning a score on a Likert-type scale. Where there is greater community agreement the variation in numerical responses will be relatively close. The stocks in which there is a disparity in numerical responses highlight where greater community dialogue is required. The Scan thus acts as a dialogue- and design-support tool to incorporate the values of community members into project development. While most Sustainability Assessment tools are quantitative, the Community Capital Framework provides an opportunity to complement rigorous monitoring and assessment with substantive community dialogue through its two constituent tools. The distinct, nested stocks add rigor to both tools: these stocks are measured through indicators in the Balance Sheet and are the basis of participant dialogue questions in the CC Scan.

### **2.2.3 The Community Wellbeing Wheel**

The Community Wellbeing Wheel (CWBW) is a multi-criteria framework developed by the Nānwaḱolas Council to understand and enhance all forms of Community Wellbeing (CWB). Community Wellbeing is a term that has been adopted by the Canadian Government to score aboriginal communities (McHardy & O'Sullivan, 2004). A working group of representatives from Nānwaḱolas First Nations convened in 2014 to define what Community Wellbeing should look like for the Nānwaḱolas Nations themselves. The group agreed that Community Wellbeing must “be understood on—and in—the First Nations’ own terms, and interpreted as referring to all things that contribute to and determine a First Nation’s wellbeing, their state of happiness, and the quality of life of all members belonging to a First Nation.” Representatives from the Nations brought Wellbeing priorities from their communities with the aim of finding the priorities which were common among all Nations. The group was struck by the interconnectedness of all aspects of community wellbeing and so conceptualized a Community Wellbeing as a wheel of 5 inseparable *CWB areas*: Health, Economic Prosperity, Culture, Community, and Resource Stewardship (see Figure 2.2). One participant summed up the sentiment: “If you focus on one aspect of community wellbeing in isolation, you aren’t going to succeed. All the factors—culture, health,

resources management, you name it—they are all intertwined and interdependent. They all have to be approached understanding how they relate to each other.” (*Aweenak’ola: Newsletter of the Nanwakolas Council*, 2014)



**Figure 2.2: The Nanwakolas Community Wellbeing Wheel, illustrating five Community Wellbeing Areas**

The Community Wellbeing Wheel is detailed in the *Community Wellbeing and Capacity Strengthening Plan (CWCS)*(Roberts, 2014). In the document, various goals are suggested within each CWB area but many overlap and are not clearly defined, far from the concise *stocks* that can be found in the CCF. The CWCS proposes the development of the wheel as a measurement tool, which has yet to be realised. The striking similarity to the CCF stimulated our research effort to explore how the Community Wellbeing Wheel might be operationalized using the CCF as a basis.

#### **2.2.4 Comparing the Frameworks**

Examination of the composition of the CCF and CWBW and the extent to which they have been operationalized as assessment tools reveals a distinction between the

two frameworks. In the CCF each of six *capitals* encompasses several distinct subcomponents referred to as *stocks* which have been developed with indicators in the CC Balance Sheet and dialogue criteria in the CC Scan. The CWBW on the other hand consists of five *CWB areas*. In the CWCS, each CWB Area contains many suggested goals but without clarity as to how these could be condensed or eventually measured. Thus, we can draw the distinction that the CCF has been operationalized into an actionable framework through the two tools of the Scan and Balance Sheet while the CWBW remains a conceptual framework without distinct nested subcomponents

A possible strength of the CWBW is that it has been conceived of by the very communities who will use it. The CWBW might incorporate or balance the particular indigenous values of the represented communities more completely than the CCF which has been largely developed and tested in Euro-Canadian contexts, although CCF has been employed in engagements with indigenous populations in Bolivia (see Ferguson, 2012). The aim of the Community Wellbeing working group was to provide a frame for Community Wellbeing which has been defined by the *Nanwakolas* and not the Canadian Government. Reed et al. (2006) highlight the importance of local participation in defining sustainable development at the community level, but recognize the challenge of multiple frameworks that might result. Their study examines expert-led top down approaches and community-led bottom up approaches around the world. The results emphasize the importance of participatory approaches in setting the context for sustainability assessment at local scales, but stresses the role of expert-led methods in indicator evaluation and dissemination.

While the CCF and CWBW are at various stages of being operationalized, they share basic similarities as multi-criteria frameworks. Both encourage consideration of a broad range of community sustainability dimensions beyond conventional metrics. The circular imagery in both is no coincidence as it represents interconnectedness and interdependence between dimensions. The frameworks guide users towards decisions that will maximize community benefits in as many dimensions as possible.

Our research project will develop the CWBW towards an operationalized sustainability assessment tool using the CCF as an example. Specifically, the CC Scan will be used as a model to develop the dialogue support capability of the CWB Framework. My own contribution to this development and what is described in this

thesis is using the structure of the CWBW to assess a dialogue session that occurred with Nānwakōlas representatives about shellfish LBA to develop distinct subcomponents within each of the CWB Areas. My qualitative use of the two frameworks here will provide a preliminary understanding of their compatibility and of the utility of the CWBW as a Sustainability Assessment tool.

## 2.3 Food Sovereignty

Food Sovereignty is a rights-based approach to food system change. As the Nānwakōlas Council seeks to engage with land-based aquaculture, a food sovereignty framework could direct development towards food security for MFNs and a sovereign role in resource management within their traditional territories.

Food sovereignty has emerged in recent years as a mobilizing frame to describe social movements' and communities' efforts of reclamation of rights to food, production and consumption. While first appearing in Mexican government documents in the early 90's, the term was catapulted into current usage by *La Via Campesina*, an international peasant organization, at their 1996 convention (Edelman, 2014). In 2007, roughly 500 people from more than 80 countries gathered in Sélingué, Mali to discuss food sovereignty in the Nyéléni Convention (named after Nyéléni, the legendary Malian peasant woman who farmed and fed her peoples well). Peasant farmers, pastoralists, fisherfolk, indigenous peoples, migrant workers, women, youth, environmentalists and family farmers were all in attendance. A declaration on food sovereignty emerged from the conference:

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. It puts the aspirations and needs of those who produce, distribute and consume food at the heart of food systems and policies rather than the demands of markets and corporations. It defends the interests and inclusion of the next generation. It offers a strategy to resist and dismantle the current corporate trade and food regime, and directions for food, farming, pastoral and fisheries systems determined by local producers and users. Food sovereignty prioritizes local and national economies and markets and empowers peasant and family farmer-driven agriculture, artisanal fishing, pastoralist-led grazing, and food production, distribution and consumption based on environmental, social and economic sustainability. Food sovereignty promotes transparent trade that guarantees just incomes to all peoples as well as the rights of consumers to control their food and nutrition. It ensures

that the rights to use and manage lands, territories, waters, seeds, livestock and biodiversity are in the hands of those of us who produce food. Food sovereignty implies new social relations free of oppression and inequality between men and women, peoples, racial groups, social and economic classes and generations (“DECLARATION OF NYÉLÉNI,” 2007).

A recent move in the literature suggests moving beyond critiquing a global agenda which is predominantly focused on food security towards real, place-based food sovereignty movements. Numerous examples can be found in the literature of food sovereignty being counter-posed against food security (Hopma & Woods, 2014; Jarosz, 2014; Rudolph & McLachlan, 2013; Schanbacher, 2010; Wald & Hill, 2015). Jennifer Clapp (2014) deconstructs this opposition by analyzing the *rival normative frame* that has been inserted into food security. Clapp positions food security as descriptive: whether an individual has adequate access to food and nutrition. Food sovereignty on the other hand is normative and describes one of many possible ways of creating and maintaining food access. While the mainstream policy agenda for food security may in fact be overly focused on production rather than access, nothing about the concept of food security is inherently productionist. Thus, food security can be a worthy goal and food sovereignty an ongoing way of attaining and maintaining that goal. Wittman (2015) suggests getting past this binary “by identifying adaptive and place-specific mechanisms for implementing the principles of food sovereignty and sustainability while considering practical contradictions and limits.”

The evolving discourse of food sovereignty is not strictly defined yet still offers adaptive and analytical insight. Scholars have made calls to measure food sovereignty, create frameworks, define and operationalize it (Chaifetz & Jagger, 2014; Shattuck, Schiavoni, & VanGelder, 2015). While the food sovereignty movement has been critiqued for lacking clarity (Agarwal, 2014; Hospes, 2013), some scholars argue that undue emphasis on pursuing definitions detracts from discussing real ways to bring about food security in particular contexts (Wald & Hill, 2015). This trend in the literature has created a call for research that embraces possible definitional conflicts as junctions to better define goals (Shattuck et al., 2015) and engage in localized community research to acknowledge the nuances of different food sovereignty movements around the world (A. Desmarais, 2015). The current body of research allows us to consider food security in terms of a deeply politicized issue that places communities’ rights to food and a healthy environment at the centre.

Despite a lack of definitional clarity, a list of food sovereignty principles which emerged from the Nyéléni conference has been proposed as an analytical frame. The list is not meant to be exclusive or exhaustive and cannot encompass the multiplicity of efforts occurring across diverse geographies. Instead, the list represents the dialogue that occurred between sectors and interest groups at the conference and embodies the common principles of food sovereignty movements. The principles presented in Table 2.1 are synthesized from the Nyéléni Synthesis Report (*Nyéléni Synthesis Report*, 2007).

**Table 2.1: Six food sovereignty principles which emerged from the Nyéléni conference**

<b>Food Sovereignty Principle</b>	<b>Explanation</b>
<b>Focuses on food for people</b>	Food sovereignty puts the right to sufficient, healthy and culturally appropriate food for all individuals, peoples and communities, including those who are hungry, under occupation, in conflict zones and marginalised, at the centre of food, agriculture, livestock and fisheries policies; and rejects the proposition that food is just another commodity or component for international agri-business.
<b>Values food providers</b>	Food sovereignty values and supports the contributions, and respects the rights, of women and men, peasants and small scale family farmers, pastoralists, artisanal fisherfolk, forest dwellers, indigenous peoples and agricultural and fisheries workers, including migrants, who cultivate, grow, harvest and process food; and rejects those policies, actions and programmes that undervalue them, threaten their livelihoods and eliminate them.
<b>Localises food systems</b>	Food sovereignty brings food providers and consumers closer together; puts providers and consumers at the centre of decision-making on food issues; protects food providers from the dumping of food and food aid in local markets; protects consumers from poor quality and unhealthy food, inappropriate food aid and food tainted with genetically modified organisms; and resists governance structures, agreements and practices that depend on and promote unsustainable and inequitable international trade and give power to remote and unaccountable corporations.
<b>Localises decision-making</b>	Food sovereignty places control over territory, land, grazing, water, seeds, livestock and fish populations on local food providers and respects their rights. They can use and share them in socially and environmentally sustainable ways which conserve diversity; it recognizes that local territories often cross geopolitical borders and ensures the right of local communities to inhabit and use their territories; it promotes positive interaction between food providers in different regions and territories and from different sectors that helps resolve internal conflicts

	or conflicts with local and national authorities; and rejects the privatisation of natural resources through laws, commercial contracts and intellectual property rights regimes
<b>Builds knowledge and skills</b>	Food sovereignty builds on the skills and local knowledge of food providers and their local organisations that conserve, develop and manage localised food production and harvesting systems, developing appropriate research systems to support this and passing on this wisdom to future generations; and rejects technologies that undermine, threaten or contaminate these, e.g. genetic engineering
<b>Works with nature</b>	Food sovereignty uses the contributions of nature in diverse, low external input agroecological production and harvesting methods that maximise the contribution of ecosystems and improve resilience and adaptation, especially in the face of climate change; it seeks to heal the planet so that the planet may heal us; and, rejects methods that harm beneficial ecosystem functions, that depend on energy intensive monocultures and livestock factories, destructive fishing practices and other industrialised production methods, which damage the environment and contribute to global warming.

Chaifetz and Jagger (2014) propose the use of these themes as a framework or ‘goalposts’ with which to analyze current and future food systems. As far as I am aware, no trials have been made to assess any actual or proposed food systems against these principles.

Scale is a critical aspect of any place-based research and informs food sovereignty movements as they relate to each other and to broader neoliberal practices and policies. Important dimensions of scale in characterizing any food system are size (e.g. small or large farms) and level (e.g. household or national)(Robbins, 2015). Often, food sovereignty movements represent partnerships and cooperation within and between communities to overcome the challenge of economies of scale which conventional or large-scale food production can impose (Bijman, Poppe, Cook, & Iliopoulos, 2012). Iles and Montenegro de Wit suggest food sovereignty movements should consider a further notion of *relational scale*. The authors contend that relational scale reminds us that “sovereignty is not an extraneously existing object but is a living process, [and] foregrounds the conscientious building and maintaining of relationships between people, institutions, technologies, ecosystems, and landscapes across multiple scales” (Iles & Montenegro de Wit, 2014). Acknowledging scale as relational allows individual food sovereignty movements to both see themselves as working units in



connection to all factors surrounding them and organize more broadly with other movements to work towards influencing positive change at multiple scales. Furthermore, considering scale in food sovereignty movements allows us to avoid definitions which become overly focused on physically bounded conceptions of sovereignty and in turn self-sufficiency, similar to the “defensive localism” characterized by Winter (2003). Madeline Fairbairn (2012) extends the notion to food sovereignty to point out that an over-emphasis on self-sufficiency limits the transformative potential of the food sovereignty movement and instead leads to “islands of food sovereignty in a neoliberal ocean.” Rachel Soper, in an engagement with indigenous producers in the Andean country side, further characterizes the reverse of this over-romanticization in her finding that the peasant producers preferred production for export markets for the stability (Soper, 2015).

Hannah Wittman expands the role that scale plays in the article *From protest to policy* (2015) in which she highlights the process of food sovereignty evolving from localized resistance movements toward broader institutionalization. The *multi-scalar* approach she describes distinguishes between three scales: the fundamental *autonomous and localized initiatives* which are supported (or contested) by *state actions*, all of which is taking place in the *global policy arena*. The approach enables us to consider the process by which food sovereignty might be ‘scaled-up’ without creating a prescriptive or top-down national or global food sovereignty regulatory framework and undermining the very efforts of decentralization that food sovereignty movements are based upon.

Food sovereignty analyses employ the political economy approach of *food regimes*. Food regime studies take a political economy approach to food studies which focuses on social change taking place over time rather than ascribing to the belief that universal economic laws apply to all places and historical periods (Friedmann, 2017). Food regimes are founded on commodity studies which emerged from the ground breaking work of Carole Counihan (1984). Counihan showed how changes in the ways in which one commodity (in this case bread) is produced, distributed and consumed could be a lens to consider significant changes which had occurred in family, community and work. Food regimes integrate a world systems theory to conceptualize relations in commodity chains through the global capitalist system and understand periods of relative stability or fluctuation. Scholars have characterized periods of economic

contraction through food regime analysis. Periods of contraction are typically coincident with periods of transitions in power (Arrighi & Silver, 1999). The most significant food regimes were those centred on imperial power under British hegemony (1870-1914) and on national regulation of food and agriculture under US hegemony (1947-1973) (McMichael, 2009). Scholars characterize the current global food regime (often called the “neoliberal” or “corporate” food regime) as one of transition, which has endured since the food crisis of 1973-74. The regime has not involved the dramatic wars of earlier transition periods, although the expansion of neoliberal policies throughout has been a major source of international and class conflict which in part mobilized the food sovereignty movement (Condra, 2012; Gambling, 2016; McMichael, 2010; Patel, 2007). Food sovereignty employs the critical political economy perspective of food regimes and bridges it with assertions of governance typically at the level of communities.

### **2.3.1 Indigenous Food Sovereignty**

A growing body of food sovereignty research analyzes and advances issues of food access in indigenous communities, describing movements that strive for food security through self-determination. Rudolph and McLachlan (2013) engaged one First Nation and one Metis community in Northern Manitoba to investigate the causes of a current food crisis and discuss solutions with community members. The researchers found that the issue was not necessarily a lack of food but systemic factors preventing access to healthy and traditional foods. Food sovereignty was suggested to be a useful frame or movement as it politicizes the issue of food access, unlike a conventional supply-side approach. Kamal et al. (2015) assessed another Northern Manitoba First Nation the (O-Pipon-Na-Piwin) that was displaced by flooding from a Hydro-electric project. The community had formed an organization called *Ithinto Mechisowin* (‘food from the land’) meant to guide individual and community claims to the land through a reconnection with traditional foods. The researchers analyzed the program’s champions’ usage of food sovereignty, finding that it both words were redefined from their conventional usage in the literature: *food* being more about the connection between people and the land, and *sovereignty* describing their efforts to decolonize through a reclamation of traditional resources.

Dawn Morrison, an author and advocate with the Indigenous Food Sovereignty Organization in BC, expands upon the theme in *Indigenous food sovereignty: a model*

*for social learning* (2011). She takes the approach that food sovereignty is a method of arriving at real and lasting food security. Morrison suggests that an Indigenous food system is best described in ecological rather than neoclassical economic terms: Indigenous peoples do not manage the land but manage their behaviours in relation to it. Morrison outlines 4 main principles identified by Elders, traditional harvesters, and community members:

- *Sacred or Divine Sovereignty* respects the fact that food is a gift from the creator and thus cannot be constrained by colonial laws or institutions.
- *Participation* suggests that IFS is fundamentally based on action, and the day-to-day practice of nurturing relationships with land, plants, and animals.
- *Self-determination* in this context refers to the freedom and responsibility to respond to their own needs for healthy, culturally-adapted indigenous foods, ultimately to gain freedom from corporately-controlled food production.
- *Legislation and Policy* thereby provides a restorative framework for a coordinated approach to policy reform within colonial laws.

A politicized approach to food refocuses the discussion of food security not around supply but around power structures and social life (Figueroa, 2015), an approach that has resonated with indigenous peoples asserting sovereignty and self-determination.

### **2.3.2 Food Sovereignty in the Blue Revolution**

A food sovereignty approach which integrates rights and governance into food systems change might contribute to sustaining communities in the face of aquaculture development. Many food sovereignty scholars today are characterizing movements which combat the inequality born of the modernization of global agricultural that was the green revolution (Giunta, 2014; Holt-Giménez & Altieri, 2012; Petersen, Mussoi, & Dalsoglio, 2012). Some scholars have extended this approach to the management of aquaculture. Ahmed et al. analyse the blue revolution of prawn aquaculture in Bangladesh and illustrate that while new forms of aquaculture increase income and food security and alleviate pressure on local wild stocks, limitations to resource ownership and access to credit hindered translation of benefits to the rural poor (Ahmed, Allison, Muir, Ahmed, & Muir, 2010). Allison highlights the disadvantages that the poor and food insecure have within existing power relations in aquaculture management. These

individuals lack access rights to the land, sea, water and credit necessary for aquaculture development. He asserts that some element of a food sovereignty agenda must be adopted if global trade and aquaculture development are to benefit the poor (Allison, 2011). Pinkerton and Silver conceptualize the development of shellfish aquaculture in BC as an advancement of neoliberal government priorities. They present the creation of tenures for shellfish aquaculture as a form of cadastralization, or the state efforts to make the productivity of landscapes more measurable for purposes of rent generation and taxation. They identify three key elements that emerged from a transition to a market based paradigm:

- (a) *ownership*: private parties gain access, exclusion, management, and alienation rights to a former common pool resource;
- (b) *management*: landscape is ecologically simplified and greater rent is extracted by government; and
- (c) *technological change*: the required commitment to aquaculture technology, together with this new form of ownership, allows global market forces to more easily penetrate local property relationships. (Pinkerton & Silver, 2011).

Silver (2013) characterizes aquaculture development through the neoliberal logic of *disciplining coastal subjects* (i.e. resource users) and highlights the particular tension for First Nations. Engaging with the provincial tenure system of aquaculture commits tenure-holders to state-defined productivity minimums. For some First Nations, this is seen as a positive step in modernizing their economies and distinguishing territories in treaty negotiations. Other Nations criticize the tenure system as an imposition of neoliberal expectations of resource management which relinquishes the collective rights to broader swaths of territory. To date, no research effort has been made to extend a consideration of a rights-based approach to food systems toward the proliferation of land-based aquaculture.

While the contribution of LBA to the overall aquaculture sector remains small (Klinger & Naylor, 2012), its technological nature demands some use of a rights-based lens to understand the social impacts of the blue revolution. Suryanata and Umemoto (2003) propose the replacement of natural processes with technological ones as one basis by which aquaculture development erodes the decision-making power of local communities. They state that "... aquacultural development represents a major

breakthrough because it allows industrial capital to regulate the conditions of production. Key in this process is the ability of industry to substitute labor, technology, and capital for some of the natural processes necessary in the production of fish and shellfish. It gives the industry flexibility in distributing production, temporally as well as spatially, to provide a best fit to a global pattern of resource availability and market demand.” Considering the effects that technological development in aquaculture production may have on local control is particularly relevant to technologically advanced LBA development. Raising seafood on land necessarily isolates production further from natural processes, particularly with ‘closed-contained’ RAS. A rights-based approach of food sovereignty may aid in assessing how communities could engage with the Blue Revolution in ways that do not erode local decision-making.

## 2.4 Table of Criteria Derived from Literature Review

**Table 2.2: Criteria Derived from Literature Review, against which results will be analyzed.**

	Topic	Literature Derived Criteria and References
Chapter 2.2: Sustainable Community Development	Reflection of Community Values in Sustainability Assessment	<ul style="list-style-type: none"> <li>• Frameworks for Community Development should reflect a Sustainability value set which is appropriate for the community (McCrea et al., 2014; Reed et al., 2006).</li> <li>• Furthermore, frameworks for indigenous communities should be based on a definition of wellbeing which encompasses unique values (Atkinson et al., 2010)</li> </ul>
	Distinct nested subcomponents in frameworks	<ul style="list-style-type: none"> <li>• Distinct subcomponents nested within the dimensions of sustainability these are necessary for measuring or enabling dialogue around community development (i.e. quantitative or qualitative sustainability assessment) (Roseland, 2012).</li> </ul>
Chapter 2.3 Food Sovereignty	Food systems should align with the six Nyéléni principles	<ul style="list-style-type: none"> <li>• The Nyéléni principles are proposed as a set of ‘goalposts’ to frame discussion around existing and planned food systems (Chaifetz &amp; Jagger, 2014). Aquaculture developments should adhere to these six principles to ensure that community development is prioritized in the Blue Revolution. (For a detailed list of the six principles and their criteria, see Table 3.2).</li> </ul>
	Indigenous Food Sovereignty	<ul style="list-style-type: none"> <li>• Food production and gathering can be a way to define territories to which indigenous people have resource management rights, including as a form of protest (Kamal et al., 2015).</li> </ul>

		<ul style="list-style-type: none"> <li>• Traditional foods play a key role in health and sustenance but also act as a medium which connect indigenous people to their environments (Morrison, 2011; Rudolph &amp; McLachlan, 2013).</li> </ul>
	Consumption vs. Commodification	<ul style="list-style-type: none"> <li>• The balance between food resources being for community consumption or commodification should be defined by the community and fit their needs (Chappell et al., 2013; Wittman, 2011).</li> <li>• Self-sufficiency (i.e. community consumption) is not the exclusive goal of food sovereignty as commodification can support stable production. (Fairbairn, 2012; Soper, 2015).</li> </ul>

## Chapter 3.

### Methods

The research partnership *Rethinking Seafood Production: Developing Sustainable Communities with Land-Raised Fish* began in June of 2016. Myself and two other master's students under the supervision of Dr. Mark Roseland were funded by the N̓nwaḱolas Council and Mitacs, a federal not-for-profit research foundation. We initiated the project with a Working Group meeting at the N̓nwaḱolas Tribal Council offices in Campbell River, British Columbia. The Council's Regional Economic Development Coordinator Chris Roberts convened community representatives from the six Member First Nations (MFN). We invited these representatives to represent their involvement with the aquaculture industry and/or their Nations' economic development interests. This first working group acquainted the researchers and community representatives through dialogue about project scope, research questions and desired outcomes.

#### 3.1 Aquaculture Scan

The first stage of research was to understand the breadth of possibilities of LBA technology around the world. As an emergent food-production method, the possibilities of land-based aquaculture are ever expanding through a variety of successful and unsuccessful business cases in British Columbia and around the world. We set out to understand the breadth of possibilities that the N̓nwaḱolas could engage with by first scanning the range of commercial land-based aquaculture practices around the world. The aim was to generate an extensive list of different endeavors around the world, noting the species farmed, type of technology employed, location and points of success or failure when available. The literature cited in section 2.1 which details innovations in land-based aquaculture refers to specific ventures as case studies which provided the initial basis for the scan. Additionally, we conducted a google search for a range of finfish and shellfish species combined with LBA keywords "RAS", "raceway", "flowthrough" and "closed-containment". We gathered information about the ventures from company websites and media related to the company. Because this scan was based on ventures with a searchable web presence, the results are not meant to be

exhaustive or exclusive but instead indicative of the current potential of LBA. A summary of the Scan can be found in Appendix A.

Following the global scan, we sought to understand the specific trends within BC by visiting sites and engaging in discussions with owners and operators of land-based aquaculture facilities. We found ten sites by a google search using the same LBA keywords and “British Columbia” and “Ontario” and visited them to speak with owners and operators. The sites covered a range of LBA facilities from research-focused to full scale commercial grow-out facilities, as well as hatcheries and processing facilities. Summaries of the Site Visits can be found in Appendix B.

### **3.2 Semi-Directed Interviews**

Together with the two other research interns, I conducted semi-directed interviews with community representatives in the Summer of 2016 to obtain qualitative information regarding the relationships that the N̄n̄wak̄olas MFNs have with aquaculture and their aspirations for future LBA projects. The interview participants (five in total) were selected in conjunction with Chris Roberts, the Regional Economic Development Coordinator for the N̄n̄wak̄olas council. Chris provided us with suggestions for representatives from each constituent community who were involved with various capacities of aquaculture, food security, community development and band leadership. The selected five participants were key informants and knowledge-holders in these areas. In their small communities, many of the key informants serve a range of leadership and decision-making roles on a breadth of key capacities, positioning them to inform our broad research objectives. The specific identities of the five key informants are withheld for confidentiality, but several of the capacities which they represented are listed below:

- Elected band councillor
- Manager of band-owned aquaculture enterprises
- Regional liaison with provincial nutrition and health agencies
- Community organizer for food, social and ceremonial harvests
- Community Wellbeing Working Group Representative



- Retired fishermen
- Manager of youth employment programs

The interview method provided us with rich data which we qualitatively analysed for emergent themes. We gathered responses related to experiences that community members had had with aquaculture, regulation pertaining to seafood, barriers and opportunities to community-oriented economic development projects, community health and community food security. This breadth of experiences which each one of our key informants could draw upon necessitated an open approach to discussion. We used open-ended interview questions, giving participants the flexibility to elaborate on any questions or provide additional thoughts that they deemed relevant. Appendix C is a list of the open-ended questions we asked.

Conducting the interview as a three-person team allowed us to cover a breadth of questions and topics in the interviews. For my specific food systems focus, I asked questions about the state of food security within communities, the role of traditional foods and the barriers to food access and production. However, results from the other research interns' approaches informed my results as well. Specifically, discussions of regulations possibly restricting Food Sovereignty emerged from the questions related to Regulation, and discussions around a cooperative ownership structure emerged from the questions around Social Enterprise. No time limits were set on interviews (duration ranged from 1-2 hours). Interviews were all conducted in person in locations chosen by the participants including band offices, workplaces and public restaurants. We electronically recorded and transcribed the interviews. All interviews were conducted in accordance with the ethics protocol approved by Simon Fraser University, study number 2016s0191 (see the consent form in Appendix D). Finally, we conducted qualitative analyses using NVivo software of the themes that emerged from the discussions with the community representatives.

### **3.3 Working Group on First Nations and Land-based Aquaculture**

In November of 2016, a Working Group convened again in Campbell River to engage in a community dialogue related to our research to date and to envision future steps. Attendees included our five key informants, some additional community members

who had since become interested and one industry representative (eight members in total). Participants had each received a “Meeting Primer” (Appendix E) which summarized our preliminary findings. The full day meeting allowed us to enhance the participatory nature of the project as participants had the chance to offer feedback on our preliminary findings and thus inform the final results. We (the three research interns) facilitated the dialogue session along with Chris Roberts, the Regional Economic Development Coordinator for the N<sub>a</sub>n<sub>w</sub>a<sub>k</sub>o<sub>l</sub>a<sub>s</sub> Council. In the dialogue, we presented our findings of the Aquaculture Scan to gauge community interest in different possibilities, asked prompting questions on our research themes and envisioned next steps.

We initiated the day with a round of introductions and a “place-sharing” exercise in which facilitators and participants shared a favourite place on Google Maps, with the opportunity to share with the group about why that place matters. Several members of the working group offered locations and stories of places they lived when they were children and/or traditional band territory. The exercise was an icebreaker and an opportunity to root the research as connected to place.

Each research intern facilitated a 30-minute dialogue on each of their respective research themes (Regulation & Planning, Food Systems and Social Entrepreneurship & Economic Development). The participants’ interpretations of the preliminary findings from the “Meeting Primer” served as the basis for these dialogue sessions, while we asked guiding questions:

#### Regulation & Planning

- *Is it easier to get land based licenses from a regulatory point of view?*
- *If we had a magic wand to eliminate DFO regulations for land based shellfish, does interest in LBA lie in shellfish or finfish?*

#### Food Systems

- *How does this spectrum of consumption vs. commodification resonate?*
- *How might aquaponics come into play?*
- *Is Food security a priority in your communities?*

#### Social Entrepreneurship & Economic Development

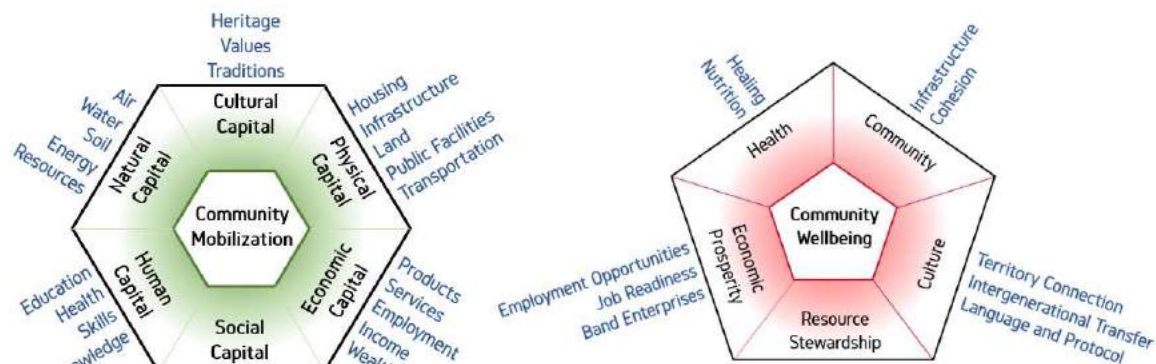
- What does your interest in a land-based aquaculture operation look like?
- What might future collaboration look like for the *Nanwakolas*?
- What would a viable business bring to your community (i.e. employment, food, etc.)?

While my research project focuses on the Food Systems research theme, the questions for the other two research themes were included as content from those dialogues added valuable nuance to the participants' understandings of food systems. Finally, a dialogue with the whole group was facilitated on the future direction of the project, and whether the development of some sort of decision- or dialogue-support tool would be valuable for the community. The results of the dialogue were recorded as hand-written notes.

### 3.4 Developing a Dialogue Support Tool with the *Nanwakolas*

I tested the utility of the Community Wellbeing Wheel as a potential sustainability assessment tool using the Community Capital Scan as a model to create a Community Wellbeing Framework with distinct nested subcomponents, or stocks. First, the loose descriptions of the Community Wellbeing Wheel from *Nanwakolas* documents were synthesized into a first iteration framework. This framework was then tested against a community dialogue which occurred against shellfish aquaculture to highlight strengths and identify gaps for improvement.

I derived the first iteration the CWB Framework using the descriptions from the *Community Wellbeing and Capacity Strengthening Plan (CWCS)*. Within the CWCS, possible components within the five CWB Areas (equivalent to the stocks within the six



**Figure 3.1: Community Capital Framework and Community Wellbeing Wheel, showing nested stocks within the six capitals/five CWB areas**

Community Capitals) are roughly suggested but not clearly organized. My first step was to create distinct stocks which could be nested within each CWB Area, which I synthesized from the CWCS. **Error! Reference source not found.** illustrates the Community Capital Framework next to our itemized Community Wellbeing Framework.

In the Community Capital Scan, stock descriptions are provided as dialogue criteria. These points give Scan participants clarity in what should be considered when evaluating a particular stock. I derived dialogue criteria for the CWB stocks from the CWCS, shown below in Table 3.1.

**Table 3.1: Dialogue Criteria for each stock within Community Wellbeing Areas**

Area	Stock	Dialogue Criteria
Economic Prosperity	Employment Opportunities	Provide diverse employment opportunities (mainstream economy, First Nation Government/Administration, Band enterprises, public sector) Provide employment options that are near community and throughout territories
	Job Readiness	Establish educated, skilled, and trained Band workforce Focus on youth readiness
	Band Enterprises	Encourage independent wealth creation Discover, develop and support entrepreneurship
Resource Stewardship	Governance	Shared decision making, comanagement and Ecosystem-based Management agreements are pursued Strengthen capacity of Chief and Councilor and senior administrative staff to make resource decisions
	Monitoring and Protection	Members have skills and certifications to perform monitoring and protection work (e.g Guardian Watchmen program) Nations are able to protect and monitor lands and resources
	Resource Health	Secure health of traditional foods and resources for future generations
Culture	Territory Connection	Strengthen documentation and articulation of links between resource stewardship and cultural values and teachings Provide opportunities to spend time in territories Support infrastructure and activities that facilitate occupying homelands
	Intergenerational Transfer	Strengthen family relationships Enhance cultural/traditional knowledge transfer opportunities from elders to youth

	Language and Protocol	Build, maintain, expand modern knowledge systems of territories (e.g. cultural cedar inventory project) Modernize of traditional protocols Encourage "practical" learning opportunities, particularly for language
Community	Infrastructure	Increase membership housing, particularly on reserve Provide infrastructure that will increase access to remote villages (docks, lodging)
	Cohesion	Improve band participation through greater communication and awareness Establish support for elders and youth Build, maintain and expand modern information management systems for Nations (e.g. member data, community plans)
Health	Healing	Improve mental and emotional health, self-esteem and pride in identity through place-based cultural connections Decrease incidence of drug and alcohol use and abuse Strengthen partnerships with regional health and social agencies
	Nutrition	Provide options to support members having better access to traditional foods, especially off reserve members Continue to protect and enhance traditional foods and cultural resource harvest areas Enhance membership nutrition

Once I had completed the first iteration of the CWB Framework, I used the dialogue that occurred surrounding a shellfish hatchery to explore the suitability of the stocks and dialogue criteria. General dialogue from the working group was characterized into nine “dialogue themes”. The Dialogue themes were then tested against the first iteration of the CWB framework according to the Dialogue Criteria in Table 3.1.

Table 3.1. While many of the dialogue themes could conceivably connect to many community values, I limited the connections to three for clarity. I provided commentary for each theme in the following two categories:

- a) *Rationale for connections based on Dialogue Criteria*
- b) *Observed Strengths and Gaps of the first iteration CWB Framework*

Finally, I conducted a gap analysis to show what aspects of the community dialogue were not sufficiently captured in our first iteration of the Wheel based on the observed weaknesses of the first iteration of the CWB Framework. The identified gaps were

proposed as recommendations to enhance the utility of the framework in supporting Dialogue.

### 3.5 Assessing Shellfish Aquaculture with a Food Sovereignty Framework

I used the six principles of food sovereignty that emerged from the Nyéléni conference as a framework to evaluate how LBA can make contributions to food sovereignty for the Nanwaḱolas communities. The criteria are shown below in Table 3.2.

**Table 3.2: Six Nyéléni principles reworded as criteria to serve as an analytical framework**

Food sovereignty principle	Criteria
<b>Focuses on food for people</b>	<ul style="list-style-type: none"> <li>-the right to sufficient, healthy and culturally appropriate food for all individuals, peoples and communities is at the centre of food-related policies</li> <li>-food is not treated as just another commodity or component for international agri-business.</li> </ul>
<b>Values food providers</b>	<ul style="list-style-type: none"> <li>-Food sovereignty values and supports the contributions, and respects the rights, of all who cultivate, grow, harvest and process food;</li> <li>-policies, actions and programmes that undervalue food providers, threaten their livelihoods and eliminate them are rejected</li> </ul>
<b>Localises food systems</b>	<ul style="list-style-type: none"> <li>-Food sovereignty brings food providers and consumers closer together;</li> <li>-providers and consumers are at the centre of decision-making on food issues;</li> <li>-producers are protected from the dumping of food and food aid in local markets;</li> <li>-consumers are protected from poor quality and unhealthy food, inappropriate food aid and food tainted with genetically modified organisms;</li> <li>-governance structures, agreements and practices that depend on and promote unsustainable and inequitable international trade and give power to remote and unaccountable corporations are resisted</li> </ul>
<b>Localises decision-making</b>	<ul style="list-style-type: none"> <li>-Food sovereignty places control over territory, land, grazing, water, seeds, livestock and fish populations on local food providers and respects their rights.</li> <li>-Food sovereignty recognizes that local territories often cross geopolitical borders and ensures the right of local communities to inhabit and use their territories;</li> <li>-positive interaction between food providers in different regions and territories and from different sectors is promoted to help resolve internal conflicts or conflicts with local and national authorities;</li> <li>-the privatisation of natural resources through laws, commercial contracts and intellectual property rights regimes is rejected</li> </ul>

<b>Builds knowledge and skills</b>	<ul style="list-style-type: none"> <li>-Food sovereignty builds on the skills and local knowledge of food providers and their local organisations that conserve, develop and manage localised food production and harvesting systems, developing appropriate research systems to support this and passing on this wisdom to future generations;</li> <li>-technologies that undermine, threaten or contaminate knowledge or skills are rejected</li> </ul>
<b>Works with nature</b>	<ul style="list-style-type: none"> <li>-Food sovereignty uses the contributions of nature in diverse, low external input agroecological production and harvesting methods that maximise the contribution of ecosystems and improve resilience and adaptation, especially in the face of climate change</li> <li>-methods that harm beneficial ecosystem functions, that depend on energy intensive monocultures and livestock factories, destructive fishing practices and other industrialised production methods, which damage the environment and contribute to global warming are rejected</li> </ul>

As far as I am aware, no trials have been made to assess any actual or proposed food systems against these principles but I followed the suggestion of Chaifetz and Jagger (2014) to use the principles as ‘goal posts’. I will use these principles to address research question 2-1: “What features of shellfish LBA align with or are incongruent with a food sovereignty approach?”

I used interview responses and dialogue themes which we had collected as research interns to understand community members’ conceptions of how LBA might contribute to local food sovereignty. As food sovereignty is a politicized frame to examine power within food systems and depends entirely on the political and institutional structures in which it is embedded, it is necessarily place-based and contingent on local food providers’ conceptions of their own food system. For this reason, I interrogated participant responses in the interviews and dialogue using the Nyéléni principles as an analytical framework to identify points of alignment or incongruence between LBA and the food sovereignty literature. Participant context is critical in that food sovereignty is entirely dependent on the history, community capacity, and ecology of a given place, and is subject to local communities’ conceptions of rights (Gambling, 2016; Pimbert, 2006; Wittman, 2011). Furthermore, a criticism of food sovereignty literature is that it oversimplifies producers’ motivations and romanticizes the ‘peasant way’ (Bernstein, 2014; Collier, 2008). Grounding the analysis in the subjects’ own experiences and desires is a way to ensure that research is meaningful and not purely abstract. A necessary note of our approach is that this research represents the experiences of a few

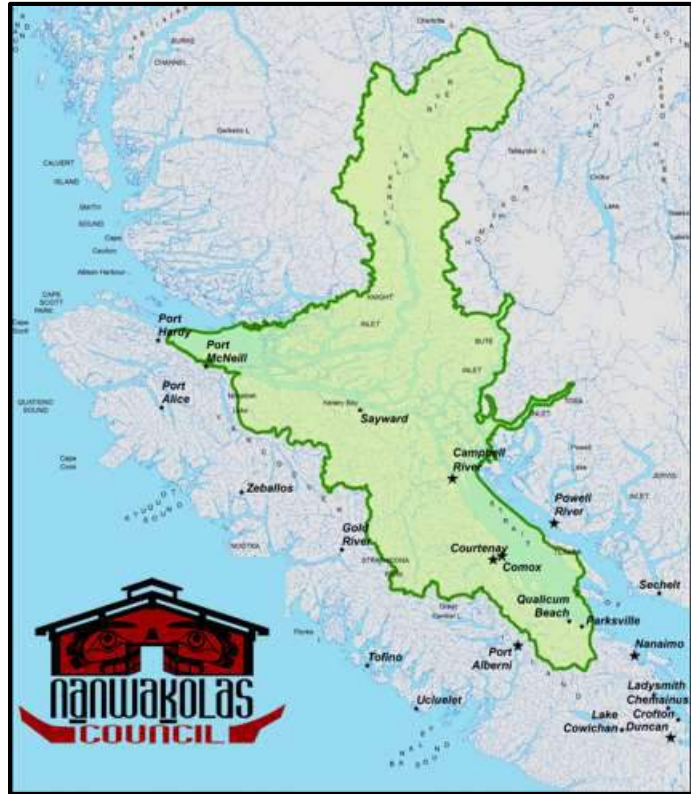
select community members who are key knowledge holders, but not necessarily a representative sample of the community's interests. In addition to the Nyéléni framework analysis, I coded interview transcripts and focused on two emergent themes of Indigenous Food Sovereignty and Consumption vs. Commodification, addressing the research questions 2-2 ("What does a non-traditional food production, in this case LBA, offer First Nations in their pursuit of self-determination through food sovereignty?") and 2-3 ("How do communities navigate the decision to commodify or consume locally produced food resources?") respectively. I also present relevant themes which emerged from the community dialogue in the analysis for context.



## Chapter 4.

### Study community Description: The Nanwakolas Council

The Nanwakolas Council represents the interests of six Member First Nations (MFNs) whose traditional territories are in the northern portion of Vancouver Island and adjacent South-Central Coast (see Figure 4.1). These nations are: Mamalilikulla Nation, Tlowitsis Nation, Da'naxda'xw Awaetlatla First Nation, We Wai Kum First Nation, Kwiakah First Nation, and K'ómoks First Nation. The council, formed in 2000, serves as a vessel to facilitate discussion and action between member nations in their dealings with the provincial and federal governments, as well as with stakeholder and industry groups. Through these collaborations and negotiations, the council advocates for and promotes its Member First Nations' (MFNs) Aboriginal rights and interests in marine and land planning.



**Figure 4.1: Territories of the Member First Nations of the Nanwakolas Council (Roberts, 2014)**

The Nanwakolas Council represents communities whose abilities to acquire and access food have been marginalized in part by the current food regime in BC, and who participate in aquaculture for diverse reasons. Increased pressure on wild stocks combined with prohibitive and sometimes discriminatory settler-state regulation has limited the ability of many coastal First Nations to produce and harvest traditional foods to both feed their communities and participate in market trade (e.g. see Davis & Wagner,

2006; Haggan & Brown, 2002; Morrison, 2011; Turner & Turner, 2008). A wealth of literature highlights the many ways in which indigenous peoples are regaining access to traditional foods critical for cultural and physical health (A. A. Desmarais & Wittman, 2013; Grey & Patel, 2014; Turner & Turner, 2007). Many of the N<sub>an</sub>w<sub>a</sub>k<sub>o</sub>las' MFNs practiced some form of aquaculture since time immemorial and some today are involved with conventional marine net-pen (i.e. finfish) and shellfish aquaculture. These engagements can serve as a means of economic development and assertion of rights to resource management for First Nations in their traditional territories (Deo, 2002; Silver, 2013; Tollefson & Scott, 2006). The Aboriginal Aquaculture Association of Vancouver Island states that, "With millennia of experience in fisheries and/or aquaculture in their territories, Canada's Aboriginal people are well positioned to employ their political access, experience, know-how, and labour to the aquaculture sector. To reach this potential, communities and industry will need to work together as partners" (Aboriginal Aquaculture Association, 2015). Even still, First Nations' rights to produce food through aquaculture and manage their traditional waters is hindered by an ongoing neoliberalization of ocean spaces, state management and competition with multinational corporations (Gerwing & McDaniels, 2006; Richmond, Elliott, Matthews, & Elliott, 2005; Silver, 2013; Volpe & Shaw, 2008).

## **4.1 Rethinking Seafood Production – Project Objectives**

Our research partnership fits within the N<sub>an</sub>w<sub>a</sub>k<sub>o</sub>las Councils' mandate of community economic development. In the N<sub>an</sub>w<sub>a</sub>k<sub>o</sub>las Council's Community Wellbeing and Strengthening Plan (CWBS), the following are listed as some of the economic development priorities of the N<sub>an</sub>w<sub>a</sub>k<sub>o</sub>las: creating jobs and employment opportunities, generating revenue for First Nations, building healthier and happier communities, sustainable resource use, being self-sufficient, increasing participation in the general economy, partnerships, Nation building, financial independence, and community building (Roberts, 2014). The breadth of these motives underscores the importance of Economic Development as not an end, but a means of striving for sovereignty and self-determination. Concern for the health of traditional waters as well as a desire for increased engagement with the sustainable aquaculture industry catalyzed the project *Rethinking Seafood Production: Developing Sustainable Communities with Land-Raised*

*Fish* as a preliminary investigation into the potential of land-based aquaculture for the communities of the Nanwakolas Council.

## Chapter 5

### Results

In this section, I present the results of the CWB Framework development process as well as the food sovereignty analysis of LBA development. Section 5.1 presents the results of our testing the Community Wellbeing Wheel (CWBW) modeled after the CC Scan using a community dialogue that occurred about a shellfish hatchery and a discussion of those results. Nine main themes which emerged from the dialogue are connected to the first iteration of the CWB Framework. A gap analysis then identifies the points which emerged in the dialogue but were not adequately captured in the first iteration. The gaps are then proposed as recommended improvements to the CWB Framework, including the addition of a sixth CWB Area of Community Capacity. The food sovereignty analysis in section 5.2 relates the results of the key informant interviews in terms of a shellfish hatchery (with potential growout) to food sovereignty for the Nanwakolas Nations. First, I frame the interview responses are framed using the Nyéléni framework as an analytical food sovereignty frame. Next, I present additional responses according to the emergent themes of Indigenous Food Sovereignty and Consumption vs. Commodification.

#### 5.1 Results: Developing a Dialogue Support Tool with the Nanwakolas

I revisited the dialogue that we facilitate on November 7<sup>th</sup> and I identified nine main themes that were relevant to a hypothetical Shellfish Hatchery. I then fit the main themes of the dialogue to the CWB stocks that I had derived from the CWCSP, using the Dialogue Criteria to justify my connections. The nine themes and the stocks that I connected them too are summarized in Table 5.1.

**Table 5.1: Themes observed in Shellfish aquaculture Dialogue and the particular stocks (and CWB areas) which I connected them too through analysis.**

<b>Dialogue theme</b>	<b>Stocks (<i>Wellbeing Area</i>)</b>
1. There is limited human capacity to support the technical know-how behind shellfish LBA	Job Readiness ( <i>Economic Prosperity</i> )
2. Shellfish LBA technology could be very expensive	Band Enterprises ( <i>Economic Prosperity</i> )
3. Building a project with community food as its priority might facilitate licensing and commercialization to follow	Band Enterprises ( <i>Economic Prosperity</i> ) Nutrition ( <i>Health</i> )
4. Raising shellfish on land with RAS would require growing nutrients, when we have access to good ocean water full of nutrients	Band Enterprises ( <i>Economic Prosperity</i> ) Territory Connection ( <i>Culture</i> )
5. A venture should be a business first; community benefits might flow from it but if they are prioritized the business can suffer	Band Enterprises ( <i>Economic Prosperity</i> ) Infrastructure ( <i>Community</i> ) Nutrition ( <i>Healing</i> )
6. Some partnerships or shared ownership structures might build capacity for small nations, but could create inter-nation tension	Cohesion ( <i>Community</i> ) Protocol ( <i>Culture</i> )
7. A project needs to be understood and supported by the whole community	Cohesion ( <i>Community</i> )
8. Access to seed might allow us to seed our own beaches as a protest to DFO	Governance ( <i>Resource Stewardship</i> ) Territory Connection ( <i>Culture</i> )
9. Industry pressure influences DFO more than the priority of supporting First Nations	Governance ( <i>Resource Stewardship</i> )

In the following section I will go through each Dialogue theme and provide commentary on the following sections:

- a) *Rationale for connections based on Dialogue Criteria*
- b) *Observed Strengths and Gaps of the first iteration CWB Framework*

**1. There is limited human capacity to support the technical know-how behind shellfish LBA**

- a) *Rationale for connections based on Dialogue Criteria*

This theme arose as a concern that the complexity of a shellfish hatchery would limit band employment as highly skilled workers, particularly trained biologists, would be needed to operate a hatchery. I saw this as a connection to *Job Readiness (Economic*

*Prosperity*). In a sense, the concern is actually that the community does not currently have sufficient job readiness to take on such a project – not that such a project would hurt the communities’ readiness. While this was voiced as a concern, it could be turned into an opportunity if implementation came with specific training partnerships for band membership and youth.

*b) Observed Strengths and Gaps of the first iteration CWB Framework*

The challenge in placing this dialogue theme is that the stock, as it is written asks *whether or not a project enhances Job Readiness*. The participants were more focused on limitations to capacity, which could be framed as *whether or not a project fits with the community’s existing level of Job Readiness*. Thus, the concern could fit better under a discussion of community capacity.

**2. Shellfish LBA technology could be very expensive**

*a) Rationale for connections based on Dialogue Criteria*

The placement within *Band Enterprises (Economic Prosperity)* is tenuous but fits most aptly here as band enterprises are the income generating entities within the Nanwakolas communities. These entities would thus be expected take the high investment in a potential hatchery. As an extension of this, it is implied that if a project is deemed to require to great an investment that lies beyond the capacity of existing or potential Band Enterprises, it would require significant external investment and thus remove some of the community’s ability to manage their own business enterprises.

*b) Observed Strengths and Gaps of the first iteration CWB Framework*

It seems that this stock, under its current description, is best suited to ask *whether a particular project will be supportive of independent, economically stable Band Enterprises* but it is not explicit whether financial capacity for investment should be considered. A consideration of financial capacity could encourage this discussion and allow the stock *Band Enterprises* to be more focused.

There is an implicit connection between *Band Enterprises (Economic Prosperity)* and *Governance (Resource Stewardship)*; the desire to see increased band enterprises may arise from a desire to see management decisions, particularly as they relate to resources, be made by community members as opposed to external interests. This

could be an expression of sovereignty, but is not explicitly addressed in the current dialogue criteria.

### **3. Building a project with community food as its priority might facilitate licensing and commercialization to follow**

#### *a) Rationale for connections based on Dialogue Criteria*

This dialogue theme focuses on increasing community health through more availability to food and so we connected it to *Nutrition (Health)*. An implication of this comment is that if the community were to be consuming some of the output (in the case of a full growout scenario, or a hatchery scenario which supplies local marine operations) it competes with the profitability of the enterprise, and I thus connected it to *Band Enterprise (Economic Prosperity)*. A critical consideration here is whether or not the food produced in community owned aquaculture operations would ever be destined for the community itself. This interesting tension is explored in great detail in section 5.2.3 and the discussion of food sovereignty.

#### *b) Observed Strengths and Gaps of the first iteration CWB Framework*

This dialogue theme represents a tension between two CWB areas and thus a decision that would have to be based firmly in community values. The strength of the Community Wellbeing Wheel as a tool based in Cultural Values (according to the Community Wellbeing and Capacity Strengthening Plan) is apparent here in that two values (*Band Enterprises* and *Nutrition*) which may be in tension can be considered under the same tool. Encouraging decision makers to consider multiple priorities simultaneously is the basic tenet of multi-criteria frameworks, and a strength of the CWB Framework.

Currently, the stock *Nutrition (Health)* strongly emphasizes increasing nutrition through traditional foods based on the language used in the Strengthening Plan. I elaborate on cultural relevance in food production in detail in section 5.2.2 and whether non-traditional food production would satisfy community goals. However, the stock *Nutrition (Health)* could diversify objectives beyond solely focusing on traditional foods. While traditional foods should certainly be a pillar of health efforts as they relate several key Nanwakolas objectives (i.e. Resource Stewardship and Culture), diversifying community objectives could help the community to capitalize on additional modern

nutrition initiatives. We heard participants in the dialogue express interest in aquaponics for instance for an increase in fresh lettuce, a healthy yet non-traditional food source.

#### **4. A venture should be a business first; community benefits might flow from it but if they are prioritized the business can suffer**

##### *a) Rationale for connections based on Dialogue Criteria*

I connected this dialogue theme to *Band Enterprises (Economic Prosperity)* as it emerged as a discussion of where band enterprises should focus their attention. Some participants' past experiences led them to believe that if community benefits are the priority of an enterprise, the day-to-day workings of the business fall by the wayside. What was meant by "community benefits" was not entirely clear, but would likely fall under either food for the community or infrastructure investment and so was connected to *Nutrition (Health)* and *Infrastructure (Community)*.

##### *b) Observed Strengths and Gaps of the first iteration CWB Framework*

The suggestion that community benefits might detract from business would of course have to be clarified by further dialogue with the participants. However, it illuminates the fact that the current iteration of the CWB framework is limited in its ability to allow participants to classify community benefits. A stock of *Assets* (instead of simply infrastructure) may allow a broader consideration of what community benefits might flow from a band enterprise, of which infrastructure would be a significant component.

#### **5. Raising shellfish on land with RAS would require growing nutrients, when we have access to good ocean water full of nutrients**

##### *a) Rationale for connections based on Dialogue Criteria*

I understood this theme as questioning why the *Nanwakolas* would invest in contained, land-based aquaculture (i.e. RAS) when one main asset that the MFNs possess is abundant marine water resources. Regarding a hatchery, the implicit alternative would be a more traditional flow-through hatchery model which uses marine resources to nourish the growing organisms. Most simply, the theme is a pragmatic comment of economic viability (i.e. why expend the additional funds to buy or grow feed) which we connected to *Band Enterprise (Economic Prosperity)*. In the dialogue, I observed an additional cultural implication here in a desire to engage with traditional resources, even if in a non-traditional way. My interpretation is supported by some of



the existing engagements with clam and oyster aquaculture that the nations have; even though they are culturing non-traditional species through non-traditional methods, a connection to traditional resources in any capacity still allows the nations to have governance influence. I connected the theme to the stock *Territory Connection (Culture)* as a RAS system might further isolate employment from resources and traditional territories.

*b) Observed Strengths and Gaps of the first iteration CWB Framework*

This dialogue theme represents one fairly clear connection to *Band Enterprise (Economic Prosperity)* and another that is more based in a subjective interpretation of community values in *Territory Connection (Culture)*. The second connection is not definitive as it could be interpreted instead as *Governance (Resource Stewardship)* in that the Nations' increased presence and participation in the traditional territories would give them a greater voice in governance decisions (explored in section 5.2.2). However, using the language as interpreted in the Strengthening Plan, the stock *Governance (Resource Stewardship)* would be evaluated on whether or not decision-making capacity is actually enhanced – mere presence in the territories cannot be said to enhance decision-making power by default. This example represents potential strength of the CWB Framework as a multi-criteria framework in that it could highlight design steps necessary to achieve broader community development goals. If a *Band Enterprise* were being established to have a *Territory Connection* (i.e. a flowthrough hatchery as opposed to RAS), this step could satisfy the cultural connection to resources through economic development.

**6. Some partnerships or shared ownership structures might build capacity for small nations, but could create inter-nation tension**

*a) Rationale for connections based on Dialogue Criteria*

This dialogue theme emerged from a discussion of possible ownership structures for a regional hatchery that would reduce the capital burden on individual Nations such as cooperatives or partnerships between Nations. Some participants were concerned that when businesses face inevitable hard years, shared ownership can hurt the social capital of those involved and was thus connected to the stock *Cohesion (Community)*. This concern was echoed through some interview responses in which participants brought up risk-sharing and the challenges of mixing politics and business (see section

0.0.0 , *Localizing decision making*). In addition to this, a connection was drawn to the stock *Language and Protocol (Culture)* because there was an indication that historically the bands had very specific and successful ways of cooperating, and that these may have been degraded by the segregation that resulted from colonization.

*b) Observed Strengths and Gaps of the first iteration CWB Framework*

I observed two weaknesses with the stock *Cohesion (Community)*. First, the current description focuses on methods of improving cohesion (i.e. Improve communication channels, establish support programs, information management systems for Nations) but lacks a mode to discuss the intangible outcome, which can be presumed to be the cohesion itself. The description for *Social Capital* from the community capital scan (a parallel for the stock *Cohesion* in the CWB wheel) draws a useful distinction: “[Social capital] has both an informal aspect related to social networks and a more formal aspect related to institutions and social development programs”. The current CWB description focuses on the formal aspect of cohesion and could benefit from an addition of criteria from the community capital scan which describe the informal, such as “Social solidarity between citizens,” “Opportunity for citizens to build strong networks between each other” and “No poverty or exclusion”. Second, the existing description implies a focus on programs within Nations, and does not provide an explicit avenue to consider how a project might affect cohesion *between* Nations.

The stock *Language and Protocol* adequately addresses the desire for Nations to interact in ways which honour and respect the healthy relationships that they once had. Further dialogue with community members would be needed to add context to the dialogue criteria, to determine whether a formalized business partnership would be the goal of “modernizing traditional protocol”.

Finally, this dialogue theme illustrates another opportunity to discuss capacity which was not addressed in the current iteration of the CWB Framework. The theme emerged as both a concern for the possible tensions that could arise from a partnership, but also as an opportunity for the possible gains in capacity that could emerge particularly for small nations. The current stocks within the Scan do not offer a way to discuss the limitations to capacity that small nations might experience nor the possible capacity gains that sound partnerships could offer to the MFNs and to the Nanwakolas

organization. The theme could be framed by a stock of Organizational/Governance Capacity.

## **7. A project needs to be understood and supported by the whole community**

### *a) Rationale for connections based on Dialogue Criteria*

Participants raised this concern based on a need for trust among community members before embarking on any project, particularly one that would require such investment. I connected this dialogue theme to the stock *Cohesion (Community)* as it was rooted in the need for communication between band members.

### *b) Observed Strengths and Gaps of the first iteration CWB Framework*

This theme supports our earlier observation that the stock *Cohesion (Community)* could be strengthened by expanding its focus beyond the formalized structures of social capital to include the informal goal of social capital itself. Adding a dimension of trust to the criteria description would strengthen the “what” of this goal, with the communication itself being the “how”.

## **8. Access to seed might allow us to seed our own beaches as a protest to DFO**

### *a) Rationale for connections based on Dialogue Criteria*

I connected this dialogue theme to the stock *Governance (Resource Stewardship)* as participants suggested a shellfish hatchery might facilitate greater control over resource management decisions. Furthermore, I interpreted the sentiment to be embedded within a desire for the nations to spend more time engaging with traditional resources and territories for cultural benefit, and so I connected it to *Territory Connection (Culture)*.

### *b) Observed Strengths and Gaps of the first iteration CWB Framework*

The comment supports my analysis of dialogue theme 2 (“Shellfish LBA technology could be very expensive”) in that the current iteration of dialogue criteria lacks an articulation of how band enterprises can strengthen the capacity of Nations to participate in governance discussions.

## **9. Industry pressure influences DFO more than the priority of supporting First Nations**

### *a) Rationale for connections based on Dialogue Criteria*

This dialogue theme emerged as a concern following the opportunity expressed in theme 8 in that despite the desire to influence DFO decisions through their actions, the DFO was excluding the Nations from decision-making as a result of imbalanced industry pressure. The theme was interpreted as a desire for a greater influence in resource management decisions made by the DFO and so was connected to *Governance (Resource Stewardship)*.

### *b) Observed Strengths and Gaps of the first iteration CWB Framework*

This theme and other interview responses about the dynamics of power (see food sovereignty analysis, section 5.2.2 for responses) suggest that the Nations feel limited in their ability to self-govern as a direct result of an imbalance of power with colonial laws and policies. The current iteration of the CWB Stock Criteria suggest strategies which may achieve this balance (e.g. comanagement, ecosystem based management) but may conflate means with ends. If the community currently feels that is in an imbalance of governance, more explicit wording may allow dialogue which explicitly pursues self-determination as the ultimate goal. Once again, the stocks of the first iteration did not adequately present a way to discuss capacity limitations directly. This theme was expressed as a perceived limitation to the N<sup>a</sup>n<sup>w</sup>a<sup>k</sup>o<sup>l</sup>a<sup>s</sup> organizational capacity to have a voice in governance.

## **5.1.1 Results of Gap Analysis**

Through the analysis I identified gaps identified points of suitability and identified gaps. The observed weaknesses in the first iteration of the CWB Framework were considered to be gaps in its suitability to encapsulate community discussion, which I isolated as recommended inclusions. Several of the dialogue themes presented issues which were either not addressed in the CWB Dialogue Criteria or were addressed in convoluted ways which complicated the ability to evaluate the shellfish hatchery on a stock by stock basis. Below, Table 5.2 presents a modified version of Table 3.1.

Table 3.1 after having tested the CWB Framework with the dialogue shellfish aquaculture, with proposed changes in blue. Several small themes emerged through the analysis which bolster the existing stocks, and the one central theme of *Community Capacity* has been suggested as a sixth Community Wellbeing Area. Including capacity as a sixth CWB with the three stocks of human, financial and organizational, facilitates a consideration of capacity in broader community decisions.

**Table 5.2: Community Wellbeing areas with suggested improvements (in blue) to improve Dialogue Support function**

Area	Stock	Dialogue Criteria
Economic Prosperity	Employment Opportunities	Provide diverse employment opportunities (mainstream economy, First Nation Government/Administration, Band enterprises, public sector) Provide employment options that are near community and throughout territories
	Job Readiness	Establish educated, skilled, and trained Band workforce Focus on youth readiness
	Band Enterprises	Encourage independent wealth creation Discover, develop and support entrepreneurship
Resource Stewardship	Governance	<b>Pursue self-determination</b> through Shared decision making, comanagement and Ecosystem-based Management agreements Strengthen capacity of Chief and Councilor and senior administrative staff to make resource decisions <b>Band enterprises which enhance resource management are integrated into governance discussion</b>
	Monitoring and Protection	Members have skills and certifications to perform monitoring and protection work (e.g Guardian Watchmen program) Nations are able to protect and monitor lands and resources
	Resource Health	Secure health of traditional foods and resources for future generations
Culture	Territory Connection	Strengthen documentation and articulation of links between resource stewardship and cultural values and teachings Provide opportunities to spend time in territories Support infrastructure and activities that facilitate occupying homelands
	Intergenerational Transfer	Strengthen family relationships Enhance cultural/traditional knowledge transfer opportunities from elders to youth
	Language and Protocol	Build, maintain, expand modern knowledge systems of territories (e.g. cultural cedar inventory project)

		<p>Modernize of traditional protocols</p> <p>Encourage "practical" learning opportunities, particularly for language</p>
Community	Assets	<p>Ensure adequate access to housing, food and clothing for membership, particularly on reserve</p> <p>Provide infrastructure that will increase access to remote villages (docks, lodging)</p>
	Cohesion	<p>Improve band participation through greater communication and awareness, particularly targeting off-reserve participation</p> <p>Establish strong social development programs such as support for elders and youth, and modern information management systems for Nations (e.g. member data, community plans)</p> <p>Build strong networks of trust and solidarity between membership</p> <p>Strengthen partnerships between Nations for regional resilience</p>
Health	Healing	<p>Improve mental and emotional health, self-esteem and pride in identity through place-based cultural connections</p> <p>Decrease incidence of drug and alcohol use and abuse</p> <p>Strengthen partnerships with regional health and social agencies</p>
	Nutrition	<p>Provide options to support members having better access to traditional foods, especially off reserve members</p> <p>Continue to protect and enhance traditional foods and cultural resource harvest areas</p> <p>Physical health outcomes through increased traditional food consumption are prioritized alongside promoting healthful aspects of Western diet</p>
Capacity	Human	<p>Pursue opportunities which capitalize on or build existing skills instead of relying too heavily on external expertise</p> <p>Capacity Development of membership is prioritized</p>
	Financial	<p>Matches community capacity to financially support it</p> <p>Does not require excessive reliance on external investment</p>
	Governance/ Organizational	<p>Pursue opportunities which will use existing governance voice in indigenous issues</p> <p>Build institutional support for indigenous management through regional networks</p>



Figure 5.1: Revised Community Wellbeing Framework showing updated stocks and the addition of a sixth Wellbeing Area *Community Capital*

## 5.2 Results: Food Sovereignty and Aquaculture Development

### 5.2.1 Nyéléni Principle Analysis

In this section, I present the analysis of aquaculture development focused on LBA and how it could contribute to food sovereignty for the *Nanwakolas* according to the six principles put forward from the Nyéléni conference. A cooperative regional shellfish hatchery emerged as a common pursuit from the informants' responses which might build food sovereignty for the *Nanwakolas* Nations. I highlight the features of a shellfish hatchery that might lend themselves to helping the *Nanwakolas* Nations' realise their conceptions of local food sovereignty and other features that might hinder this pursuit.

#### Principle 1: Focuses on Food for People

This Nyéléni principle highlights that food is to be produced as something to be consumed, not for its value as a commodity. A critical component of this principle then is

that food should be appropriate to the community that might consume it. The responses presented in this principle substantiate a focus on a shellfish hatchery with growout as an LBA venture which could produce food appropriate for the community. The following responses illustrate the participants' broad interest shellfish aquaculture as opposed to finfish aquaculture. One perception of shellfish is that as lower trophic-level animals they are implicitly less ecologically harmful:

I think it's effluence of the species, the shellfish doesn't have any. As towards fin fish, it's just abundance an of effluence that they have to get rid of and where do they do it? Whether it's on land or in the water [...] But we looked at shellfish as being an eco-friendly species.

Furthermore, participants expressed that their traditional affiliation with shellfish management would be an advantage applicable to modern methods and new species:

Well, because of our historical use of shellfish for food and managing it in our community, say, around our village and stuff like that, we sort of had a natural knack for dealing with shellfish and things of that nature. So it sort of led us to think that well, even though oysters are not really a genus to our territory and our use and stuff like that, we still thought that well, we spend time on the water. We sort of have that association. So that was one of the reasons why we looked into getting into [aquaculture] especially in the shellfish aquaculture portion.

Finally, finfish aquaculture is a contentious issue within Kwakwaka'wakw Nations (the larger people of which MFNs are apart) as communities seek both jobs in their territories and environmental stewardship. Participants seemed to prefer to avoid the topic of salmon aquaculture altogether because of this complicated political and social context:

It's a tense political history behind fin fish too. And I think for some nations it's just a lot easier to talk about [shellfish] aquaculture instead. We won't talk about fish. We'll talk about [shellfish]. 'Cause it's just easier to avoid the history behind it. There's been some strong champions for [finfish] and some strong champions against and there's been some pretty intense conversations at times in the past. [...] So it becomes very pretty quickly probably an easy posture just to slide over and say, well, let's talk about [shellfish] aquaculture. We're interested in that.

In discussing what species would be of interest to the participants for aquaculture if membership consumption were the goal, participants demonstrated a greater willingness to discuss shellfish and a resistance to farmed finfish for satisfying their own food needs. One participant said:



But would I eat farmed fish? No. Have I tried it? Yes. No, it's not my cup of tea. No comparison whatsoever. It's apparent to me because I grew up with wild fish, ate it all my life and still do.

Another participant implied resistance to consuming farmed finfish through his commitment to the wild salmon fishery:

I look at it and I'm selfish in my perspective and thoughts on the fin-fish aquaculture industry, I look at, let's do fin-fish aquaculture to generate revenue. Leave the commercial wild fishery alone and the wild fish, that's for us here in B.C. to enjoy. Like, recreational, food, social, ceremonial, to heck with the commercial side of the salmon fishery. Let's leave it alone. We can generate revenue with the finners and then we got-- we can have-- and enjoy all the Pacific salmon that we want. For us here in B.C. I'm selfish. So that's my mindset is, like, okay, we do economic here, we do food, social, ceremonial here.

The comments illustrate less willingness to pursue finfish aquaculture for community consumption. In contrast, participants did not express resistance to consuming farmed shellfish and in fact expressed interest in consuming abalone, a species which the literature suggests can be grown to full growout in recirculating systems (Jarayabhand et al., 2010) While the species was poached to near extinction in BC and is now illegal to catch, it used to have cultural relevance as a food source and its shells were used to make regalia. One participant explained the desire to recover abalone as a community food source:

If you can farm abalone [...] and provide it to the elders, for them to have something they've never had in a long, long time. I know for a fact there's a lot of them that don't even know what it tastes like now, sort of thing. In my lifetime I've eaten abalone twice. Only because my friend was a diver.

Furthermore, participants indicated that their traditional relationship with shellfish has been one of management as opposed to a wild fishery such as salmon. The following two responses illustrate this relationship of management:

I guess going back, maintaining our shellfish or our clam beds was a top priority when-- even when we were kids we were combing, you'd never go to the same place right away. You move around and get the clams moving in the sand. You get the smaller ones in there and-- so you don't just keep harvesting in one spot, right.

Well, abalone's always been on the top priority for all nations because they grow wild and, you know, you'd put a line in the water and you'd leave it there for a couple days. Then you'd pull out-- full of it, right.

You could look down there and see them all and it was, like, one of the most important stuff. Now we can't take it.

I have begun to address the question of community appropriateness within this food sovereignty principle in terms of taste and aesthetic, but the issue of community preference will require greater investigation of cultural relevance and community consumption. The participant responses indicate shellfish as a preferred focus for our LBA investigation; however, the N̄nwākolas context is critical here as traditional foods are not merely for sustenance but an opportunity to connect with the Creator's gifts (Roberts, 2014). A shellfish hatchery with growout might offer some elements of food sovereignty in that the community could consume culturally relevant species, but consumption alone does not encompass all aspects of traditional foods. This theme of traditional food and territory connection as an expression of sovereignty is explored in greater detail in section 5.2.2. More broadly, the discussion of community appropriateness depends on whether community members actually consume the food produced: if the N̄nwākolas were developing an aquaculture program would it focus on revenue generation for economic development or food for the community? Because this question underlies the discussion of many of the Nyéléni principles, I explore it later in section 5.2.3, *Balancing Consumption and Commodification in Aquaculture Development*.

## **Principle 2: Values Food Providers**

The main contribution a shellfish hatchery might make in this Nyéléni principle is the employment it could create. Participants expressed desires for more steady and localized work. Many livelihoods within the nations are based on seasonal resource management work. The literature suggests that a well planned and managed land based facility could continue production through the year (Engle & Leung, 2006). When discussing limited employment, participants expressed dissatisfaction with the inconsistency of current seasonal employment such as tourism and fisheries. For instance:

Yeah, to be able to sustain growth in the village there would need to be all-year-round employment and that would be the key to have people moving back. If they can come back and work all year long instead of just working four to six months and, you know, that's it. That's what we're looking at trying to create is a long-term opportunity.

One participant shared their perception of the current commercial salmon fishery:

I look at where our salmon industry is in comparison to where it was when I was a kid ... talking with the old man, when I was a kid you'd say goodbye to the old man around February. 'Cause he's getting ready for herring. And then he was gone. And you'd see him around the end of Mar-- or sorry, the end of October. He'd come home for a weekend or two here and there. But, I mean, the commercial fishery back in the '80s was nonstop. Today he goes-- does a commercial fishery. He'll hop in somebody's boat and he's home the very next day and it's, like, hey, I thought you were going fishing? I did. It was only open for six hours. What are you doing home? How do you make money doing that?

The comments indicate a desire to see more diverse and consistent employment for their membership. The theme of employment and human capacity is explored further in the later principle *building knowledge and skills*.

### **Principle 3: Localizes Food Systems**

The following responses illustrate participants' desires to see food production, trade and investment localized, as well as their pragmatic thoughts on limitations. A focus of this food sovereignty principle is on bringing consumers and producers closer together. A flowthrough facility like Hummingbird Cove could in fact bring food production near the MFN communities, as it relies on marine resources which several of the communities have access to. Additionally, the literature suggests that RASs can be in a diversity of locations because of reduced water requirements (Singer et al., 2008; Verdegem et al., 2006; Zohar et al., 2005). However, participants pointed out the realities of human capacity and remoteness as limits to place-based economic development in their communities. One participant stated that

...I wouldn't be surprised if you find some over-arching limiting challenges for nations. Location, remoteness, population, capacity. We hit all of those. We've got under 250 members, 90 percent, 95 percent living away from home. Home itself is accessible only by boat. Nice dock, great place. I love to be there all the time I can. But it's a challenge to get people out there. If we were to set up something, say, we had the ideal piece of land and we had great investment or partners and we were going to start a business, because we'd never had one before doing this. There's the human capacity now, you know, how do you attract the right people to come in and do the work. How do you find membership and build the interest to do this-- to get trained to do this work and then to move out to the village.

Additionally, the literature also stresses the high energy costs of any land-based aquaculture system (Ayer & Tyedmers, 2008), which may be particularly significant in remote locations. For instance, a participant told us that his remote community is

powered entirely by diesel generators. This discussion of localization begs the crucial question – if the community are not the primary end-consumers, is localizing production alone still *localizing the food system*? Again, this will be addressed in the section 5.2.3 *Balancing Consumption and Commodification in Aquaculture Development*.

Participants also shared comments which reflect the other side of this food sovereignty principle of localizing trade and investment. The principle criteria states that food sovereignty “resists inequitable international trade and power from remote and unaccountable corporations”. Food sovereignty scholarship is unresolved on the role of trade however agrees that local players’ perception of fairness is paramount. Participants who were shellfish aquaculture practitioners shared their perceptions of external trade and investment. One participant jokingly shared an experience of attempting to sell oysters to international buyers (as opposed to the local Fanny Bay Company as he typically sold too):

What we started doing is we had some product, custom processed and, of course, we asked the big boys if they would custom process our product and have it so we could go out and market our own product. And they went, no. Well, how come? Because now you’re competing against me. I don’t want you out there competing against my product. My product’s far superior than yours. Well, of course, it is because you’ve been buying off me for the last seven or eight years. So it’s always fun. I told you that story with regards to one of our board members in New Zealand, right. The Americans saying, oh, we only buy Fanny Bay oysters, like, well, you’ve eaten our oysters. No, we only buy Fanny. Well, you’ve been buying our oysters.

The participants’ experience represents a situation where the ignorance and anonymity of large markets prohibited effective and fair trading. Another participant shared an experience of investment, another aspect of external partnerships:

We even had a couple of meetings with potential investors. We couldn’t get any local guys interested in it ‘cause they didn’t want to have their money sitting around too long ‘cause the-- four years for market so you’re probably looking six years for the first-- for a turnaround, right. And then we talked to a Japanese company that was all gung-ho, really liked the idea. They wanted to get this thing going. But they turned around and sort of killed our project ‘cause they said, well, it’s too small. They wanted it like 10 times bigger and it was, like, well, you know, you don’t just double your capital costs and make 10 times more ‘cause that number usually is a lot larger when you try to start-- multiplying on your fingers. It’s not like a matter of doubling or tripling your-- it usually goes to five or six times more. And he wasn’t prepared to invest that kind of money.

Another participant shared the following related to investment:

But that was the other option we had was we looked at Japanese investment 'cause they were looking to invest a lot of money. But we didn't get to meet with them because we didn't know what the control was, what kind of control they wanted for putting in all that money. So we didn't-- we were iffy on that. We wanted to be in control of our own product, not have somebody come in and say that's mine, that's mine.

In these cases of selling to and accepting investment from an external entity, the food system is delocalized through market mechanisms. The literature on land-based shellfish hatcheries and growout facilities does not give a clear understanding of the economic viability of these systems yet, but high equipment costs might necessitate commodification. The notion of the means of production having a potentially delocalizing effect is further explored in section 5.2.3, *Balancing Consumption and Commodification in Aquaculture Development*.

#### **Principle 4: Localizes Decision-making**

This fourth principle is particularly contingent on local context and a wealth of participant comments inform how a hatchery might advance food sovereignty. We heard comments following the two main themes of inter-nation cooperation and local shellfish seed dynamics. First, I explore the participants' comments about cooperation and partnerships among nations structure as a possible means of addressing the challenges of economies of scale. Second, a hatchery would influence the dynamics of local seed supply and the participants with experience in aquaculture were able to speak to the possible impacts.

##### *Thoughts on inter-nation cooperation*

The theme of partnerships and cooperative structures emerged in our discussions to address the challenges associated with economies of scale and to alleviate the capital burden of aquaculture projects. Participants suggested that cooperation is deeply ingrained in the history of the Nations on their traditional territories, and that protocol exists for how that cooperation should play out. In discussing the possibility of cooperation, one participant said that:

It's always been our way to go into another territory and we go to the chief and ask permission to enter his territory to fish or to hunt. And

then he would give it to you and then he would come along sometime down the road and say, "Hey, remember what I did for you?" Yeah.

And continued to stress the importance of finding points of common interest between Nations to create capacity to effect positive change:

Yeah, well, that's what we've been working towards is meeting with each other to discuss this problem. Back in the earlier days we always worked together no matter what was on the table. Marriage, to deaths, to everything. We've always worked together. And to go into another territory, like I said, we asked permission for that, even just to step on their land. But we've been talking with each other for quite a few years now to try to bridge that gap. And to talk about this is how we did it in the day. We used to always sit down and talk about how are we going to do this. How is it going to benefit our people. Because it's always about our people. And if you look from-- even Victoria to Bella Bella, I have relatives up and down the coast, from each First Nation. Which leads me to believe at one time we were all one. At one time. And I know the stories of my family moving from the Coast Salish up this way. So we need to come together again as a family and to start working together so we can create this opportunity for our children. We can't, you know, we got to work hard to do that because if we don't then our children are going to be fighting the same battle. And we have made that progress so-- really happy about that that we've done what we did so far. There's still lots of work to do and it'll probably pass my time before it really comes together.

Additionally, there was a recognition that the leadership structures imposed upon Nations through the Indian Act may have some limiting effect upon their ability to cooperate:

Um-hum. But it also shows a big grouping of people rather than 15 or 20 nations in the area. It's one language with one area. One larger actual nation rather than 15 or 20 Indian bands. Which is what we need to break out of, the whole, I think, point of where this is going is breaking out of the Indian band train of thought. And allowing us to find a better way to work together again.

However, participants also expressed cultural and business-related concerns about potential partnerships. Possibly stemming from the result of fracturing at the hands of colonial governments, a participant expressed that:

[...] there's so much that needs to be unraveled or undone in terms of how we've thought about each other for so long. It's not about-- or I guess I could say it shouldn't be about what am I getting out of it, but what are we doing.

Concerns that politics and business need to be separated were expressed by an aquaculture practitioner:

I think the important thing with regards to that dialogue and with regards to moving forward in a partnership of any sort is making sure we have the politics and business separate [...] No disrespect to chief and council, but I mean, you can have a change in council every two years or every four years. Okay, well, here's what our vision is and you turn around and it's a long-term vision. You look at [name of aquaculture organization], it's not just something that happens overnight. It's 10, 15, 20, 30 years from now, this initiative, this project. So you need to make sure if you're going to make that investment in the industry, that everybody's on the same page. Sometimes you are and sometimes you aren't. But again, if you have this vision and this is our plan for the community and we're going in this direction then we can have changes in council and you're still moving forward.

In response to a question about a cooperative hatchery, one participant expressed hesitation regarding the structure of how a coop might function.

Other people have talked about it too about trying to build a hatchery here in B.C. that would supply all the growers on the coast. And they tried to even talk about a co-op kind of setup or-- but if there's a lot of competition out there then, you know, you grow so many seed a year, how much does this guy get, what happens if you get-- he gets all the seed, is there a little left over, what do you do with that. So it became a little bit of a political nightmare because some people are just not going to be happy that, 'oh, yeah, everybody gets this much and that's the end of the picture, right.'

The participant went on comment about tribes working together in business:

Normally tribes work-- and this has been my experience, the tribes work together pretty well on a lot of things. But as soon as you mention money they usually-- the thing usually ends up falling apart in the end 'cause somebody's figured that they're not getting their share. Or they'll believe they need more share or stuff like that. Then once that comes in, sometimes political feelings get in the way and stuff. So it's always been a real challenge. Some-- you can get maybe two tribes that can work together, do something, maybe even three. But once you get more it becomes very difficult because they all-- they're all autonomous and they all believe that their needs are more paramount than everybody else's...

In general, however, there was enthusiasm and general recognition that combining efforts in some sense could enhance the efficacy of their programs and build capacity.

One participant said:

One of the things I'd like to do is try to find a way to break out of the regular path to partnerships, engagement too [...] And one of the things that I'm looking at is talking with different nations and talking with different partners and trying to build support from the [guardian watchmen stewardship program] and expanding it to an emergency evacuation service, a medical feedback service. So that you're combining efforts to increase the need and then you can get appropriate funding, appropriate training, appropriate capacity.

Another participant, after expressing some concerns about politics and money complicating these potential partnerships, concluded with:

I mean, it [...] certainly balances out the cost if you can do that, you know, have more groups involved in it.

Is there a consideration of doing something like that? We always leave the door open. So we don't say no. Let's sit down, let's have some dialogue and if there's a way for the nations to turn out and work collaboratively together, and do something, then, yeah, let's do it. If you want to come and talk and have some dialogue and-- is there a means to us working together on a particular project that's going to provide community benefits to everyone at the end of the day?

These comments illustrate resignations which may stem from failed past experiences, hesitation to mix business and politics or continued challenges associated with settler government impositions. However, the comments also demonstrate a willingness for further dialogue among the nations to address some of the hesitations.

Another consideration of *Localizes decision making* is fair access to means of producing, particularly of seeds. The following section explores how a local hatchery might balance power and decision making to the local scale and build capacity across nations through enhanced local seed supply.

#### *Dynamics of Seed supply*

The following comments illustrate how a localized seed supply (i.e. local hatchery) might localize decision making. The theme emerged from comments related to the volatility of the current free-market seed supply; and how this market limits their decision-making power. Participants demonstrated frustration in the following two responses:

And some of it is a little frustrating 'cause it always seems we're up this time and then next time it's like this, up and down again. And it's not gentle swings. It seems to be really cyclical. Like, this year we were



totally bamboozled on how come we didn't have any seed available for a lot of the growers and they were banging on the doors.

Where the extra cost comes in now you have to buy seed. It has to come from Washington or the U.K. It's-- they're the only ones that actually have the facilities to grow seed. Right now we're even buying seed from Chile so there's really nobody in the Province of B.C. supplying the coastal oyster operations or even growing clams. [...] So that really put a big strain on being able to restock on a regular basis and trying to keep that rotation in your crop on a regular basis.

One participant described a lack of stability in the supply which can force them to go to bigger sellers even if it means more regulatory challenges:

Well, we did, I mean, the shellfish industry as a whole ran into some issues with regards to procurement of oyster seed about three years ago, four years ago. So the B.C. industry as a whole really struggled with procuring oyster seed and guys were going outside of Canada, obviously, you know, our neighbours in Washington State and California were the first guys that we normally go to when it comes to purchasing oyster seed. But they ran into issues with regards to their hatchery facilities and the product that they had dying. So then it was, like, okay, now you go-- you broaden your horizons. So of course, you know, New Zealand, Australia, Europe, Chile and of course, you know, you still need to go through all the regulatory exercise with the Canadian Food Inspection Agency and Health Canada and B.C. as well.

Another participant shared that participating in international markets sometimes led to losses in quality:

But we had a really good return off there when we bought them from these guys [a small local hatchery] 'cause we're thinking, well, they're growing in our local waters. We'll put them over here. There's-- like, there's no shock, there's no long time delay from being taken out of the water and then put back in the water. We're kind of surprised that by, you know, we get stuff from the U.K. and it's probably-- thing's got to be about 15 hours before it gets to Vancouver. 'Cause it's got to go from Guernsey to Heathrow or wherever, and then from there to Toronto and then to Vancouver.

In this case, the producer was willing to accept a loss in productivity that results from such extensive transport as opposed to the local seed which grew better because the price of the imported seed was so much lower.

Despite sharing these stories of troubles with the current free-market access, participants were not necessarily eager to jump on ownership of a hatchery due to their knowledge of the challenges and risks associated with ownership. For instance:

I've also seen the other side of things with regards to hatcheries and when we got-- I'm sitting on 40 million oyster seed and there's a blowout sale in Chile, Australia and New Zealand, so now nobody's buying my seed. Now what am I doing with it?

One participant shared his experience related to growing seed to juvenile (which he did at his existing operation) and related it to the challenge that would accompany an owned hatchery:

And then now all the seed is available and we started growing to an ounce and we've only got the one customer that really wants a sizeable amount. So you still want to buy that-- buy the seed to create juveniles, but if you don't sell them, well, you end up getting stuck with a whole bunch of juveniles that you paid for and the cost for rearing them to a certain age.

Another comment was raised related to the human capacity that is needed for a shellfish hatchery, not merely skilled labour but trained biologists:

I could build or design one that was just small enough or big enough to handle what we need on a regular basis, if we were just doing it to restock our own stuff. [...] But we still need somebody that's got some science background on the algae and the process of how to rear them in the tanks to make sure that they're doing well. Because you can't just pull water-- pull the water out of the ocean and then pump it in there. Because there's certain [critters] in the water that are poisonous to the animal.

Participants expressed uncertainty in the economies of scale required for feasibility:

It's the volume that you have to have. Like, if you're only going to grow a million, two million that-- for the amount of money it costs you to set up. You can set up a smaller scale on it if you're going to just do Pacific oysters. But if you're only going to grow two, three million, for setting everything up it's just not worth it. [...] 'Cause you're getting, for let's say, screen size 23-80 is \$9 a thousand. You're not getting that much of a [return] and it-- figure that it cost you for certified biologist technician, you know, \$80,000 salary plus and your other labour components cost. I've seen some of them, there's guys in Spain that, they've just got one of those sea cans and they're paying a little laboratory and they're growing their own [shellfish]-- from their own [hatchery] operation there. It can be as small as that [...] if you had your own property on the waterfront and you could do it on your own property, you could probably set up a little thing and the cost wouldn't be quite as dramatic.

Finally, a very telling comment from a participant shows an understanding of the risks that would be associated with owning a local hatchery, but also the social capital that might come from localizing the food system and decision making:

Okay, well, I got 30 million oyster seed. And I got 40 million clam seed. We're open for business. Here's the price. Oh, well, I can get it cheaper from Taylor Shellfish out of Washington State or I can get it from Bullet Bob over in Europe for, you know, 10 cents cheaper, then you go that route. And I understand that from the business perspective you would do that. But again, with regards to looking after the interests of hatchery facilities here in B.C., the guys that are down the road here that, you know, are producing oyster seed, and you turn around and say, yeah, I don't want your stuff 'cause I want to save 10 cents. Well, what about next year when that guy's hatchery down in Washington State isn't open for business or Canada decides to shut its border. And now you go back to this guy that you've turned around and went, ehh, stuck your nose up at. What do you think's going to happen to you?

This comment substantiates the possible food sovereignty gains that could emerge from a localized hatchery in that it could bring resilience to the local food production economy. Furthermore, it supports a cooperatively owned local structure as an alternative to a free-market solution to acquiring shellfish seed but only if such a partnership could include formalized agreements to deal with risk-sharing and purchasing agreements.

### **Principle 5: Builds Knowledge and Skills**

In our interviews, we heard a consistent desire from participants to engage youth and make training and knowledge transfer an important part of any venture. Participants did not specifically relate the point to land-based aquaculture but shared stories of how other businesses are established with this goal in mind. The following two responses demonstrate this priority in business formation:

Is it just strictly about business or is it, you know, how many people can we put to work at the end of the day. And that's great, we put 40 people to work, but you still lost, you know, \$2.3 million this year because we had 40 people working when we really should have only had 15. I think down the road, and I guess that would be some of the dialogue that would occur down the road with regards to what is our perceptions, what are our thought process-- as a group with short, medium, long-term objectives, obviously you want to employ people, for sure. You want your employees doing well, for sure. But you want to make sure that that entity, that that business is sustainable at the end of the day too, right.

So we had-- when we first invested in the shellfish or the shellfish for oysters, we thought, well, we'll start growing oysters and we'll create

some job opportunities for our members. It sort of started off slow and we had a few-- a lot of jobs and things that we have, especially with First Nations. We've got quite a large turnover of people that actually would like to stay that really enjoy the work. Some people want the job but when they get out and they find that, ahh, it's not quite what I'm looking for. There's a lot of turnover that way. But we have-- seem to have honed down a pretty stable crew now that enjoys being outside and working in all weather conditions.

As well, the previous response about the need for a professionally trained biologist should be revisited ("...figure that it cost you for certified biologist technician, you know, \$80,000 salary..."). The fifth food sovereignty principle rejects "technologies that undermine, threaten or contaminate knowledge or skills". The complexity of hatcheries could threaten the potential to hire membership, and inhibit the internal capacity building that the nations desire.

The responses suggest a desire to have an in-depth discussion around defining community benefits in any potential project, that creating employment which values knowledge of membership is very important and that a singular focus on profit might not reflect the way that these operations should be established.

### **Principle 6: Works with nature**

Conflicting results emerge when comparing the conception of "works with nature" within this food sovereignty principle with the common conception of ecological sustainability in aquaculture: a conflict which was reflected by participant sentiment in the dialogue. The main conception of ecological sustainability within food sovereignty literature has been based on agroecology, which focuses on minimizing conventional inputs and maximizing ecological inputs to integrate food production systems with ecosystems. RAS technology is often touted for its ecological sustainability in terms of its low water use and reduced (or eliminated) effluent. However, practitioners at Hummingbird Cove claim that their flow-through system, although more expensive, was chosen for its environmental benefit as it actively cleans seawater. Flow-through systems do maximize the ecological input compared to RAS. The seed/juveniles are able to feed on abundant marine resources and do not rely on external feed. This has the added benefit of encouraging compatibility of seed with the waters in which they'll be planted. The literature descriptions of RAS technology suggest it is preferable for hatcheries specifically *because* it completely isolates organisms from ecological interference (see Frias & Segovia, 2010). The close-contained nature of these systems

necessarily means that a RAS hatchery would be input dependent and unable to benefit from ecosystem contributions. The desire to use local resources was echoed by participants in the dialogue session. Some comments were expressed about the apparent contradiction of using an expensive technology whose main feature is that it has such low water requirements (i.e. RAS) when in fact, healthy, nutrient rich water is one resource that many of the communities do in fact have. Participants' conceptions of "works with nature" along with the food sovereignty literature may align more closely with a flow-through vs. RAS hatchery system. This result emerges again in terms of governance of resources in section 6.3.2.

### **Nyeléni Principles: Summary Results Table**

From analysis of interview results with the key informants according to the six Nyéléni principles, a cooperative regional shellfish hatchery emerged as a potential LBA venture which might support Food Sovereignty. The most supportive comments toward this result fit in Principles 1, 3 & 4. Fewer responses were observed to fit under principles 2, 5 & 6, or the informants' responses varied more greatly which merits further questioning on these particular principles. The results are summarized in the table below.

**Table 5.3: Summary of interview results according to six Nyeleni principles**

<i>Principles in support of a shellfish hatchery</i>	
<b>1. Focuses on food for people</b>	<ul style="list-style-type: none"> <li>• An emergent interest in shellfish</li> <li>• Ecological Preference, Political Tension, Cultural Choice</li> </ul>
<b>3. Localises food systems</b>	<ul style="list-style-type: none"> <li>• Interest in LBA in diverse locations</li> <li>• Limitations of remoteness – human capacity</li> </ul>
<b>4. Localises decision-making</b>	<ul style="list-style-type: none"> <li>• Interest in cooperative models to localize ownership</li> <li>• Hatchery to manage seed-supply decisions</li> </ul>
<i>Principles for further research</i>	
<b>2. Values food providers</b>	<ul style="list-style-type: none"> <li>• Informants looking for options to have more consistent production (and thus employment), a hatchery may not satisfy that</li> <li>• A hatchery would support existing shellfish growers</li> </ul>
<b>5. Builds knowledge and skills</b>	<ul style="list-style-type: none"> <li>• Dependent on implementation –               <ul style="list-style-type: none"> <li>○ if training were a priority, it could satisfy this principle</li> <li>○ However, LBA could also represent “a technology which undermines local knowledge”</li> </ul> </li> </ul>

<b>6. Works with nature</b>	<ul style="list-style-type: none"> <li>• Definitional gap in “input-intensive”</li> <li>• LBA is necessarily several degrees isolated from nature, contradiction of low water requirements</li> <li>• A flowthrough system could align better with the informants’ conception of “works with nature”</li> </ul>
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## 5.2.2 Indigenous Food Sovereignty

In this section, I present responses that were particularly presented by the participants as stemming from their uniquely indigenous experiences. Through the analysis I isolated the relevant responses to examine the particulars of the community in question being an indigenous community, and how LBA and food sovereignty interact in that particular context. Responses are organized according to the themes which emerged of 1) renewed capacity for resource management in their traditional waters 2) the related power dynamic of state regulation impeding their rights to self-determination and 3) the theme of cultural and traditional foods.

### *Renewed capacity for resource management in traditional waters*

The following response illustrates that participating in the modern aquaculture industry is of course for economic development but also to insert a voice into resource management discussions in their traditional waters:

So for us from the community perspective a lot of support for the industry, a lot of support for the resource management side of things. And I think that’s the part that intrigued the community the most was it’s-- you’re now involved in the resource management of the aquaculture industry within traditional territory [...] there’s so many intangibles and tangible components of any First Nation business. But again, with regards to even [participant’s aquaculture operation], okay, you’ll go to a community, well, what’s [participant’s aquaculture operation] doing for me? Okay, well, there’s a lot of intangibles that you don’t understand or you don’t know of with regards to what [participant’s aquaculture operation] does for the [participant’s nation], with regards to one, first and foremost, resource management.

While a hatchery alone would not necessarily be a vehicle to assert management rights, it could build the capacity of local marine shellfish ventures and a greater voice in resource governance. This notion is inextricably linked to the power dynamics between the MFNs and the Canadian Government.

### *Power dynamics with state regulation*

Participants expressed respect for state regulation in order to engage in resource management in traditional territories, but also expressed a willingness to contest regulations when their sovereignty was challenged. One participant expressed this clearly through the following story:

Our approach has always been to try and do it with honey. Don't go in there stomping and we're going to do this, you know, 'cause Aboriginal rights and title. We didn't play the First Nations card unless we had to. So we always went through the process, again, through the tenure application process and trying to get amendments to zoning and that kind of stuff. I mean, we went through all that process, went through public consultations and that's always an interesting experience. But we've also gone the other side of things too with regards to our rafting program [...]. Where, again, dealing with [local government] over a period of five and a half years of trying to get an amendment to their zoning. And [local government] is still saying no. And then [my Nation] had to make that decision, do we drop the hooks without the zoning? And then go through that fight? Or not. And we just decided after five and a half years we-- we're very proactive. Looking after both parties' interests at the end of the day and just finally saying, pfft, that's it. We're dropping the hooks. And then the nasty letters came and, you know, we're going to take [my Nation to court and it's, like, great, let's do it. And then all of a sudden lawyers from Islands Trust are going, hmm, maybe we should reconsider. So-- and then we received a letter from Islands Trust with regards to that's as close as you're going to get, as a letter of support from them saying we just-- we recognize the [my Nation], where they are in the treat process, where they are with regards to their aquaculture program, and that aquaculture is a means of them asserting their rights and title now. Our fishing activities aren't with a spear anymore. It's not throwing out a net in the middle of the river. It's, here's our fishing activities now. It's another form of fishing, the aquaculture industry. So we're asserting our fishing rights in and around the area where we have lots of history over on Denman Island with regards to our fishing activities there. So if you want to go to court, let's go. So they chose to go a different route with their letter saying that they wouldn't, what's the word, force the bylaw. And they'll just wait a see where [my Nation] is in the B.C. treaty process down the road. So it worked out good.

A participant in the working group dialogue extended this theme of contestation to a community-owned hatchery. The participant suggested that if they had access to cheap enough seed, they could seed their traditional beaches (currently prohibited under Department of Fisheries and Oceans regulation without a tenure) to send a message of sovereignty to the Canadian Government. Participants expressed hope that with

enough time and capacity, state government would have no choice but to accept and adapt the regulations.

### *Cultural Relevance and Traditional Foods*

The participants suggested that even if culturally relevant foods were grown through LBA, they would not necessarily satisfy the need for traditional foods in its entirety. One reason is simply taste or aesthetic – participants jokingly shared that elders would never touch something grown in a tank:

[Elders] are very hard to please and like I said, from myself and the taste of farm fish to wild fish, no comparison. And the elders would maybe notice, like I said, by the time this project-- this comes to fruition, I'm going to be the elder. You can bet on that.

However, further comments suggest that traditional foods are not mere sustenance, but play two additional cultural roles. First, traditional food was discussed as a subject upon which generations converge and through which elders can transmit knowledge to youth in these two responses:

I've been doing [taking the youth elk hunting] for three years now, continuous [...] They get to pull the trigger, not me. They get to clean it once I show them how it's done. [...] And they get to deliver it to the elders when it's all frozen and ready. That's what I like. It puts a smile on my face when I see their smile when that animal goes down. Then I tell them, now the work starts. We can take all the pictures we want, but now the work's going to start. And I tell them why, it has-- there's a certain time limit to get that animal hide off and so on processed, the whole nine yards. And they learn. And I do have a group of young fellows that are taking it straight to heart. They realize that when they do what they do and they see the smile on the elder's face when we deliver it to their door around mid-December, it's a real charge for them too. And they understand why I do what I do to help them get to that point.

[...] the majority of the time I've been left in charge of looking after the food fish for our community wherever we can get it. When I go clam digging I don't go for the community. I go clam digging mainly for my family and the elders of my family. But as it turns out I end up sharing with the elders no matter what. It's just a natural process that we do.

Secondly, food and its harvesting was described as a connection or interface between the Nations and their environment. In the following response, a participant was describing how his elderly father continues to participate in the very limited and not profitable commercial salmon fishery today primarily to maintain a connection to his territory:



It's more of a hobby, just getting out and checking things out, right. Oh, I remember this hole. 'Oh, I remember that tree and tying off on that tree,' you know, that kind of stuff.

Another participant told us about finding the last remaining clam beaches in their territory, and proudly told us that:

I've been doing it all my life to get food, wherever we have to go to get it, I will venture there to go and get it. 'Cause it's something that we've grown up with.

Finally, the following comment connects both of these additional cultural roles that food plays:

[...] a lot of times it's elders and youth. Elders talking about how things were, what types of things they ate and that connection, even though it's not as strong or prevalent as some would like to see. But there is still a connection there and the youth hear it. They see it. They pick up on it. I talked to my kids about a trip up into our territory [...] And they were curious about what I meant, what I was referring to. So I showed them on a map. Told them where I was going to go. I think they want to go now 'cause it's just a natural instinct to follow and want to be interested.

This one response represents the two roles of traditional food of territory and inter-generational connector, roles which would not likely be satisfied by LBA or for that matter any kind of aquaculture.

### **5.2.3 Balancing Consumption and Commodification in Aquaculture Development**

In our interviews, we heard a range of participant responses which illuminate how the Nanwakolas communities might decide between food production for consumption or for commodification; the results also suggest that the decision may not be as simple a dichotomy as our research question implies. Several principles of the Nyéléni framework refer to both consumption and production without clarifying how each might impact food sovereignty. In *focuses on food for people*, food is to be “not treated as just another commodity or component for international agri-business”. The principle *localizes food systems* is contingent on providers and consumers being brought closer together but not clear whether production be considered localized if consumption is not. To follow a food sovereignty approach, I aimed to understand this tension based on the participants' own conceptions of their food system. A breadth of responses shed some

light on how the community might interpret this decision. Responses ranged from an explicit focus on revenue generation to a community food focus along with creative combinations of the two. For instance, one participant expressed a strong commitment to a conventional “bottom line”:

So those opportunities, what you’re talking about, about the economic opportunities of the shellfish, this is why I say that the membership would have to approve it. Because at the end of the day if it’s not going to be able to provide something else besides food for the community, that they’re going to oppose it. Because they can say, okay, you want to invest a million dollars of our money into building this and you’ve got no guarantees after five years. [...] This is what I think the mindset of our community is now. They’re very smart as far as getting a return on the value dollars that you’re investing.

The comment represents a hesitation to over-promise the accessory benefits of a project. The comment indicates a strong commitment to fiscal responsibility of band leaders making decisions about spending membership funds. The same participant affirmed this commitment by later continuing that,

Now we’re signing million-dollars leases and stuff like that with different companies. When [large companies] came on board, you know, things have changed for the better for us. Our tax base and getting our own tax regulations, that affords us the opportunity to go and do things for our community members that other bands can’t do. That we have the wherewithal to assist our members, to lead better lives. Not to fill our pockets as we get accused of, but to make them-- because we can provide different health dollars now. We can provide education dollars. [...] We provide programs to the elders and the youth of our community.

Another participant’s comment about a focus on jobs in the community addresses the broader challenge of balancing business objectives with community benefits:

When you’re developing this business case or where you want to go with this down the road, [...] is it just strictly about business or is it, you know, how many people can we put to work at the end of the day. And that’s great, we put 40 people to work, but you still lost, you know, \$2.3 million this year because we had 40 people working when we really should have only had 15. I think down the road, and I guess that would be some of the dialogue that would occur down the road with regards to what is our perceptions, what are our thought process-- as a group with short, medium, long-term objectives, obviously you want to employ people, for sure. You want your employees doing well, for sure. But you want to make sure that that entity, that that business is sustainable at the end of the day too, right.

The comment certainly represents openness to detailed dialogue in which the community can discuss what the goals of a particular project are, but is ultimately rooted in a “bottom-line” approach of economic sustainability. The same theme re-emerged in our working group dialogue when some participants shared stories of businesses in the past having their priorities overly focused on community benefits and owners or coordinators becoming fixated on the charitable aspects and forgetting to run the business. When asked about balancing these objectives, other participants expressed their approaches quite differently as placing a focus on community benefits and discussing revenues as a necessary part of a business but with a willingness to consider them as a means to an end:

Every time I hear of a possible opportunity I look for how it can help feed us. [...] And as far as growth of aquaculture opportunity, first and foremost is our people. Money doesn't mean anything, like you said, money we can get any day. But the food, like that given to our people and having them employed. [...] That's the downfall of a lot of big companies is that they get greedy. And that's not what I'd like to see anyway and, you know, first and foremost is our people. And getting them up and working and eating and stuff like that. That's the most important thing. Breaking even is good. If we make money, that's good too but, you know, it's the last part of the puzzle.

A consideration of whether the output of an LBA system could be consumed by the community would have to be rooted in a realistic analysis of the financial and technical hurdles. Some participant responses addressed this pragmatism. One participant noted that, particularly with seafood products, regulation is extremely complicated and lends itself to economies of scale which might limit community consumption.

And you can't move the product unless you go through a certified processing plant which is controlled by Canadian Food Inspection Agency and Fisheries and Oceans. So you can't sell to the general public unless you go through there and very few, if any, of the processing plants - 'cause they're looking after their own bottom line - they won't provide custom services for certifying your product.

This participants' experience reflects that experience which limits a community's ability to consume (or locally sell) their own food resources as an indirect result of regulatory measures. In addition to the challenges associated with regulation, the market price of certain species could preclude community consumption. One participant speaking of abalone raised this concern:

[...] it's like 3,000 U.S. dollars for half a dozen of them in Hong Kong at the time.

In this case, international market access might preclude the community from accessing their own food resources.

Participants expressed willingness to re-imagine priorities through dialogue. Most interestingly, most participants did not see the issue as a simple dichotomy between consumption and commodification as demonstrated in their willingness to consider creative combinations. In discussing abalone, a species that would have cultural relevance to the Nanwakolas, one participant expressed that:

If you can farm abalone and take 75 percent of it and put it to market, take 25 percent of it and provide it to the elders, for them to have something they've never had in a long, long time.

In the dialogue, participants showed interest in creative combinations, such as a hatchery that would generate economic return in the short term but could eventually provide seed for communities to seed traditional beaches for food, social and ceremonial purposes. Finally, a participant suggested that:

I think it's going to be [...] an emerging theme through time that it's a common interest to balance some sort of profit with food security.

## Chapter 6

### Findings & Discussion

In this chapter, I discuss the results presented in Chapter 5 by reflecting on the usage of the various frameworks, relating my findings to the literature, commenting on limitations to our approach and finally highlighting the overarching theme of capacity which emerged throughout the study. First, section 6.1 presents a table which summarizes the key findings which can be taken from our results according the criteria derived from the Sustainable Community Development and Food Sovereignty literature review (see Table 2.2). In section 6.2, the findings of the CWB Framework development process are discussed in terms of the suitability of the CWBW to serve as a dialogue support tool and the recommended addition of a sixth CWB area of Community Capacity based on the gap analysis. I discuss limitations to our process and the ways in which our results might be more broadly relevant to the discussion of Sustainable Community Development. Future directions for the research partnership with the Nānwakolas are explored. Section 6.2 discusses the findings of the food sovereignty analysis. I will reflect on using the Nyéléni Framework as a way to analyse food sovereignty and synthesize some of the key findings, address some of the limitations to our approach and suggest how this research might be more broadly applicable. The food sovereignty literature calls for the principles of the movement to be better understood through place-based research initiatives. Our findings furthers this discussion by exploring how the particular community of the Nānwakolas might best engage with future land-based aquaculture development through a shellfish hatchery. The research also contributes to the broader discussion of how technological advances in food production might relate to food sovereignty. I comment on how the analysis might be relevant to the Nānwakolas going forward and on future research that might bring further understanding to the topic.

## 6.1 Findings

**Table 6.1: Table of Sustainable Community Development and Food Sovereignty Findings according to Criteria derived from Literature**

Food Sovereignty		Sustainable Community Development	
Topic	Literature Derived Criteria and References	Findings from Interviews, Dialogue and Framework Development	
<i>Reflection of Community Values in Sustainability Assessment</i>	<ul style="list-style-type: none"> <li>• Frameworks for Community Development should reflect a sustainability value set which is appropriate for the community (McCrea et al., 2014; Reed et al., 2006).</li> <li>• Furthermore, frameworks for indigenous communities should be based on a definition of wellbeing which encompasses unique values (Atkinson et al., 2010)</li> </ul>	<ul style="list-style-type: none"> <li>• The Community Wellbeing Wheel is a multi-criteria framework created specifically for Nanwakolas Nations to define community development, and reflects their community values. Further development could operationalize the framework to a Sustainability Assessment Tool.</li> </ul>	
<i>Distinct nested subcomponents in frameworks</i>	<ul style="list-style-type: none"> <li>• Distinct subcomponents nested within the dimensions of sustainability these are necessary for measuring or enabling dialogue around community development (i.e. quantitative or qualitative sustainability assessment) (Roseland, 2012).</li> </ul>	<ul style="list-style-type: none"> <li>• The Community Wellbeing stocks and accompanying Dialogue Criteria were derived from Nanwakolas literature, tested and improved to provide nested subcomponents for sustainability assessment (see Results Table 5.2 <b>Table 3.1</b>)</li> </ul>	
<i>Food systems should align with the six Nyéléni principles</i>	<ul style="list-style-type: none"> <li>• The Nyéléni principles are proposed as a set of 'goalposts' to frame discussion around existing and planned food systems (Chaifetz &amp; Jagger, 2014). Aquaculture developments should adhere to these six principles to ensure that community development is prioritized in the Blue Revolution. (For a detailed list of the six principles and their criteria, see Table 3.2).</li> </ul>	<ul style="list-style-type: none"> <li>• A cooperative regional shellfish hatchery emerged as a finding which may build food sovereignty in the Nanwakolas Nations as it is a food which is appropriate for the community, it could support their existing local capacity and localize decision making through cooperative partnerships and enhanced local seed supply. Further research could better define how a hatchery fits other dimensions of their food sovereignty (see Results Table 5.3).</li> </ul>	
<i>Indigenous Food Sovereignty</i>	<ul style="list-style-type: none"> <li>• Food production and gathering can be a way to define territories to which indigenous people have resource management rights, including as a form of protest (Kamal et al., 2015).</li> <li>• Traditional foods play a key role in health and sustenance but also act as a medium which connect indigenous people to their environments (Morrison, 2011; Rudolph &amp; McLachlan, 2013).</li> </ul>	<ul style="list-style-type: none"> <li>• A Cooperative Shellfish hatchery could increase capacity for resource management within Nanwakolas territory.</li> <li>• A growout option for a land-based hatchery could provide community appropriate food (e.g. clams or abalone), but informant responses suggested 'traditional food' must be more than sustenance – LBA would not provide a connection to land and environment</li> </ul>	
<i>Consumption vs. Commodification</i>	<ul style="list-style-type: none"> <li>• The balance between food resources being for community consumption or commodification should be defined by the community and fit their needs (Chappell et al., 2013; Wittman, 2011).</li> <li>• Self-sufficiency (i.e. community consumption) is not the exclusive goal of food sovereignty as commodification can support stable production. (Fairbairn, 2012; Soper, 2015).</li> </ul>	<ul style="list-style-type: none"> <li>• Informants expressed a range of interests from purely commercial to purely community food, to indicate that the dichotomy is not so simple</li> <li>• Responses also indicate that defining production first (regardless of consumption or commodification) was key for the community to achieve other Community Development Goals.</li> </ul>	

## 6.2 Discussion: Community Wellbeing Framework Development

The results CWB Framework Development illustrate that the CWBW could be developed to be a Sustainability Assessment tool that can support community dialogue particularly because it has been designed by and for the community. Sustainability Assessment (SA) tools are the actionable frameworks which enable multicriteria analysis to inform and support decision-makers at all scales to incorporate a holistic approach (Singh, Murty, Gupta, & Dikshit, 2009). Sustainable Community Development asserts that a holistic approach to development needs to be firmly rooted in place to effectively mobilize citizens (Roseland & Spiliotopoulou, 2016) and puts forward the Community Capital Framework as a Sustainability Assessment tool that can be locally responsive. SA tools can be limited in their applicability to all people and places, as a prescriptive approach to sustainable development may undermine local initiative and limit communities' abilities to define their own objectives and strategies for community development (Reed et al., 2006). The Community Wellbeing Wheel is the beginning of a Sustainability Assessment tool that has been designed by the community. My preliminary testing shows that our first iteration CWB Framework was able to encapsulate many of the community's concerns. Other SA tools may have missed or under-emphasized such concerns relating to the importance of territory connection. For instance, within the Community Capital Tool the a stock *Land* exists within both natural and physical capital but it is described from a perspective of conservation and biodiversity within natural, and availability for a variety of land uses within physical (Roseland, 2012). The dialogue theme eight ("Access to seed might allow us to seed our own beaches in protest to DFO") suggests territory connection as cultural, which may have been missed in the CCF's conception of land as a natural or physical asset. My contribution to a framework which has been defined by the community to monitor their own state of development follows a finding of the Sustainable Development and Community Wellbeing literature: that the diversity of needs and values across communities necessitates frameworks which are locally reflective, particularly in indigenous communities defining their own development aspirations (Atkinson et al., 2010; McCrea et al., 2014; Reed et al., 2006).

I did identify gaps in the first iteration of the CWB Framework and offered recommendations for it to better serve as a sustainability assessment tool through the

development of distinct nested stocks. Several small gaps within existing stock criteria emerged that we presented as recommendations that would help community members relate their thoughts to stocks. Suggested additions based on the identified gaps include: a diversification of health objectives, a more concrete pursuit of social capital, a broader consideration of community assets that can result from investment, an explicit goal of self-determination through governance. Finally, the most significant gaps centered on Community Capacity, which I proposed to be a sixth CWB Area.

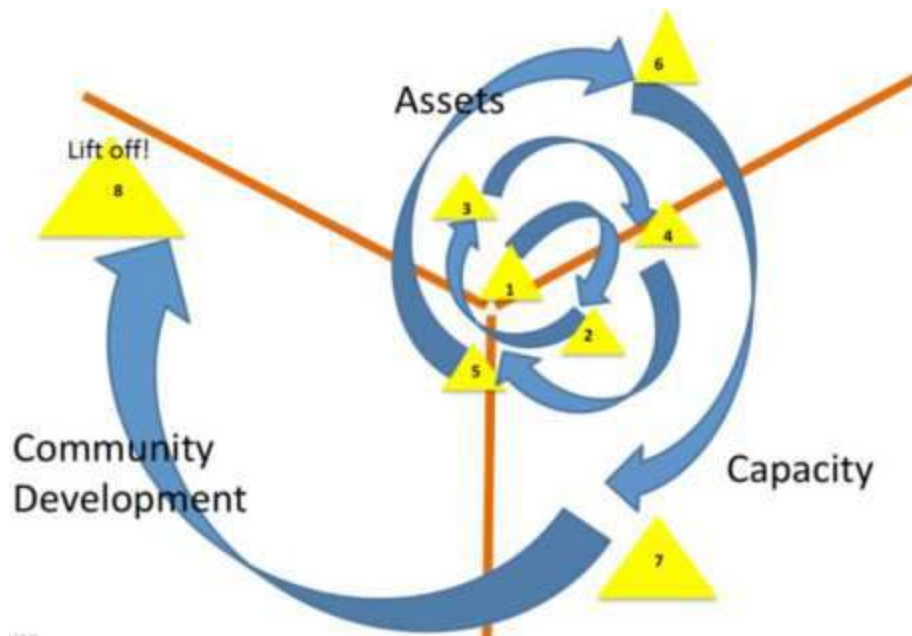
### **6.2.1 Introduction of Capacity as a sixth Community Wellbeing Area**

The persistence of capacity as a dialogue theme, particularly as a limitation, suggested that it should be included in a community dialogue support tool. For example, dialogue theme 1 (“There is limited human capacity to support the technical know-how behind shellfish LBA”) was a concern of limited available human capacity. If *Community Capacity* were an available CWB Area for consideration, it might clarify a discussion of how a particular project like a shellfish hatchery might enhance another CWB Area such as *Economic Prosperity* but might be currently limited by or hinder *Community Capacity*. For instance, while *Job Readiness* was an existing stock within the CWB area Economic Prosperity which asks whether a project might enhance the overall skill or training level of membership, the CWB Framework lacked a way to critically assess whether a project fits within existing capacity. The approach may be pessimistic or overly focused on limitations, but the results indicate that the participants sought a way to explicitly discuss limitations. A realistic understanding of strengths and weaknesses in community capacity is the first step to taking measures to enhance it. If future iterations of the CWB Framework are to be dialogue- and design-support tools be used early in project life, the inclusion of *Community Capacity* as a CWB Area could help local decision makers conceive of projects in ways that boost capacity *while* enhancing other CWB Areas. For example, if a shellfish hatchery were pursued primarily for *Economic Prosperity*, integrating an education or training aspect into a shellfish hatchery as opposed to simply hiring outside labour would directly address community capacity. Such a holistic approach is what makes multi-criteria sustainability assessment tools effective (Bird, 2015; Joss et al., 2012; Roseland & Spiliotopoulou, 2016).

The CWCSP and the sustainable development literature acknowledge capacity as an underlying necessity to community development but my results based on the



dialogue I facilitated along with the other research interns suggest capacity should be more explicitly acknowledged in Sustainability Assessment tools. In *Toward Sustainable Communities*, Roseland presents the Community Capital Tool as being based on community capacity which is strengthened through mobilization (2012). Capacity is only loosely defined in the CWCS and is not initially presented as a CWB Area itself. Two offered definitions are “everything required for the Nations to reach their long term goals and objectives of resource stewardship and economic prosperity” and “What is needed to mobilize the assets available for Community Benefit” (Roberts, 2014). Capacity, and how it contributes to development, is also presented as something iterative. The Nānwaḱolas have conceptualized this iterative nature in a diagram (Figure 6.1):



**Figure 6.1: Community Development Dynamics and Components, taken from the Nānwaḱolas’ Community Wellbeing and Capacity Strengthening Plan. Numbered triangles are only to represent iterative progress. (Roberts, 2014)**

In Figure 6.1, taken from the CWCS, the Nānwaḱolas illustrate their conception of capacity as iterative: as a process through which assets are mobilized for community development. In the existing description within the CWCS, the assets themselves are considered separate from community capacity in that capacity underlies and mobilizes all these things – it is not a goal in and of itself, but a means to the ends of strengthening the other CWB Areas. The inclusion of Capacity as a sixth dimension of Community Wellbeing would additionally position Capacity as an asset itself. The recommendation

is based on our observations from the dialogue that capacity should be explicitly considered when discussing Community Wellbeing. By considering capacity as a sixth dimension of Community Wellbeing enables more tangible dialogue around capacity enhancement, paralleling Amartya Sen's development approach of "enhancing capabilities". We recognize that the inclusion of Community Capacity as a CWB area could conflate capacity as an end, but with the goal of creating an effective community dialogue support tool, the inclusion of capacity as a CWB Area might enable discussion around limitations and enhancement in the future.

## **6.2.2 Limitations of the Framework Development Process**

The three main methodological limitations to the development of the CWB Framework are the interactions between different dimensions of sustainability, the design and analysis of the dialogue session itself, and the narrow land-based aquaculture focus. The interactions between different CWB Areas were a significant challenge in this research. I decided to limit the connections to CWB stocks to three, but several dialogue themes could have connected to many more. This challenge of interactions poses a significant hurdle to quantification, as evidenced in the literature on Sustainability Assessment tools (Nilsson et al., 2016). The way that the CWCSF addresses interconnections between CWB areas is not concise: "Because CWB is a holistic concept, these areas are not isolated from each other. Many CWB features could fit into more than one category" (Roberts, 2014). This overlap may not have arisen from lack of clarity on the Nānwaḱolas' part but instead because the issues being discussed are inseparable. Our interpretation of the CWCSF and creation of concise stocks may prove to be too rigid and arbitrary to adequately frame a nuanced community dialogue. An extension of this limitation is the design of the dialogue engagement and later analysis. I used an existing dialogue and retroactively fit it to specific wellbeing sections based on our own interpretation using the descriptions available in the CWBSP. The interpretation process leaves room for researcher bias. Ideally, dialogue participants would have actively connected their own thoughts to the stocks and CWB areas. Finally, this first trial of the Dialogue Support tool and the accompanying gap analysis must be considered as one trial with the specific focus of shellfish aquaculture. Because I only tested the utility of the framework with this one context, certain CWB areas are explored more than others. Naturally, as a resource-based economic development initiative we

developed more insight in the areas of *Resource Stewardship* and *Economic Prosperity*. Recommendations in the other CWB Areas of *Culture*, *Community* and *Health* should be considered less complete. These areas would benefit from relevant further testing on potential or existing projects (e.g. a new language enhancement program, a traditional hunting camp for youth).

While using a framework that was conceived of by the community has the benefit of firmly rooting the tool in place and community context, the approach has some consequences concerning the transferability of the results. First, a community-designed tool will look different in every community and limits comparison between communities. Comparability is a priority for most Sustainability Assessment tools, such as the UN's Sustainable Development Goals, to facilitate national and international goal setting and monitoring (Nilsson et al., 2016). I propose that this limitation is less of a problem with a dialogue-support tool (such as the CC Scan) than it is with a baseline assessment tool (such as the CC Balance Sheet) as the goal of dialogue-support tools is to increase understanding between community members rather than between communities. I found that the community-designed CWBW is well suited to frame their development initiatives which supports the findings of Reed and colleagues (2006). These authors found that data gathering and inter-community dissemination should be expert-led, while goal-setting is best done by communities themselves. Second, it limits the transferability of the results to other communities, even those which may have similar circumstances (i.e. other Vancouver Island First Nations) –the CWCSF explicitly states “is not intended to represent the views of other First Nations in the region who did not participate in the planning process” (Roberts, 2014). However, the methods outlined in this thesis could assist other communities who may have a preliminary framework in operationalizing their own tools.

### **6.2.3 Next Steps in Tool Development with the Nanwakolas**

Developing a sustainability assessment tool based on the Community Wellbeing Framework could serve the Nanwakolas Council to support future decisions in aquaculture and other developments. The recommendations that I identified from the gap analysis should be considered as suggestions and need to be tested and understood by the community for cultural applicability. Furthermore, the second iteration of the CWB Framework which resulted from our research requires further testing in

areas which are not primarily resource-based economic development initiatives, such as a new Regional Health Centre, designing a new Kwakwaka'wakw language program, a cultural cedar inventory, and so on. To truly create an operational tool, steps will need to be taken towards operationalizing the Framework. A sustained partnership between the N̓n̓w̓a̓k̓o̓l̓as Council's Community Wellbeing working group and the Centre for Sustainable Development is undertaking this continued development. Operationalization could include the development of a web-platform based on that which exists for the Community Capital Scan.

### *Benefits of an engagement tool*

Participants in our dialogue identified that dialogue-support tool, or a CWB Scan, would be beneficial to engage both externally with partners and internally with community members. After our dialogue on research themes on November 7<sup>th</sup>, we concluded the day with an open discussion around whether a tool would be of interest to the MFNs. In the context of aquaculture, participants suggested that they are frequently approached by investors seeking new business engagements and that such a framework would facilitate discussion that prioritizes the MFNs values. This could potentially extend beyond aquaculture to serve the N̓n̓w̓a̓k̓o̓l̓as MFNs in various engagements with industry and government. Furthermore, many of the MFNs have membership which is both on and off reserve and in some cases membership is highly dispersed (the remote Da'naxda'xw Awaetlala community of New Vancouver, for instance, houses just 10% of the tribe due to accessibility issues) (Roberts, 2014). In the dialogue on aquaculture, participants expressed a deep concern to get the approval of the community before taking on any risk. The contributions I have made to the CWB framework of distinct nested stocks enable the framework to be operationalized in the future to an online CWB Scan tool that might bolster community engagement. While an online tool will never supplant the face to face dialogue that is of utmost priority to First Nations, a dialogue support tool might facilitate at least preliminary community engagement when membership cannot always be engaged in traditional ways.

## 6.3 Discussion: Food Sovereignty and Aquaculture Development

### 6.3.1 Framing the Nanwakolas' Shellfish Hatchery Development Using the Nyéléni Principles

I analyzed the key informants' responses in terms of how land-based aquaculture, particularly a shellfish hatchery, might build or limit community food sovereignty using the six Nyéléni principles as an analytical framework. Focusing on shellfish resonates with the community's interests and existing capacity. If the product were to be locally consumed participants expressed interest in shellfish, a choice which *focuses on food for people*. Developing a hatchery may *value food providers* in the sense that it could produce more consistently across seasons and perhaps provide more consistent employment options for band membership. However, participants pointed out that the employment may demand qualifications beyond existing band capacity and require outsourcing jobs. If implemented carefully such a facility could represent an opportunity to train the Nanwakolas' own membership and build local knowledge and skills. A hatchery may *localize the food system* and *localize decision making* because of the opportunity to place it in various communities to build employment capacity, the ability to localize decision-making through seed sovereignty, and build capacity through cooperation between nations. However, taking on the burden of ownership was met with some hesitations. Particular partnership or cooperative structures could alleviate the hesitations rooted in capacity limits but would require resolving some existing tension and reticence between bands. Furthermore, such a venture would be capital intensive and participants highlighted how in their past experiences investment can delocalize the food system capitally (by necessitating investment beyond the community's existing capacity) and geographically (through necessitating trade to recoup costs), both of which can limit the power of the community to make management decisions. The system may *work with nature* in that, if it were flowthrough as opposed to RAS, it could in part match community members' desires to use their available resources and. However, land-based aquaculture is necessarily many degrees separated from ecosystem inputs (and particularly if it were RAS) which some of the participant responses suggested may be an ideological concern.

Using the Nyéléni principles early in LBA development gives the Nānwakolas the ability to learn from food sovereignty literature and consider rights and power dynamics in further dialogues on project design. Chaifetz and Jagger's suggestion of using the Nyéléni principles as 'goalposts' (2014) implies that this framework could be consulted not only to analyse existing food systems but to envision what nascent food sovereignty movements might aim for. My analysis sheds light on three main points of discussion and research to be further addressed if the Nānwakolas proceed with such a project, particularly concerning ecological impacts (under *works with nature*), cooperation between Nations and the technical nature of LBA (both under *localizes decision making*).

My findings related to the principle *works with nature* highlighted a definitional gap within the food sovereignty literature concerning the notion of "input-intensive" production. In a review of the future of shellfish aquaculture, Allison et al. speculate that there will be a rise in RAS shellfish hatcheries/growout in response to climate change (to limit the impact of changing water quality on conventional marine or flowthrough operations) (Allison et al., 2011). The authors liken RAS to industrialized poultry farming, implying densification as production is separated from a dependence on natural processes in place of conventional inputs. Their speculation begs the question of what input-intensive really means – how do we distinguish between culturing algal strains on-site (the main input for RAS hatcheries or growout) and growing livestock in confined spaces with feed produced through fertilizer and pesticide intensive agriculture? The food sovereignty and agroecology literature frequently condemns "input-intensive" production without clearly defining what the term means or why it is detrimental to local food sovereignty (Chappell et al., 2013; De Schutter, 2010; Dennis, 2016; Holt-Giménez & Altieri, 2012). The typical conception of "input-intensive" or "industrialized" is presumed to be harmful ecologically. Less explicitly however, the literature also suggests however that reliance on inputs ties producers to markets and their volatility, destabilizing food systems (Fader, Gerten, Krause, Lucht, & Cramer, 2013; Soper, 2015). If a RAS system could be growing its own algae on site as in the case of Hummingbird Cove, would it still be input intensive? One can thus characterize the harms associated with "input-intensive" in two ways: a farmer's impact on the environment, and a farmer's ability to make local decisions not subject to external market forces. A RAS system could be conceived of as "input-intensive" in that it might be separated from ecological processes, but if algae were grown on site it may not be

subject to the second characterization of “input-intensive” which is being tied to external markets. The Nanwakolas community would need to determine whether land-based aquaculture *works with nature* according to their own conceptions of “input-intensive”. Navigating this discussion should be approached pragmatically and ideologically by the community – investigating studies of environmental impact in comparison to other food production and economic development opportunities, tied with a dialogue concerning the community’s conceptions of what input intensive is and how it might have a destabilizing effect on local economies and ideologies.

The results within *localizes decision making* highlighted that further inter-nation dialogue about partnerships and cooperation will be important in project design. The responses include resignations concerning a cooperative, resignations which may stem from failed past experiences, hesitation to mix business and politics or continued challenges associated with settler government impositions. The language that some participants used of an “open door” is relevant to cooperation as it implies willingness to engage, but not necessarily to take initiative. The encouraging notion substantiates the need to have more dialogue. The central tenet of cooperative business enterprises is based in economies of scale, in that a certain scale can be attained for business feasibility while maintaining participant control (Bijman et al., 2012; Roy & Thorat, 2008). A strong cooperation provides the economies of scale that may be necessary for efficient production without delocalizing decision making. The MFNs should consider the economic and social barriers to their cooperation. Feasibility studies would illuminate how the costs of a business could be shared and further dialogue would shed light on individual communities’ willingness to participate.

The technical nature of LBA and how it might affect *localizing decision making* is another key consideration as the Nanwakolas communities decide how to proceed with aquaculture development. The trade-off may be an inherent property of land-based aquaculture – the technology may be so expensive that it necessitates de-localising to accumulate initial capital and recover costs. Participants shared past experiences about this delocalization of decision-making occurring both geographically by relying on distant markets and capitally by necessitating investment beyond the community’s means. Suryanata and Umemoto (2003) explore this tension in aquaculture development, suggesting that innovation in aquaculture represents a decreasing reliance on natural processes as they are replaced with technological substitutes. The technological

reliance increasingly allows industrial capital to regulate the conditions of production instead of natural systems. Pinkerton and Silver (2011) extend this to suggest that as a result global market forces can more easily penetrate local economies. Land-based systems represent the ultimate separation of food production from nature: particularly RASs which are necessarily “closed-contained”. While offering various ecological and economic benefits, the capitalization of production in substitution for natural processes opens the door for the destabilizing effects of global investment and markets. If a hatchery were to be pursued, a flow through model as opposed to RAS could satisfy the participants desire to engage with natural resources and create a connection to localizing the food system and in turn decision making as it is tied one degree closer to natural inputs.

Using Nyéléni principles as an analytical framework allowed me to discuss food system change in the Nanwakolas’ investigation of a shellfish hatchery and yielded emergent themes which may inform the food sovereignty movement. The research in this thesis addressed the need for more applied food sovereignty analyses through investigation of specific agri-food sectors, raising further questions that will need to be addressed as the food sovereignty movement evolves in theory and action (Gambling, 2016). The context for this study makes it specific to the Nanwakolas and to shellfish hatchery development, but the research sheds light on the challenges that a technologically intensive production method might create for local food sovereignty. How these challenges might apply more broadly to the food sovereignty movement are explored in the following section through the themes of indigenous food sovereignty and of balancing consumption with commodification.

### **6.3.2 Indigenous Food Sovereignty**

This study illustrates how non-traditional food production might still be used in a greater expression of sovereignty through developing resource governance capacity. This theme emerged from participants’ responses conceptions of how aquaculture and specifically a shellfish hatchery might build their capacity for resource management and enable them to assert governance rights. In most indigenous food sovereignty literature, indigenous populations are seeking to define their own food system through distinctly traditional foods and resource stewardship methods (e.g. Grey & Patel, 2014; Kamal et al., 2015; Morrison, 2011; Rudolph & McLachlan, 2013). While pursuing traditional food



is likely the preferred goal of First Nations, our study presents an accompanying approach in which non-traditional food production methods (culturing non-native shellfish with novel sea- and land-based technologies) was considered by the participants to facilitate asserting resource management rights in the territories, an expression of food sovereignty which was not based on community consumption, but on production. Silver (2013) frames an ongoing debate which questions whether the participation of First Nations in modern aquaculture represents a relinquishing of sovereignty by accepting state-defined regulations (in the case of BC, the tenure system) or a necessary step in the treaty process as Nations carve out their traditional territories and assert management rights. The key informants' responses generally suggest the latter, that engaging with the aquaculture industry was an opportunity to modernize economies while simultaneously defining their traditional territories.

My results suggest that some community members can also view production as a mode of demanding change from state governance, whether or not that production is traditional. By contesting colonial laws through food production, itself, the nations are engaging in their right to self-determination. Participants' stories suggested that by contesting state regulations they felt they were positively influencing those of the future which might permit greater voice in resource governance. A shellfish hatchery may allow them to participate in contestation more. Regional or cooperative ownership could enhance the notion of self-determination because decision making power might be localized. We are reminded here that a technology alone cannot facilitate food sovereignty as that depoliticizes the issue: food sovereignty must be accompanied by policy changes. Dawn Morrison explores how legislation and policy around food production can inhibit indigenous sovereignty, but also that legislative or policy change which responds to indigenous need can provide a restorative framework (Morrison, 2011). Wittman's *multi-scalar* approach describes this relationship between the MFNs and the state regulations as an instance where an *autonomous and localized initiative* is challenged by *state actions* (Wittman, 2015). The multi-scalar approach politicizes individual food sovereignty so that institutionalization can occur as food sovereignty is scaled up. The research findings of my colleague Elizabeth Mozier (2017) outline some of the recommended policy changes which might enhance the ability of First Nations' to engage with aquaculture development.

Finally, my research suggested that producing a culturally relevant species through LBA would likely not wholly satisfy the loss of cultural foods that many of the Nanwakolas Nations have experienced. Producing food through LBA would not be the interface between the Nations and their environment because these LBA systems necessarily remove food production from the ecosystem. Nor would food produced in LBA be a subject which unites generations and upon which elders can transmit knowledge to youth as a new technology would require external training. The literature on Indigenous Food Sovereignty supports the idea that traditional foods provide opportunities beyond mere sustenance. Dawn Morrison (2011) suggests that Indigenous Food Sovereignty is based on action, on the day to day practice of nurturing relationships with land, plants and animals. Kamal and colleagues (2015) document the O-Pipon-Na-Piwin Cree Nation in Northern Manitoba using traditional food gathering as an explicit connection to territory to protest hydroelectric development projects; the name of the Nations' program was *lthinto Mechisowin* or "food from the land". That LBA-produced food does not wholly constitute traditional food does not preclude community consumption however. Nations might still benefit from healthy, locally produced foods for instance but would not expect LBA to fill all the aspects of traditional foods which are crucial to their physical and cultural wellbeing.

While LBA development through a Shellfish Hatchery would not likely be the complete expression of sovereignty that embodies other Indigenous Food Sovereignty movements which focus solely on traditional foods, it may strengthen various components of the MFNs' expressions of self-determination through enhancing their resource governance role and creating opportunities to contest state regulation.

### **6.3.3 Balancing Consumption and Commodification in Food Sovereign Systems**

The apparent dichotomy drawn between "Consumption vs. Commodification" oversimplifies the paths to food sovereignty. Too often, food sovereignty is romantically conflated with food self-sufficiency, suggesting a notion of sovereignty that is geographically bounded and rejects exterior interaction of any kind. Madeline Fairbairn (2012) suggests that an over-emphasis on self-sufficiency, or "defensive localism" (Winter, 2003) limits the transformative potential of the food sovereignty movement and instead leads to "islands of food sovereignty in a neoliberal ocean" (Fairbairn, 2012).

While the role of trade and non-local consumption in the food sovereignty literature remains unsettled, the participant responses throughout the analysis parallel the literature finding that local consumption is not the only path to food sovereignty. Rather, localizing decision-making surrounding the means of production seems to be paramount in the participants' conceptions of their food system. Development of a cooperative regional hatchery could allow the Nanwakolas to 'decommodify' by producing their own seed. Community consumption could still be a long term outcome of a comprehensive project (e.g. by seeding beaches as one participant suggested), but focusing on production builds a base of community capacity first and community food afterwards.

Furthermore, my findings reaffirm the literature finding that current food safety regulations which favour larger scale aquaculture may inhibit the ability of local communities to choose consumption at all. Participants expressed challenges with the current food regulation limiting the ability of community consumption. The food sovereignty literature has characterized modern food safety standards as a proliferation of neoliberal logic which has disadvantaged the local scale for the sake of industry efficiency. For instance, Condra (2012) explores the *Food Safety Modernization Act* in the US which put a bureaucratic burden on producers, limiting the ability of small-scale farms to participate. Gambling characterizes the actions of raw milk cooperatives in Canada as food sovereignty struggles against a state system which has disproportionately favoured industrial production disproportionately (Gambling, 2016).

My findings add to the discussion of 'local food' which remains relatively loosely characterized in the literature. The benefits of local foods have been explored through a variety of lenses, including emissions reduction, local resilience, etc. (Robbins, 2015; Wald & Hill, 2015; Wittman, Beckie, & Hergesheimer, 2012). It has also been challenged as "the local trap" and can contribute to an over-emphasis on self-sufficiency if *localizing the food system* (Nyéléni principle) is interpreted as necessarily localizing both production *and* consumption (Sonnino, 2010). My results indicate a strong desire among participants to see capacity return to their communities through employment opportunities. If these goals were achieved through aquaculture development, the participants' conceptions of their own food systems suggest that they would find food sovereignty through local production that is not contingent on local consumption.

An interesting case from the Huuayaht First Nation (a West Coast Vancouver Island Nuu-chah-nulth First Nation) adds further context to this discussion, particularly because it relates to abalone (a species the key informants expressed interest in consuming). The Huuayaht Nation embarked in the mid 2000's on a DFO sponsored venture to grow abalone. The main purpose was to grow juveniles for a wild restocking program to rebuild a healthy wild stock that could be fished. The program was to be complemented with some sale of the high-value seafood to provide revenue for the venture. In principle, this is an interesting way of striking a balance between consumption and commodification. The high cost of rearing the shellfish necessitated some kind of commodification, but the production was enabling several interconnected community goals, such as resource governance and in the long-term community food. Interestingly however, a political economy frame here lends itself well because a piece of federal legislation separate from the DFO, the *Species At Risk Act*, forbade the sale of any endangered species. This regulatory hurdle eventually proved insurmountable at the time and after several years of battle, the DFO pulled its funding from the project and the Huuayaht enjoyed a million-dollar abalone feast. (Information gathered from Globe and Mail article, (Clarke, 2010)). This is a very interesting case of balancing consumption with commodification that merits further research, particularly as the Nanwakolas have expressed interest in abalone. Specifics of what the regulatory barriers might enable future development and partnerships between VI FNs.

#### **6.3.4 Limitations of Food Sovereignty Analysis**

The value of my use of the Nyéléni Principles is limited by its alignment with the participants' motives, the design of the interview and dialogue process and its untested validity as a research tool. My approach to the food sovereignty literature in this thesis is an alternative to the typical approach which is usually descriptive of ongoing struggles. Here, I consulted the literature in the design of a new food system. The aim was to avoid the overly state- and techno-centric approach to food production that led to many of today's food sovereignty struggles. As far as I am aware, the community has not articulated an explicit pursuit of food sovereignty which calls into question the suitability of framing aquaculture development as a food sovereignty issue. Food sovereignty is necessarily place based and rooted in the community's motives and thus cannot be a prescriptive approach to food system change (Wittman, 2015). Thus, the first limitation

is whether the approach is overly imposing. I used an external framework created from the experiences of other communities to form recommendations for the Nānwakolas, who are not explicitly pursuing food sovereignty. Indigenous food sovereignty scholars and activists have focused on both explicit and implicit pursuits of food sovereignty. Kamal et al. (2015) explore the ways that the O-Pipon-Na-Piwin Cree Nation project champions were already using the term food sovereignty to achieve community goals. On the other hand, Rudolph and McLachlan (2013) use food sovereignty to frame the food struggles of two indigenous communities in Northern Manitoba who were not explicitly using the term. These authors used the existing literature to frame the Nations' challenges and craft specific actions. I suggest the literature can frame both explicit and implicit pursuits of food sovereignty, and that my particular usage can inform the Nānwakolas' future discussions of a shellfish hatchery. A second limitation is that the semi-directed interviews did not specifically address food sovereignty issues; rather, the results were retroactively analysed from a frame of food sovereignty. Further iterations of the research would interrogate shellfish hatchery development with the food sovereignty principles more specifically in mind. Furthermore, there are no clear efforts in the food sovereignty literature to use the list of Nyéléni principles as an analytical framework so there are limitations because it is untested. However, my on-the-ground interrogation and analysis can help to validate it as an analytical framework, such as has been called for in the literature (Chaifetz & Jagger, 2014; Chappell et al., 2013; Wittman, 2015). Additionally, certain principles were evident in many more responses than others, so the analysis is not entirely balanced. Future investigations could specifically probe those less populated principles (such as *works with nature* and *values food producers*).

My own assumptions as a researcher should be acknowledged as I interpreted a broad range of interviews and dialogue from the perspective of our project focus of land-based aquaculture. Our initial assumptions (myself and the other research interns) had been that the Nānwakolas Nations would be interested in high value finfish such as salmon for LBA development. These assumptions were challenged through the interviews and dialogue as participants consistently raised points related to existing or proposed marine shellfish aquaculture operations. Additionally, participants exposed us to the finfish debate which is ongoing among Kwakwaka'wakw Nations and consequently, their preference to avoid it. While we eventually focused on a shellfish

hatchery as a connection between the land-based scope of the project and the participants interest in shellfish, our initial interviews did not have this narrow scope. In our interviews, we were not clearly asking questions as they would relate to a potential shellfish hatchery but instead asking them broadly about aquaculture and later interpreted responses according to how their experiences would relate to a potential shellfish hatchery.

### **6.3.5 Framing Food Sovereignty using Community Capacity**

Community capacity was an overarching theme of this research, specifically as a limited resource to be effectively mobilized to achieve community development. The results of the food sovereignty analysis can be framed as limits to the three distinct stocks of community capacity that emerged from the framework development. The informants suggested an inability to challenge state government (limited governance capacity), a limitation to affording LBA without relying on external investment (limited financial capacity) and a hesitance to depend on external labour/expertise (limited human capacity). These same three categories were offered as recommended inclusions to future iterations of the Community Wellbeing Wheel after analysing the Community Dialogue.

Framing the food sovereignty findings according to the three stocks of Community Capacity strengthens the notion from the CWCS and the literature that community capacity is an asset strengthened through mobilization (Roseland, 2012). I observed this notion as community members shared stories of asserting fishing rights and strengthening governance capacity, or investing in aquaculture projects which over time trained membership and strengthened human capacity. That capacity is strengthened through mobilization is clearly articulated in the Nānwaḱolas' own CWCS, which highlights capacity *limitations* as the very basis for pursuing holistic development in the first place. The CWCS introduces the Community Wellbeing Wheel and the need for holistic decision making by stating that "There is however limited capacity to address everything at once" (Roberts, 2014). The second iteration of the CWB Framework which we produced with the Nānwaḱolas is a framework that seeks to consider and maximise as many assets as possible to *build* capacity and *overcome* limitations. What the food sovereignty analysis ultimately clarified was the areas which would require greater dialogue before embarking on shellfish development. The findings

of my food sovereignty analysis support the development of a dialogue support tool based on the holistic nature of the community's own values which explicitly considers Community Capacity.

### **6.3.6 Towards Food Sovereignty in Shellfish LBA Development**

The consideration of food regimes here was broadly analytical in order to conceptualize the commodification vs. consumption discussion, and could be extended to further understand how a shellfish hatchery might serve the Nanwakolas. The perspective allowed me to consider the participant experiences of the Nanwakolas pursuing shellfish LBA within the broader context of a neoliberal or corporate food regime, and to consider the output of a potential venture as a commodity in a global system. The research could be expanded following the methodology of particular commodity studies researchers. For example, in the book *Tangled Routes: Women, Work and Globalization on the Tomato Trail* Deborah Barndt follows the life of two tomatoes (one "corporate" and one grown by indigenous gardeners) and issues of race, class, gender and nationality of the various workers and consumers along the way are interrogated (2008). Such a study could further inform how the Nanwakolas' investment in shellfish aquaculture might link them economically and socially to broader global markets.

Using the Nyéléni principles as an analytical framework relates the Nanwakolas to the broader food sovereignty discussion. The framework allowed us to interrogate the participant responses from the perspective of the broader global food sovereignty discourse, which has two parallel benefits. First, the Nanwakolas can learn from the lessons of other food sovereignty movements in proceeding with LBA development. Secondly, the Nanwakolas MFNs are aligned to the broader food sovereignty struggle through these research connections. As food sovereignty movements are necessarily local, global networks allow for capacity building across jurisdictions to influence a blue revolution that values community development.

## **6.4 Concluding Remarks**

We have explored the topic of land-based aquaculture in a partnership with the Nanwakolas Council. The Council had expressed interest in investigating Land-based

Aquaculture in order to be aware of the leading practices and to participate in sustainable aquaculture in their traditional territories. The bulk of research concerning land-based aquaculture focuses on its technical and economic feasibility, as well as innovations in ecological sustainability. Our research design allowed us to focus on the potential social aspects of LBA development for the N̄anwak̄olas while more broadly contributing to the non-technical knowledge gap that we observed in the literature. Technical, economic and ecological aspects will need to be further explored by the community before moving forward with any investment in LBA. In this thesis, I addressed the two broad questions of what community planning tools could be developed and used to support dialogue for such large decisions, as well as how LBA might impact community food systems from the perspective of food sovereignty.

I first enhanced the N̄anwak̄olas' existing CWB Framework by developing distinct stocks and dialogue criteria. The community dialogue that occurred surrounding a shellfish hatchery was used as a basis to test the utility of the N̄anwak̄olas' own Community Wellbeing Wheel as a Sustainability Assessment tool. My aim was to answer the specific research question 1-1 ("Can a framework which reflects the N̄anwak̄olas' community development objectives be created with distinct nested subcomponents?") I found that the Community Wellbeing Wheel was suitable basis to frame the community dialogue. Through a gap analysis, I highlighted possible improvements so that it might encapsulate concerns and opportunities voiced by community members in future iterations if the framework is to be fully operationalized to a Sustainability Assessment Tool. I made progress toward a community planning tool which is firmly rooted in place by beginning with a framework conceived of by the community itself and then enhancing that framework using the Community Capital Framework as a model. Further research engagements between the Centre for Sustainable Development and the N̄anwak̄olas Council will build on this research to operationalize a tool that the community could use in future discussions of aquaculture and other community development projects.

Next, I assessed the specifics of LBA and interrogated participant interview responses and dialogues from the frame of food sovereignty. To address research question 2-1 ("What features of LBA align with or are incongruent with a food sovereignty approach?"), I used the six principles which emerged from the Nyéléni conference as an analytical frame to highlight ways that the communities of the



Nanwakolas Council might best engage with future shellfish hatchery development if food sovereignty is an objective. My findings include a potential cooperative structure to alleviate capital burdens while maintaining localized ownership, a focus on seed production to build the capacity of existing Nations' shellfish operations and enhance resource governance capacity, and a focus on employment through production with eventual consumption as a potential community benefit. In addition to assessing LBA from within an analytical food sovereignty framework, I focused on two additional themes which emerged from the interviews and dialogue. My results in research question 2-2 ("What does a non-traditional food production, in this case LBA, offer First Nations in their pursuit of self-determination through food sovereignty?") suggest that a shellfish hatchery could be an example of a food production method which is not traditional but could still be an avenue through which to build capacity for resource governance. In research question 2-3 ("How do communities navigate the decision to commodify or consume locally produced food resources?") we sought to understand the broader discussion of consuming or commodifying community food resources through the specific example of the Nanwakolas engaging with LBA development. We found that drawing a dichotomy between Consumption and Commodification may oversimplify the paths to food sovereignty by over-emphasizing self-sufficiency (i.e. community consumption). Our findings suggest the Nations' would find value and food sovereignty through local production that would be enhanced by, but not contingent on local consumption.

Capacity emerged as a common theme throughout the research. Specifically, limitations in the communities' capacity to define their own food system emerged in the same categories which were recommended for inclusion under the sixth CWB Area of *Community Capacity* (Governance, Human and Financial). Having a dialogue support tool which allows users to explicitly focus on capacity would facilitate mobilization in future community development projects.

In addressing the non-technical knowledge gap within sustainable aquaculture research, I have highlighted some socioeconomic aspects which should be considered as the "blue revolution" continues forward. I have identified some features of LBA that may help or hinder the food sovereignty of the communities within which the blue revolution is occurring. The technological solution of growing fish on land could repeat some of the errors of the green revolution. These include delocalizing decision making

through forcing small producers and communities into inequitable investment and trade relationships and isolating production from local ecosystems. However, my investigation of a shellfish hatchery for the Nānwakōlas illustrates an instance where these risks might be overcome by certain cooperative structures which contribute to existing food production capacity and could satisfy other community goals such as resource governance and employment. As sustainable aquaculture continues to be investigated as a solution to falling employment and declining wild stocks, the blue revolution should be wary of blanket solutions. If aquaculture is to be an emerging industry to answer the call of a growing and hungry global population, detailed community-based research will be necessary to identify paths of development which do not hurt, but help the capacities of small communities.

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## **Appendix A.**

### **Global Aquaculture Scan Results**



# LAND-BASED AQUACULTURE SCAN

An initial Scan of Industry Best Practices

## ABSTRACT

This document offers an initial scan of current best practices in land-based aquaculture from around the world.

[Jake Bastedo](#), [Jeff Lemon](#), & [Elizabeth Moiser](#)

Group	Species	Operation	Location	Type of Facility	Technology Used (RAS, pen, mixed); Proven / Experiential	Description	Key Points of Operation (market, innovation, etc.)	Link(s)
Finfish	Arctic char, Atlantic halibut, Atlantic salmon	Canaqua Seafoods Limited	Advocate Harbour, NS	Hatchery, Grow out  (Onsite - salmon & char; Off-site - halibut [Scotia Halibut])	RAS; Proven	Annual production - 250 MT total  Operation supplies local markets with three species of finfish; Transitioning to full organic certification  Supports local jobs and industry in rural NS	Access to both fresh & salt water wells  Well depth allows water to be clean, pure and pathogen-free; water is also at a constant temperature, year-round.	<a href="http://canaquaseafoods.ca/">http://canaquaseafoods.ca/</a>  <a href="http://aquaculturenorthamerica.com/profiles/canadian-organic-salmon%3A-a-new-venture-for-canaqua-seafoods/">http://aquaculturenorthamerica.com/profiles/canadian-organic-salmon%3A-a-new-venture-for-canaqua-seafoods/</a>
	Atlantic Halibut	Halibut PEI	Victoria, Prince Edward Island	Grow out	Saltwater RAS; Started experimental in 2008	Pilot project began in 2008 in an abandoned lobster holding facility in Victoria, PEI.  The location has three deep salt wells; the pure salt water requires no antibiotics and results in a low environmental footprint.  The project demonstrated acceptable salinity levels and temperature from the water wells.	The facility makes use of an costly technology to develop by reusing the salt water well facility for lobster holding tanks.  The facility is unique due to its natural salt water wells.	<a href="http://halibutpei.ca/about-us/our-story/">http://halibutpei.ca/about-us/our-story/</a>
	Atlantic Salmon	Kuterra	Port Hardy, BC	Grow out; Hatchery (possible)	RAS; Experimental	One of the first land-based Atlantic salmon farms globally to achieve sales quotas.  Currently designed: 470 MT/year; Future expansion: potential to add 2000-3000 metric tonnes, hatchery, on-site solid waste composting, & aquaponics.  Grow four cohorts (batches) at a time at about 40,000 fish per cohort; 160,000 total	Utilizes SCD principals for success of enterprise: the 'Namgis First Nation, project partner SOS Marine Conservation Foundation, funder & advisor Tides Canada, and seafood distributor Albion Fisheries.  100-percent 'Namgis First Nation ownership; benefits 'Namgis community  Module one has five direct operations staff. Full-size farm	<a href="http://www.kuterra.com/">http://www.kuterra.com/</a>

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						Kuterra salmon have achieved a green, "Best Choice" ranking from Monterey Bay Aquarium's Seafood Watch, designated a Best Choice by SeaChoice, and designated "Ocean Wise"	to create 29 downstream jobs, measured with standard industry multipliers  Preliminary discussions of partnerships to offer training and certification in RAS technology; need for qualified staff (& training) is likely to increase as demand RAS in Canada and globally expands.	
		Marine Harvest	Campbell River, BC	Hatchery, Grow out, Processing, Distribution	Mixed (RAS/pen); proven	Hatchery/grow out takes place in RAS system; last stages of grow out happen in traditional pens off BC coastline	1. Smolts - Smolts are grown in RAS hatchery until the mature into adult salmon; for final stages of grow out (3-6 months), salmon are moved to pen enclosures off the coast  2. Harvest - After fish have reached market weight (4.5 to 5.5kg) and are then harvested and taken to a MH processing facility  3. Processing / Distribution - Processing activities take place in specialized facilities; once processed, MH uses a combination of road, rail, ship and airfreight for distribution to maintain product freshness and to minimize travel time.	<a href="http://www.marineharvest.ca/">http://www.marineharvest.ca/</a>
	Barramundi	MainStream Aquaculture	Australia	Hatchery, Grow out, Processing, Distribution, R&D	RAS / Proven	Developed proprietary RAS technology unique in enabling continuous (year round) high quality production of the popular table fish, Barramundi.	Operation is supported by an advanced selective breeding program conducted in the world's largest Barramundi hatchery in Melbourne, Australia	<a href="http://www.mainstreamaquaculture.com/">http://www.mainstreamaquaculture.com/</a>

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						Operates largest recirculating aquaculture system in mainland Australia; top 5 domestic provider of Barramundi in Australia.  Distributes food products into premium retail outlets around Australia and exports juvenile Barramundi to 17 countries, across 5 continents.	Breeding program underpins Mainstream's production process through the supply of high quality juvenile Barramundi that demonstrate rapid growth, low growth variance, high fillet yield and disease resistance.	
	Tilapia	Redfish Ranch	Courtenay, BC	Hatchery, Grow out	RAS; Proven	Started in 2000, still running in 2010 but hard to find anything since then  Up for sale in 2010; no website, probably now defunct	Privately owned, Selling live to mostly Asian buyers in the lower mainland.	<a href="http://www.bcbusiness.ca/natural-resources/fish-farming-tilapia-in-bc">http://www.bcbusiness.ca/natural-resources/fish-farming-tilapia-in-bc</a>
		Tropical Aquaculture Products	Headquarters in Vermont, USA; Farms in Brazil, Columbia, & Ecuador	Hatchery, Grow out, Processing	Land pen flow through with filtering (mixed water with Fresh from Andes and saltwater from Pacific)	Vermont employ 15 people; company partners with tilapia farms around the world.	Similar to a co-op model, Tropical distributes tilapia farmed elsewhere in the world.  The fish are raised in ponds on land with access to natural water sources. Fish feed is 94% vegetables, 4% fish meal; the protein production ration is just 0.24:1.	<a href="http://www.eattilapia.com/operations/tilapia-farming/">http://www.eattilapia.com/operations/tilapia-farming/</a>

Multi-trophic	Oysters / Algae	Smit & Smit	Netherlands	Grow out	RAS; Experimental	Father and Son team starting world's first RAS oyster production system with full grow out	Growing the algae that feed the oysters onsite.  Completely isolated RAS, so substantially reduced risk of disease	<a href="http://advocate.gaalliance.org/dutch-shellfish-farmers-bringing-the-sea-onto-land/">http://advocate.gaalliance.org/dutch-shellfish-farmers-bringing-the-sea-onto-land/</a>
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	Steelhead Salmon / Aquaponics	Little Cedar Falls	Nanaimo, BC	Grow out	RAS; Experimental	<p>Production will reach 100 MT of Steelhead annually - 3 cohorts stocked in the system at a time; 100% hormone and antibiotic free</p> <p>10,000 fish stocked every 8 weeks; growth from 20gm to 2kg in 45 weeks @ 15 Celsius</p> <p>Operation won runner-up for innovation at Stanford's Fish 2.0</p>	<p>Operation cost \$1.4M to build; Atkinson suggests that building a second facility at same time would have dropped costs and decreased vulnerability of operation over the long run</p> <p>Worked with Tides Canada, Albion Fisheries, and other special interest groups to</p>	<p><a href="http://www.littlecedarfalls.com/steelhead-salmon.html">http://www.littlecedarfalls.com/steelhead-salmon.html</a></p> <p><a href="http://www.tidescanada.org/wp-content/uploads/2015/03/D-2-4SteveAtkinsonNanaimoLanD-BaseD-SteelheadD-MoDelAquafarm.pdf">http://www.tidescanada.org/wp-content/uploads/2015/03/D-2-4SteveAtkinsonNanaimoLanD-BaseD-SteelheadD-MoDelAquafarm.pdf</a></p> <p>VIDEO - <a href="https://www.youtube.com/watch?v=oIBvXMwwwzY">https://www.youtube.com/watch?v=oIBvXMwwwzY</a></p>
	Sturgeon / Aquaponics	Target Marine Products Inc.	Nanaimo, BC	Hatchery, Grow out, Processing	RAS; Proven	<p>Sturgeon &amp; caviar production; facility has hatchery, grow-out sites, &amp; processing plant</p> <p>Aquaponics system grows watercress to filter out nitrates &amp; effluent</p>	<p>Sells product to Albion Fisheries</p> <p>Products are Certified Organic, recommended by Ocean Wise, and recognized BEST CHOICE by SeaChoice and SeafoodWatch</p> <p>Watercress is shipped and sold to Vancouver restaurants</p>	<p><a href="http://www.northerndivine.com/">http://www.northerndivine.com/</a></p> <p>VIDEO - <a href="https://www.youtube.com/watch?v=gueSq_E1Gik">https://www.youtube.com/watch?v=gueSq_E1Gik</a></p>
	Tilapia / Aquaponics	Blue Ridge Aquaculture	Martinsville, Virginia, US	Grow out	RAS; Proven	<p>Largest RAS tilapia operation in the world; 4 million pounds per year</p> <p>Entire system is closed loop; adding only feed for the tilapia.</p>	<p>Designed as a multi-purpose facility for research into the science, technology, and economic potential of fish and shellfish production using RAS</p> <p>Aquaponics utilize: traditional hydroponic techniques (nutrient film and gutter systems), raft (floating</p>	<p><a href="http://advocate.gaalliance.org/dutch-shellfish-farmers-bringing-the-sea-onto-land/">http://advocate.gaalliance.org/dutch-shellfish-farmers-bringing-the-sea-onto-land/</a></p>

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							<p>Styrofoam boards), &amp; drip irrigation systems.</p> <p>Aquaponics - grows basil, peppers, tomatoes, and different types of lettuces (butterhead, red leaf, romaine and lollo)</p>	
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Shellfish	Abalone	Connemara Abalone	Galway, Ireland	Hatchery, Grow out	RAS; proven facility operating since at least 2009	<p>Grow Ezo (haliotis discus hannai) Japanese variety.</p> <p>Facility is located on the shores of Galway Bay and uses sea water, abalone are fed locally harvested seaweed</p>	One of two abalone operating producers in Ireland. Abalone was first introduced to the area in 1980.	<a href="http://www.abalone.ie/our-location.html">http://www.abalone.ie/our-location.html</a>
		Pure Australian Abalone (Ausab)	Australia; Bicheno, Bremer Bay, Kangaroo Island, Port Lincoln, Portland	Hatchery, Grow out, Processing, Distribution	RAS; Proven	<p>Australian abalone aquaculture industry pioneers; grow premium (sashimi grade) species including Greenlip (Haliotis Laevigata) and Tiger (Haliotis x Rubra) abalone</p> <p>Distribute IQF (individually quick frozen) abalone to wholesalers &amp; distributors across the globe; live abalone pack &amp; hand delivered to Australian customers</p>	<p>1. Baby abalone start their lives attached to layered vertical sheets. These are covered with algae (food source) for these growing creatures as they are in their juvenile stage. Trials are carried out to ensure abalone are receiving the best diets to aid health and growth</p> <p>2. RAS tech circulate fresh seawater in the tanks; tanks cleaned regularly to ensure the abalone have the best possible environment in which to thrive</p> <p>3. Abalone are hand fed daily on a 100% natural diet with</p>	<a href="http://www.ausab.com.au">http://www.ausab.com.au</a>



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							essential nutrients until they reach maturity and commercial size [3 yrs.]  4. Harvest team removes each abalone by hand from the tanks; abalone are then taken to the processing room where they are snap frozen before being packaged and delivered to customers around the world.	
		Tower Aqua Products	Cork, Ireland	Grow out	RAS; Proven, operational since 2004	Grow Eso Awabi (haliotis discus hannai) Japanese variety & Haliotis Tuberculata.  Facility is computer controlled and fed organic sustainable seaweed (fed by hand).	Provides end to end consultancy services (primarily in Europe) for farmers that need assistance developing a farm.  Farm has build out capacity to 80 tonnes; currently operating at 45 tonnes. 20,000 sq.ft purpose built facility with sea water heat exchange and gravity fed water make up.  Current activities are aimed at developing the business model and increasing operational efficiency.	<a href="http://www.toweraqua.com/">http://www.toweraqua.com/</a>  <a href="http://www.fishtech.com/qa.html">http://www.fishtech.com/qa.html</a>
		Wild Coast	East London, South Africa	Hatchery, Grow out	RAS (unconfirmed) ; Proven, operational since at least 2012	Grow abalone (Haliotis discus) in land-based tanks. Also grow all of the seaweed (kelp?) necessary to feed the abalone in open air raceways.	Seems that breeding, hatching, grow out and processing are all done on site, as well as feed production.  In the video [see link(s)], a program is described that releases some spawn to restock wild populations.	<a href="https://www.youtube.com/watch?v=Id6248PXzkY">https://www.youtube.com/watch?v=Id6248PXzkY</a> (this is a decent little doc about SA abalone crisis, start at 17:35 for content specific to this farm)  <a href="https://theweekendpost.com/">https://theweekendpost.com/</a>

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							Grow about 600 tonnes of seaweed a year, processing about 130 tonnes abalone a year.	<a href="http://wordpress.com/tag/richard-clarke/">wordpress.com/tag/richard-clarke/</a>
	Clams, geoduck, mussels, oysters	Taylor Shellfish	Seattle, WA	Hatchery, Grow out (?)	RAS; South Puget Sound sandy beaches, muddy tide flats, rocky shorelines, mussel rafts	Started in the mid-1980's, now over 500 employees and still largely a family business.	Started in the mid-1980's, now over 500 employees and still largely a family business.	<a href="https://www.taylorshellfishfarms.com/about-us/our-story">https://www.taylorshellfishfarms.com/about-us/our-story</a>
	Lobster	Norwegian Lobster Farm	Norway	Hatchery, Grow out	RAS; Experimental	<p>Lobster are cannibal throughout lifecycle; must be kept separated throughout entire lifecycle.</p> <p>Fishing for berried lobsters was protected in 2008; Norwegian Lobster Farm began as a project to developing a living gene bank for restocking purposes</p> <p>Tech is patented; provides lobster w/ optimal growth conditions, animal welfare &amp; biosecurity throughout production cycle.</p>	<p>European lobster is considered to be a high-end seafood; price is high and stable, both nationally and internationally</p> <p>Demand outstrips market supply; estimated market potential is more than 50,000MT and price generally increases with demand throughout the year</p>	<a href="http://www.norwegian-lobster-farm.com/en/">http://www.norwegian-lobster-farm.com/en/</a>
	Shrimp	First Ontario Shrimp Farm	Campbellford, ON	Grow out	RAS; Experimental	<p>Shrimp come from a pathogen free hatchery in Florida</p> <p>RAS most sustainable way to farm shrimp</p>	<p>Shrimp is the most consumed seafood in North America</p> <p>Retrofitted hog farm; RAS offered alternative uses for their empty barns</p>	<p><a href="http://firstontarioshrimp.com/about-us.php">http://firstontarioshrimp.com/about-us.php</a></p> <p>VIDEO - <a href="http://www.cbc.ca/news/business/shrimp-farm-cocchio-1.3371804">http://www.cbc.ca/news/business/shrimp-farm-cocchio-1.3371804</a></p>

Group	Species	Operation	Location	Type of Facility	Technology Used (RAS, pen, mixed); Proven / Experiential	Description	Key Points of Operation (market, innovation, etc.)	Link(s)
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							Delivers to restaurants & fish mongers in Toronto; shrimp fetch higher prices / lbs. than imported shrimp	
		Oceanic Institute (Hawaii)	Hawaii, US	Grow out	RAS; Experimental	An intensive grow out trial produced 5.7 kg/m <sup>2</sup> of market-size shrimp in 14 weeks	Alternative management strategies allowed the elimination of costly external bio filters and other system, thereby reducing production costs.	<a href="http://pdf.gaalliance.org/pdf/GAA-Otoshi-July06.pdf">http://pdf.gaalliance.org/pdf/GAA-Otoshi-July06.pdf</a>
		Planet Shrimp	Aylmer, ON	Grow out	RAS; Experimental	Massive shrimp farm in a former Imperial Tobacco plant  Producing 3,600 kilograms of shrimp a week to start; ramping up to more than 29,000 kilograms per week.	Starting with four production modules, each about the size of a football field  Intends to expand facility to almost 225,000 square feet; expansion will create largest facility in N. America  Endorsed by OceanWise & SeaChoice	<a href="http://www.planetshrimp.com/">http://www.planetshrimp.com/</a>
		Virginia Shrimp Farms (subsidiary of Blue Ridge Aquaculture)	Martinsville, Virginia, US	Brood stock, Hatchery, Nursery, Grow out	RAS; Experimental	Working w/ Virginia Tech to develop large-scale shellfish production Infrastructure necessary to develop production technologies for fish and shellfish species in RAS.  Facility includes dedicated spaces for grow out systems, a hatchery and nursery room, brood stock tanks and laboratories.  Nursery & hatchery rooms	Shrimp is top seafood species consumed in the US, it represents the largest potential market  Designed as a multi-purpose facility for research into the science, technology, and economic potential of fish and shellfish production using RAS	<a href="http://www.blueridgeaquaculture.com/research.cfm">http://www.blueridgeaquaculture.com/research.cfm</a>

Group	Species	Operation	Location	Type of Facility	Technology Used (RAS, pen, mixed); Proven / Experiential	Description	Key Points of Operation (market, innovation, etc.)	Link(s)
						<p>- live feed production, including an algae culture room, live feed tanks, and distribution systems.</p> <p>Brood stock rooms include a separate filtration system &amp; darkened rooms with photo-manipulation capabilities</p>		

### ***Closed System Land-Based Aquaculture: Description of Technology & Species***

The following descriptions highlight and used in closed system, land-based aquaculture. A list of reared species has also been added for the convenience of the reader.

#### **FinFish**

##### **Raceways (recirculating or flow-through)**

**Description:** Modern raceway systems are made from a variety of materials: concrete, plastic, steel; can be either outdoor or indoor; gravity fed by a stream; partially or fully recirculating.

##### **Species & Country**

Channel catfish (*Ictalurus punctatus*); USA  
Seabass (*Centropristis striata*); France  
Sole (*Solea solea*), Japanese flounder (*Paralichthys olivaceus*); Spain, Denmark  
Trout (*Oncorhynchus mykiss*); US, Spain, France

##### **Recirculating Aquaculture Systems (RAS)**

**Description:** Tanks can come in a variety of forms. Circular formats have been preferred in many cases because of the self-cleaning properties they provide. Polygon shapes, however, have advantages in being more space efficient. These systems are often modular and scalable, allowing producers to scale-up systems at their own pace and without having to interrupt operations to add greater capacity. Inland recirculating tanks are often located where there is both limited land and water availability, as they can be located in industrial areas and achieve high degrees of water reuse.

##### **Species & Country**

African catfish (*Clarias gariepinus*); Benin  
Barramundi (*Lates calcarifer*); Australia, USA, Russia, Netherlands, Israel, Denmark, UK  
Black rockfish (*Sebastes schelegeli*); Korea  
Eel (*Anguilla anuilla*); Denmark, Croatia & Netherlands  
Golden perch (*Macquaria ambigua*); Australia  
Jade perch (*Scortum barcoo*); Australia  
Murray cod (*Maccullochella peelii peelii*); Australia  
Pike perch (*Sander lucioperca*); Netherlands  
Seabass (*Centropristis striata*); Greece  
Seabream (*Sparus aurata*); Greece  
Sleepy cod (*Oxyeleotris lineolatus*); Australia  
Sturgeon (*Acipenser transmontanus*); Greece  
Tilapia (*Oreochromis niloticus*); El Salvador, Israel  
Trout (*Oncorhynchus mykiss*); Chile  
Turbot (*Scophthalmus maxima*); Netherlands

##### **Flow-through Tanks**

**Description:** Flow-through tanks come in similar formats as recirculating tanks. These however are more commonly found where reliable water sources are available and used to harvest species that require certain conditions (i.e. trout).

##### **Species & Country**

Arctic char (*Salvelinus alpinus*); Canada (Icy Waters), Iceland.  
Trout (*Oncorhynchus mykiss*); Europe, N. America, Chile, Latin America

### **Island Ponds & Channels**

**Description:** Ponds - analogous to tanks but dug in the ground (natural). Channels – analogous to raceways but in the ground (natural). Occasionally, these can be lined with membranes or mud but this is generally not the case.

#### **Species & Country**

Barramundi (*Lates calcarifer*); Australia  
Channel catfish (*Ictalurus punctatus*); USA  
Golden perch (*Macquaria ambigua*); Australia  
Jade perch (*Scortum barcoo*); Australia  
Salmon (*Oncorhynchus nerka*); Canada  
Tilapia (*Oreochromis niloticus*); Belize, El Salvador, USA, Australia  
Trout (*Oncorhynchus mykiss*); Europe, Australia, N. America

### **Experimental / Development Stage**

#### **Flow-through Tanks: Open-Water Systems**

**Description:** These can be found made from a range of materials, in circular as well as square shapes. Hard walled systems are generally made from reinforced plastic, concrete, aluminium. Soft walled are made from plastic.

#### **Species & Country**

Arctic char (*Salvelinus alpinus*); Canada  
Barramundi (*Lates calcarifer*); Western Australia  
Black cod (*Notothenia microlepidota*); Canada  
Bluefin tuna (*Thunnus thynnus*); Australia  
Chinook salmon (*Oncorhynchus tshawytscha*); British Columbia  
Cod (*Gadus morhua*); Denmark  
Coho salmon (*Oncorhynchus kisutch*); British Columbia  
Gilt-head seabream (*Sparus aurata*); Baltimore, US  
Mulloway (*Sciaena Antarctica*); Western Australia  
Ocean trout (*Oncorhynchus mykiss*); Western Australia  
Rainbow trout (*Oncorhynchus mykiss*); Nova Scotia  
Walleyed pike (*Sander vitreus vitreus*); USA (Michigan)  
Yellowfin tuna (*Thunnus albacares*); Panama  
Yellowtail kingfish (*Seriola lalandi lalandi*); Western Australia

#### **Flow-through Tanks: Land-Based Systems**

**Description:** Tank systems on land pumping seawater.

#### **Species & Country**

Atlantic salmon (*Salmo salar*); British Columbia  
Chinook salmon (*Oncorhynchus tshawytscha*); British Columbia  
Coho salmon (*Oncorhynchus kisutch*); British Columbia

#### **Recirculating Raceways**

**Description:** Recirculating raceways are operated as land- based (inland) systems. These can be composed of a single level or can be stacked to increase production per floor area of a given occupied space.

#### **Species & Country**

Blackspotted seabream (*Pagellus bogaraveo*); Norway  
Cod (*Gadus morhua*); Norway  
California halibut (*Paralichthys californicus*); Spain

## **Appendix B.**

### **Results of site visits**

The interns travelled to several sites throughout BC and Ontario to understand the breadth of possibilities for land-based aquaculture. To capture as much of the production chain as possible, the team visited hatcheries, growout facilities, aquaponic farms and processing/distribution facilities.

#### **Vancouver Island University**

Vancouver Island University (VIU) in Nanaimo, British Columbia, operates the International Centre for Sturgeon Studies (ICSS), which brings together research activities at the regional, national and international levels for the preservation of white sturgeon. Through the ICSS, VIU has also created an aquaponics program that runs on a freshwater recirculation aquaculture system and has partnered with the Culinary Institute at the university to demonstrate the potential of aquaculture and aquaponics production to the chefs and opinion makers of the future.

#### **Marine Harvest Canada**

Marine Harvest Canada (MHC) produces over 40,000 tonnes of farm-raised Atlantic salmon each year from farm-raised salmon farms on the coast of British Columbia and Vancouver Island. In 2015, they announced a \$40-million-dollar infrastructure investment at the company's hatchery facilities in Big Tree Creek and Dalrymple which are slated to be finished in 2017. The six-metre system at Dalrymple was the first of seven new lines to be built, which was completed in 2016. Designed to raise parr and smolts (juvenile salmon prior to seawater entry), MHC's new RAS hatchery lines are reported to help cut down the grow out stage by about 6 months, while using about one-hundredth of the freshwater as a traditional flow-through aquaculture system.

## **Little Cedar Falls**

Also operating in Nanaimo, British Columbia, is Little Cedar Falls is the first RAS facility to successfully reach continuous production with steelhead salmon in Canada. Over 2 tonnes of fish are harvested each week, which reach markets across Vancouver Island the following day. In our site visit, owner/operator Steven Atkinson attributed the exceptional quality, color, and fat content of his product to benefits of RAS technology, the feed used, and ensuring the proper depuration of the fish. In 2015, Little Cedar Falls won runner up at the Fish 2.0 Sustainable Seafood Business Competition held at Stanford University, for their sustainable business design - the entire aquafarm reuses 99.6% of its inputs. The other .4% is recirculated through their aquaponics system where they grow vegetables and leafy greens by harvesting the natural wastes of the farm.

## **Salish Sea Foods Processing Plant**

Salish Sea Foods is a processing plant owned by the K'omoks First Nation. It is the main processing plant for K'omoks owned Komo Gway oysters and performs processing of salmon and shellfish for other local seafood producers. The processing facility was bought by K'omoks and grandfathered into a licensing allowing value added processing including smoking for shellfish and salmon in a single facility - a license that would not be possible under the current Canadian Food Inspection Agency regulations. The processing facility also includes a retail store selling a variety of the products produced at the processing plant. The 7,000 square foot plant provides over 20 employment opportunities and is operating at capacity since just after its take over by K'omoks First Nation Economic Development in 2013.

## **You Grow Food Aquaponics**

Opening its doors in 2011, You Grow Food Aquaponics is a small social venture located in Hope, British Columbia, that works toward issues of local food security and economic development through education, capacity building, and public engagement. Operating on half an acre, the operation is run out of a small-scale commercial greenhouse that was retrofitted to store the aquaponics system. Two tanks house approximately 40 tilapias, which produces nutrient rich water for the more than 20 types of fresh herbs and greens they sell locally through a community supported agriculture



(CSA) subscriptions. Additionally, owner/operator Stephanie Hooker is working with Kwantlen Polytechnic University in Vancouver, to turn the excess ammonia rich water into an organic fertilizer to be sold to local farmers and gardeners as a secondary market. Although the tilapia are not sold for consumption at this stage in the operation, expanding this market is definitely part of their expansion plan. You Grow Food Aquaponics was picked as a best practice because it highlights the potential of utilizing the waste output of an aquaculture enterprise to access secondary and tertiary markets.

### **First Ontario Shrimp Farm**

Originally a hog farm operating outside of Campbellford, Ontario, the Cocchio family decided to leave the pork business when pork prices dropped in favour of the high returns on jumbo shrimp. Like finfish and shellfish, crustaceans do well in RAS systems; especially when compared to Asian counterparts grown in traditional net aquaculture. The ability to fully monitor the environment, feeding levels, and tank carrying capacity allow the shrimp to excel in terms of size and taste. Due to the excellence in product quality, First Ontario Shrimp Farm is currently selling almost half of their weekly output [approx. 50kg/week] directly to high-end restaurants across the Greater Toronto Area (GTA), before the product even leave the farm. First Ontario Shrimp Farm was picked as a best practice because it demonstrates the viability RAS products have on the market, as well as how to gain market penetration by developing relationships with buyers in lucrative markets, such a selling directly to high-end restaurants.

### **Komoka Trout Farm**

This land-based aquaculture enterprise is currently transitioning from a traditional raceway style of aquaculture to a RAS facility. Owner/operator Kevin Keck explained that his rationale for the switch was due to RAS offering a superior product and a shortened grow out period to traditional raceway aquaculture. Keck also made the point that switching to RAS aquaculture would give him the opportunity to easily ramp up his business should he ever want to expand his operation. Although the primary focus of the farm is tourism – where people from the surrounding area can come and catch their own fish to take home - trout are also grown for stream and pond restocking. During the off-season, full-grown stock are taken to a local processing facility for sale in local markets. The Komoka Trout Farm was picked as a best practice because it demonstrates the

potential versatility of land-based aquaculture enterprise and illustrates the merits of RAS aquaculture over more traditional forms of aquaculture. See Appendix A for descriptions of alternative types of land-based aquaculture.

### **Canada Banana Farm**

Operating out of Blyth, Ontario, the Canadian Banana Farm is an interesting case study to be sure. Growing bananas, papaya, citrus (lemons/lime) & pineapple alongside with traditional crops, such as tomatoes, bell peppers, cucumber, squash, & potatoes; this greenhouse operation is anything but traditional. The Canadian Banana Farm was chosen as a best practice because it demonstrates the potential secondary market for fish-based fertilizers (output of RAS aquaculture), as well as the potential of what can be grown in Canada. Using 100% fish fertilizer taken from a local aquaculture facility, the farm's produce is not only larger and tastes better than anything found on the market, but the use of aquaculture fertilizer allows for an organic certification by the Canadian Food Inspection Agency (CFIA), which offers a higher ROI [sometimes more than double] than non-organic products. The combination of fertilizer, heat (greenhouse environment is controlled; stabilized at 28 degrees Celsius) and sunlight has allowed "traditional" Canadian veggies to grow at an increased rate. Terry Brake, and business partner Laurie Macpherson, state that this combo allows a 6-week turnaround time (planting to harvest) on their tomatoes. Additionally, Brake also noted that the aquaculture fertilizer was so beneficial to his operation, that they were now looking at adding an aquaponics facility. He estimates the farm will spend over \$100 000 on fertilizer once they are running at full capacity.

### **Albion Fisheries, Processing Plant.**

Opened in 2013, Albion Fisheries' new GFSI certified processing plant is state-of-the-art, with top-to-bottom temperature control and is equipped with the latest processing technologies. During the site visit, Guy Dean, Albion's Vice President, gave the interns a personal tour around the 65,300-square-foot facility. The site visit focused upon all aspects of the new facility, including the examination of their completely automated processing system (heading/gutting – cleaning – filleting – pin boning – skinning – portioning), all which augment their traditional skilled hand cutting process. After the tour, Albion's VP generously sat down with the interns for almost two hours

offering his wisdom and personal anecdotes of the seafood industry. Albion was approached as a best practice because they have a foundational knowledge of the BC Seafood Market and the know-how to maximize market penetration and build brand loyalty. Additionally, Albion has worked with several RAS operators along the BC coast to help them get up and running. The team saw Albion as a potential ally to the Nanwakolas, in terms of the development of a land-based aquaculture project and the sale of product.

## **Hummingbird Cove**

Hummingbird Cove is located near Saltery Bay in BC. Three main aquaculture buildings have been constructed: a hatchery building with concrete tanks, a food (algae) production facility, and a lab facility. Two concrete water tanks sit behind the aquaculture buildings with a powerhouse in between that will provide ocean water storage, heating, and warm water storage (the water will be heated by propane boilers.). The facility is flow-through: pumping water up from the intake, and after flowing through the facility, water is filtered and re-oxygenated and returned via a dedicated outlet at a temperature close to the existing ocean temperature. Flow through has been selected at this facility for environmental and product quality reasons. The baby animals will eat biological matter from the ocean water and the water will be treated and returned to the ocean cleaner than when it was first drawn. The shellfish product will have the benefit of being cultivated with as close to natural conditions as possible. Recirculation is actually a cheaper option in this case with less risk since the facility will have tighter control on the chemical composition of the water. The managers plan to cultivate local seafood varieties for shellfish seed. Experimental algae production is investigating propagation of 4 species of local algae collected from the ocean in front of the facility. This will also help the shellfish when they are transitioned from the hatchery facility to the ocean to grow out.

The facility has hatchery licensing for over 20 varieties of shellfish. Future build out plans include full grow out of sea cucumber in the land based facility. The facility will provide between 20-50 full time jobs for the area. The facility will focus on collaboration and training of local residents to propagate the shellfish land based aquaculture industry in Canada

In addition to the site visits, the research interns conducted a preliminary global best practice scan of the possibilities of LBA. The findings from this scan informed the following discussion sections. The results can be found in Appendix C.

## Appendix C.

### Interview Questions

General questions
Tell me about your involvement with aquaculture.
Does aquaculture have a historical or traditional significance in your nation?
Could you tell us about your position in (your organization/band council/nation leadership?)
What species would be preferable to your community in terms of cultural relevance?
How might your community balance economic gains and community food of a potential aquaculture project?
Has your community investigated land-based aquaculture before? Aquaponics? Hatcheries? Processing?
What do you foresee would be some of the challenges to a land-based aquaculture venture for your nation?
Could you tell us about some of your engagements with aquaculture industry partners? Is community/membership employment a priority in those engagements?
How have your younger generations shown an interest in traditional foods and economic development?
What are some measures being taken to address community health through food?
Can you tell us about your interactions with DFO, and lessons you've learned there?
Do you envision successful cooperation between the N̄anwakolas MFNs in economic development projects, aquaculture or otherwise? What might be the factors that would make that happen?

Tell us about the importance of resource management in your nation and if aquaculture plays a role in that.

Questions for Aquaculture Practitioners

Can you tell us how your venture was established? What research and testing was required, and was community support a big factor?

In your experience in aquaculture, what are the pros and cons of focusing on one vs. multiple species?

Could you explain the connection between your aquaculture venture and the band governance structure?

## **Appendix D.**

### **Participant Consent Form**



## Rethinking Seafood Production: Developing Sustainable Communities Through Land-Raised Fish

### Consent form for Interviewees

The University and those conducting this research study subscribe to the ethical conduct of research and to the protection at all times of the interests, comfort, and safety of participants. This research is being conducted under permission of the Simon Fraser Research Ethics Board. The chief concern of the Board is for the health, safety and psychological well-being of research participants.

Should you wish to obtain information about your rights as a participant in research, or about the responsibilities of researchers, or if you have any questions, concerns or complaints about the manner in which you were treated in this study, please contact Dr. Mark Roseland by email: [...]@sfu.ca; or by phone: 778.[...]

Your signature on the last page of this form will signify that you have read this document which describes the procedures, whether there are possible risks, and benefits of this research study, that you have received an adequate opportunity to consider the information describing the study, and that you voluntarily agree to participate in the study.

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#### Study Team

We are a team of Master's candidates in the School of Resource and Environmental Management at Simon Fraser University, under the Centre for Sustainable Community Development.

##### *Principal Investigator*

Jake Bastedo, [...]@sfu.ca

##### *Supervisor*

Mark Roseland, [...]@sfu.ca

##### *Co-investigators*

Liz Mosier,  
Jeff Lemon, [emails provided]

#### Purpose

This particular study seeks to explore the contributions that Land-Based Aquaculture (LBA) could make to the development of sustainable communities.

This is an official invitation to participate in our study. You are being recruited as an interview participant because of your knowledge of and involvement in the LBA





industry. This project is being undertaken through the Mitacs Accelerate program under the project “Rethinking Seafood Production: Developing Sustainable Communities With Land-Raised Fish.” The project is funded by Mitacs and Nanwakolas Council.

**Your participation is voluntary**

Your participation in this study is voluntary. You are under no obligation to participate in this study. If you decide to participate, you may still choose to withdraw from the study at any time without any negative consequences to the education, employment, or other services to which you are entitled or are presently receiving. If you decide to withdraw at any moment, any data from your interview with us will be immediately destroyed and will not be considered in our research project.

**If you decide to participate in the study**

We will be conducting a one hour interview with you by phone or at your place of employment. We will ask you some questions about the nature of your work and how you think LBA could contribute sustainable communities. For the sake of data collection, the researchers may record the audio from your interview (You may specifically refuse to consent to being recorded). Our research team will use interview data to develop a comprehensive picture of the state of LBA in British Columbia, and take this knowledge to specific community development projects.

**Are there any risks to participating?**

We do not think that anything in this study could cause you harm in any way. Even so, you do not have to answer a question if you do not want to. This study is one of ‘minimal risk’; the risks encountered will be at the same level or threshold as that one would expect to encounter in their everyday life.

**What will the benefits of this study?**

We do not think that there will be any direct benefits to you participating in this study. However, we expect that this study will help to advance the LBA industry in British Columbia towards a sustainable future.

**Will you receive anything for your participation?**

To thank you for your time, we will provide you with a 20\$ honorarium.

**How will your privacy be maintained?**

Your identity will not be disclosed as a part of this study. During the course of our data analysis, codes will be associated with the interview data. Strict confidentiality cannot be guaranteed as some comments could be linked back to individual interviews. Transcripts of interviews and audio files will be stored on a password-protected file within the research database at the Centre for Sustainable Community Development. These files will be deleted two years after the completion of the study.



### **Study Results**

The results of the study will be used in the Master's researchers' theses, and in any academic publications that follow from the theses. Input from interviews may be used to construct a Site Assessment Index to assess the feasibility of future community LBA projects.

### **Who can you contact if you have information about the study?**

Any questions about the study can be directed at any one of the researchers or their supervisor.

#### *Supervisor*

Mark Roseland [email provided]

#### *Students*

Jake Bastedo [emails provided]  
Jeff Lemon  
Elizabeth Mosier

*If you have any concerns about your rights as a research participant and/or your experiences while participating in this study, you may contact Dr. Jeffrey Toward, Director, Office of Research Ethics [...]@sfu.ca or 778-[...]*

### **Consent to Participate**

*Taking part in this study is entirely up to you. You have the right to refuse to participate in this study. If you decide to take part, you may choose to pull out of the study at any time without giving a reason and without any negative impact.*

- *Your signature below indicates that you have received a copy of this consent form for your own records.*
- *Your signature indicates that you consent to participate in this study.*
- *You do not waive any of your legal rights by participating in this study.*

**Having been asked to participate in the research study named above, I certify that I have read the procedures describing the study. I understand the procedures to be used in this study and the personal risks to me in taking part in the study as described above. I understand the contributions of my participation in this study and agree to participate. (See next page)**



<b>The participant and researcher shall fill in this area together. Please print legibly.</b>		Date (use format MM/DD/YYYY):
Participant Last Name:	Participant First Name:	
Participant Contact Information:		
Participant Email:		
Participant Signature:		
May the researcher contact you for additional information after the initial interview? Yes [ ] No [ ]		
May the researcher publish your name for the explicit purposes of this report or do you wish to remain anonymous? Yes – public [ ] No – anonymous [ ]		
May the researcher use the information learned from your interview for the explicit purposes of this report or would you prefer that it be kept confidential? Yes – use in report [ ] No – confidential [ ]		
May the information gained in the interview be used again, in a different study? Yes [ ] No [ ]		
Would you like a copy of the interview transcript or the final research results? <sup>[1]</sup> <sub>[SEP]</sub>		
Interview Transcript [ ]      Final Report [ ]      Both [ ]      Neither [ ]		

## **Appendix E.**

### **Meeting Group Primer**



## Rethinking Seafood Production: Developing Sustainable Communities with Land-Raised Fish

### Meeting Primer for Nov. 7, 2016 Working Group in Campbell River

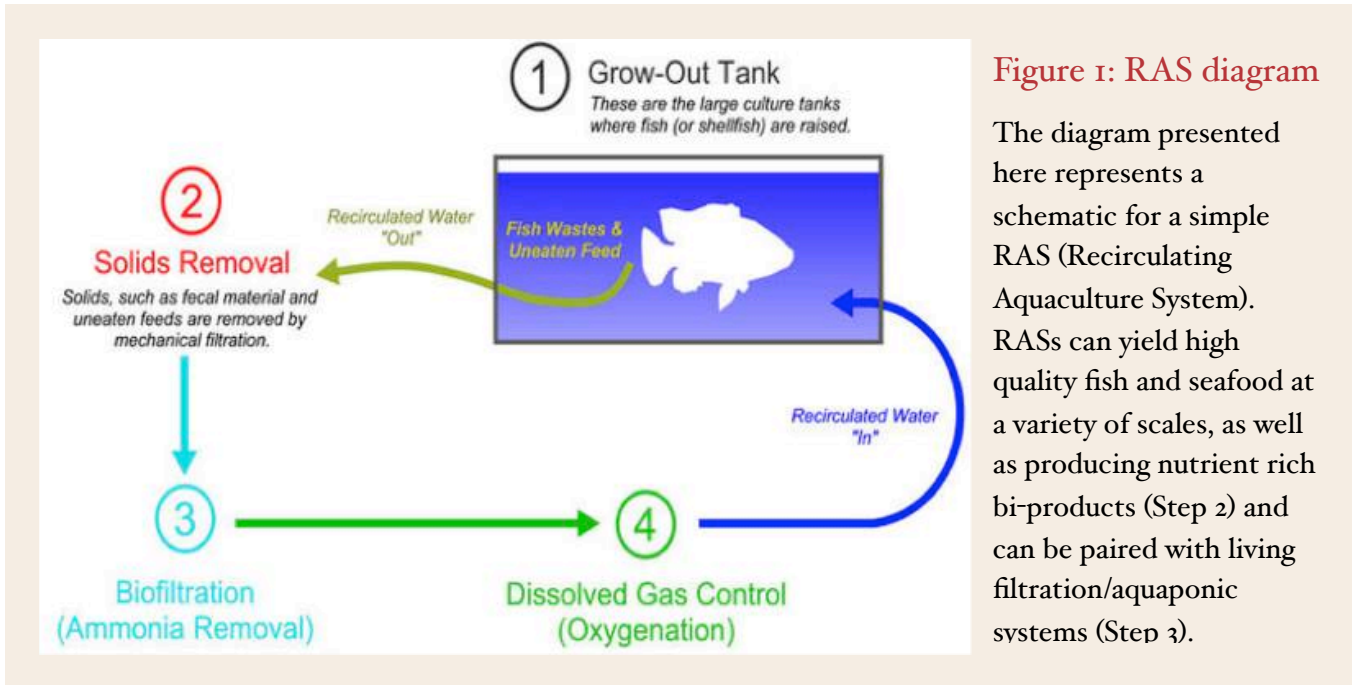
Around the world, aquaculture is gaining attention as a sustainable method of protein production in time of increased population pressure and compromised seafood stocks. Land-based Aquaculture (LBA) is unique in that it's closed contained nature isolates it from surrounding ecosystems and can be established in a range of locations. The leading technology for LBA is Recirculating Aquaculture Systems (RAS) in which up to 99.6% of water is treated and reused (see Figure 1). The primary research focus around this emerging method of seafood production has focused on technological and engineering issues and their environmental and ecological impacts. We at Simon Fraser University's Centre for Sustainable Development (CSD) noticed a lack in the consideration of the socio-economic impacts of this new technology and aimed to expand this area of research.

The Nanwakolas council expressed interest in learning about land-based aquaculture as development projects for their member nations. A partnership was established between the Nanwakolas and the CSD through Mitacs (a non-profit research federal research funding organization) to explore the possibilities of LBA development for member nations. We invite you to read the following pages as a primer for the meeting to take place on November 7. A brief synopsis of our research and observations will inform participants for dialogue sessions to discuss our research and next steps for the project. Enjoy!



### Project Plan

The research team set out to learn all they could about land based aquaculture and the aquaculture industry on Northern Vancouver Island by visiting Land-based Aquaculture operations and talking to facility operators, undertaking a literature review of current aquaculture practices and putting together a LBA scan for interesting facilities on a global scale. The SFU research team, with expert guidance from the Nanwakolas council, engaged with Member Nations through a project initiation meeting in June 2016 and followed up with formal research interviews with five representatives from Nanwakolas Member First Nations (NMFNs).



**Figure 1: RAS diagram**

The diagram presented here represents a schematic for a simple RAS (Recirculating Aquaculture System). RASs can yield high quality fish and seafood at a variety of scales, as well as producing nutrient rich bi-products (Step 2) and can be paired with living filtration/aquaponic systems (Step 3).

## Interviews with Representative from Member Nations

The research team interviewed five representatives from Member Nations and summarized the interview themes using NVivo analysis software. The team focused in on the three research themes of regulation and planning, food sovereignty, and business entrepreneurship.

### Regulation and Planning

Satisfying regulatory requirements and coordinating resources to implement aquaculture operations are critical factors in the development of aquaculture endeavours. With respect to regulation and policy, the most common themes discussed were DFO and process. DFO top down regulations and processes for acquiring licenses and fishing permits affected First Nation goals to maintain cultural and historical fishing grounds. In addition, the regulations and process affected First Nation's decisions related to cooperation and partnerships for aquaculture business opportunities; for example allowing fishing

tenures of large organizations, such as Marine Harvest, within traditional waters.

The major barriers for planning and implementation of projects discussed included costs and people. Costs are related to licensing processes such as ground-truthing and collecting information for the government agencies, and start up capital costs. When barriers were discussed in relation to people, the theme was centered on having people that are knowledgeable in aquaculture, willing to live and work in remote locations and feel that they are adequately compensated for their working conditions.

## Food Security

A variety of interest was expressed surrounding issues of food security in the communities of member nations'. Comments about the health impacts of western diets and around a lack of access to traditional food sources led to interesting discussions about what role an LBA system could play. Would a traditional food produced in a non-traditional way serve any purpose to the community? While land-based aquaculture is a food production method, a potential facility might not necessarily have a connection to food security. With several members, a discussion emerged between the potential conflict and balance between an LBA project being for economic returns or for community food; this spectrum is discussed in greater detail later on. Asserting rights to manage food resources within territories was mentioned by several members, and it seemed that an involvement in the aquaculture industry would help guide it towards sustainability. Members shared experiences of the aquaculture industry and expressed concern over the availability of seed supply as an impediment to successful farm operations.

## Business Entrepreneurship

All five interviewees noted that they see definite opportunities for council nations to work together in partnership and cooperation, for the betterment of their individual nations and the council as a whole. Strategic partnerships within both the production and processing sectors offer potential for diversification and vertical integration. With most of the interest in LBA surrounding various nodes of the food system value chain, namely developing a regional hatchery, expanding local processing, and producing a diversity of both finfish and shellfish species, the underlying importance for any potential enterprise is that it should focus on fostering the economic, social, ecological and cultural well-being of the member nations involved. Many of the discussions during the interview process concentrated around the dichotomy between an enterprise maximizing economic returns and producing traditional food sources (such as abalone) for the local community. Although a venture must be profitable, comments suggested that secondary and tertiary markets can offer flexibility in order to help remedy this division for the benefit of the community.



## Site Visits

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The research team visited several aquaculture facilities covering a range of species, business models and locations.

### Vancouver Island University

Vancouver Island University (VIU) in Nanaimo, British Columbia, operates the International Centre for Sturgeon Studies (ICSS), which brings together research activities at the regional, national and international levels for the preservation of white sturgeon. Through the ICSS, VIU has also created an aquaponics program; the combination of **aquaculture** and **hydroponics** (water-based plant production). Both systems run on a freshwater recirculation aquaculture system.



### Marine Harvest Canada

In 2015, Marine Harvest Canada (MHC) announced a \$40-million-dollar infrastructure investment at the company's hatchery facilities in Big Tree Creek and Dalrymple which are slated to be finished in 2017. Designed to raise parr and smolts (juvenile salmon prior to seawater entry), MHC's new RAS hatchery lines are reported to help cut down the marine grow out stage by about 6 months, while using about one-hundredth of the freshwater as a traditional flow-through aquaculture system.





## Little Cedar Falls



Little Cedar Falls is the first RAS facility to successfully reach continuous production with steelhead trout in Canada. Over 2 tonnes of fish are harvested each week, which reach markets across Vancouver Island the following day. In 2015, Little Cedar Falls won runner up at the Fish 2.0 Sustainable Seafood Business Competition held at Stanford University, for their sustainable business design - the entire aquafarm reuses 99.6% of its water inputs. The other .4% is recirculated through their aquaponics system where they grow vegetables and leafy greens by harvesting the natural wastes of the farm.

## You Grow Food Aquaponics

You Grow Food Aquaponics is a small social venture working to solve issues of local food security and economic development through education, capacity building, and public engagement. Two tanks house approximately 40 tilapia, which produces nutrient rich water for the more than 20 types of fresh herbs and greens they sell locally through a community supported agriculture (CSA) subscriptions. Additionally, they are working with Kwantlen Polytechnic University in Vancouver, to turn the excess ammonia rich water into an organic fertilizer to be sold to local farmers and gardeners as a secondary market.



## First Ontario Shrimp Farm

Similar to finfish and shellfish, crustaceans can do well in RAS systems; especially when compared to Asian counterparts grown in traditional net aquaculture. The ability to fully monitor the environment, feeding levels, and tank carrying capacity allow the shrimp to excel in terms of size and taste. As a testament to the excellence in product quality, First Ontario Shrimp Farm is currently selling almost half of their weekly output (approx. 50kg) directly to high-end restaurants across the Greater Toronto Area (GTA), before the product even leave the farm.

## Komoka Trout Farm

This is land-based aquaculture enterprise that is currently transitioning from a traditional raceway style of aquaculture to a RAS facility. The reason for switching to RAS aquaculture is that it offers the



opportunity of being easily ramped up whenever the operation wants to expand. Although the primary focus of the farm is tourism – where people from the surrounding area can come and catch their own fish to take home - trout are also grown for stream and pond restocking. During the off-season, full-grown stock are taken to a local processing facility for sale in local markets.

## Canada Banana Farm

The Canadian Banana Farm was visited because it demonstrates the potential secondary market for fish-based fertilizers (an output of RAS aquaculture). Using 100% fish-waste fertilizer taken from a local aquaculture facility, the farm grows a wide variety of fruits and vegetables, including: bananas, papaya, citrus (lemons/lime) & pineapple alongside with traditional crops, such as tomatoes, bell peppers, cucumber, squash, & potatoes. The farm's produce is not only larger and tastes better than anything found locally, but the use of aquaculture fertilizer allows for an organic certification by the Canadian Food Inspection Agency (CFIA), which offers a higher ROI, sometimes up to double, than non-organic products. Seeing how beneficial aquaculture fertilizer is to their operation, the farm will be adding an aquaponics facility as part of their expansion plans.



## The Range of Possibilities with LBA

The interviews and site visits demonstrated that there is an enormous range possibilities for the development of a land based aquaculture operation.

## Regulation and Planning

Regulation and licensing procedures become more arduous with the complexity of the project. Small backyard facilities for educational or individual food production require little licensing and regulation, while large scale commercial aquaculture facilities require significant regulating procedures. There

are many government regulations, acts and agencies involved in the management of wild and cultivated marine stocks including land based aquaculture. DFO is the federal lead for ensuring sustainable management of aquaculture activities under the Fisheries Act including where the provincial government is in charge of licensing. The regulating process becomes more complex with vertical integrations of business models, such as inclusion of a processing or hatchery facility.

## Food Security

With several members, a discussion emerged on the spectrum between consumption and commodification; on one hand an LBA project could entirely produce food for the community, where on the other had any seafood produced could be entirely marketed for economic gain to generate funds for community development. Our research on food systems suggests that there can be alternatives outside of this simple spectrum however, related to the integration of aquaponics or the use of system wastes as fertilizer. Furthermore, there is a diversity of species being cultivated with LBA/RAS systems around the world. Further discussions around species choice will need to include considerations of community taste/uptake if the intent is consumption, as well as markets and market prices if the intent is commodification. The research lenses of Community Food Security and Food Sovereignty could inform future advancements for the Nanwakolas and potential LBA ventures.

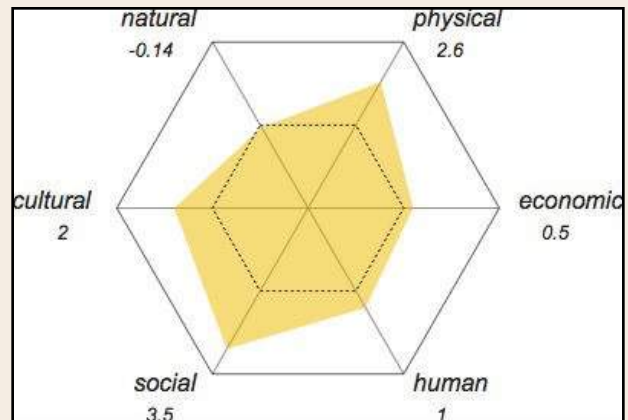
## Business Entrepreneurship

As the interview participants suggested, a viable business needs to be profitable. But what does that look like? Where traditional business would argue that profitability should be maximized no matter the cost; the social economy would contest that by working together, we can attain higher levels of economic development & social welfare for all those involved. As we look toward a better understanding of the potential and feasibility of land-based aquaculture, the lenses of regional and community economic development offer a way to balancing the view of traditional economic development with the interests of local and regional communities. The benefits of enabling the development of more vibrant and inclusive local economies extend beyond the opportunities of employment and short-term influxes of capital investment, to an increase in social cooperation and collaboration, a greater retention and recirculation of currency in the local economy, and a stronger resiliency to the boom and bust cycle of the global economy.

## Community Well Being Wheel and Community Capital Framework

In 2013, a working group orchestrated by the Nanwakolas set out to discuss Community Wellbeing with Nanwakolas Member First Nation (NMFN) representatives. In prioritizing wellbeing goals, participants were struck by how interconnected the goals were and proposed a wheel to illustrate this interconnectedness. As a possible research direction, we propose utilizing this the Community Wellbeing Wheel (CWBW) to represent NMFNs' community values and use the CWBW to narrow the range of proposed LBA possibilities.

SFU's Centre for Sustainable Development is familiar with the use of such tools. In particular, the SCD has developed a decision support tool called the Community Capital Framework (below), which itemizes six community capitals and allows decision makers to visualize how decisions might affect different community aspects. We propose that this knowledge could be adapted to guide the development of the CWBW beyond a set of ideals and into a robust decision-support tool by integrating measurable indicators. By applying this methodology to future LBA projects, we envision a tool that will guide development of LBA that is in line with the NMFNs' values.



## Proposed Project Next Steps

Our research so far suggests that because of the breadth of possibilities within LBA and the implications of decisions around scale, species, location, etc., a tool or framework to refine these possibilities based on the NMFNs' interests would be highly valuable. We envision a Community Site Assessment Toolbox (CSAT); a substantive decision support tool meant to help community leaders among the Nanwakolas Council who are interested in development of an LBA enterprise to better understand the feasibility of such a business venture. Made up of three distinct tools to determine project feasibility, the suite would identify the technical, social and organizational indicators needed to assess the risks and benefits of constructing a RAS facility within a community; including consideration of mechanical systems, energy requirements, human capacity, market analysis, and community infrastructure. The long-term value of the CSAT is to aid community leaders who are interested in developing competitive businesses and cultivating community resiliency through Sustainable Community Development practices.

The toolbox would be comprised of three separate modules: the Community Site Index, a technical site feasibility assessment, and a business feasibility study. Brief descriptions of each of the proposed modules are below:

<b>The Community Site Index</b>	<b>Technical Checklist</b>	<b>Business Study</b>
<p>The Community Site Index, will be utilized by community leaders to gauge the long-term effects a prospective RAS facility could have on their community, in terms of the economic, environmental, and social impacts. By integrating the measurable indicators offered by the CCF with the well-being goals from the CWBW, the Community Site Index will be a rigorous decision-support tool for NMFNs.</p>	<p>The technical site feasibility assessment is a technical checklist developed by the Freshwater Institute that includes resource input and technical requirements for LBA projects. The Freshwater Institute specializes in the production technology and design of aquaculture systems and shares latest technological advancements through publications and targeted workshops.</p>	<p>A business study will be developed to help community leaders to better understand the underlying factors that could lead to the success or failure of a business idea. By analyzing the strengths, weaknesses, opportunities and threats of a potential RAS aquaculture venture, a community leader will be able to assess the viability of the market and proposed location prior to investing any time and money into its development.</p>

Our aim is to use our time with you on November 7 to better understand if and how such a decision support tool would be useful to the Nanwakolas Council.

## Working Group Meeting

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On November 7, 2016, community members and stakeholders of the Nanwakolas Council will come together to discuss what we've learned about land based aquaculture as an industry and from members of the Nanwakolas Council. The goals of the Working Group are:

- Present findings of industry wide land based aquaculture scan of available technologies
- Present stories from site visits of operating land based aquaculture facilities
- Present and discuss what was heard from interviews about aquaculture from member nation representatives
- Dialogue on the spectrum of possibilities within the research themes: regulation and planning, food, business development
- Dialogue on what a useful tool for aquaculture development provides

We look forward to working with you on November 7 and exploring Land-based Aquaculture together. If you have any questions, please feel free to contact Chris Roberts ([chrisroberts@nanwakolas.com](mailto:chrisroberts@nanwakolas.com)) or any member of the research team: Liz [emosier@sfu.ca](mailto:emosier@sfu.ca), Jeff [jdl3@sfu.ca](mailto:jdl3@sfu.ca), or Jake [jbastedo@sfu.ca](mailto:jbastedo@sfu.ca).