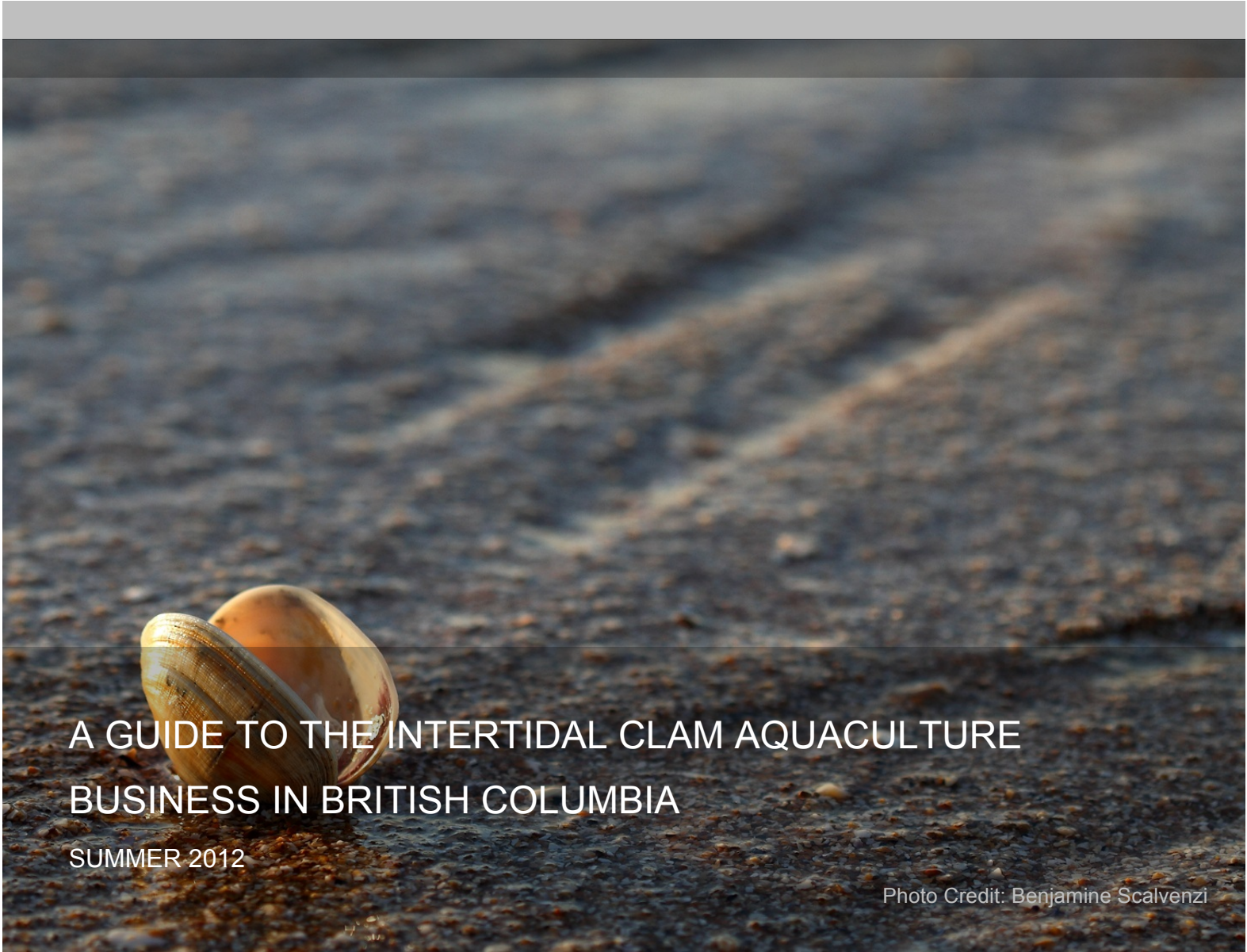




A GUIDE TO THE INTERTIDAL CLAM AQUACULTURE BUSINESS IN BRITISH COLUMBIA

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Photo Credit: Benjamine Scalvenzi

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In partnership with the Nanwakolas Council



Opening Worlds

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1.0 INTRODUCTION

For millennia, intertidal clam aquaculture has taken place along British Columbia's coastline. Well before European settlement, First Nations along the coast developed intertidal clam gardens to provide a sustainable food source for their communities. In more recent times, clam aquaculture and wild clam harvesting has become a multi-million dollar business for international, Canadian and First Nation owned corporations in British Columbia.

The intertidal clam aquaculture industry in British Columbia is growing, in 2010 production increased by 15% over the previous year.¹ Despite this increase, supply is not keeping up with consumer demand in both North America and abroad. Hence, there is opportunity for new entrants into the clam farming industry. In order to ensure a successful shellfish operation, prospective shellfish aquaculturalists in British Columbia need to be aware of the dynamics of the industry, the species involved, and capacity requirements.

The purpose of this report is to provide an overview of the intertidal clam industry for prospective aquaculturalists.



Intertidal area of Village Island, B.C.

Photo Credit: Jeff Svanhill

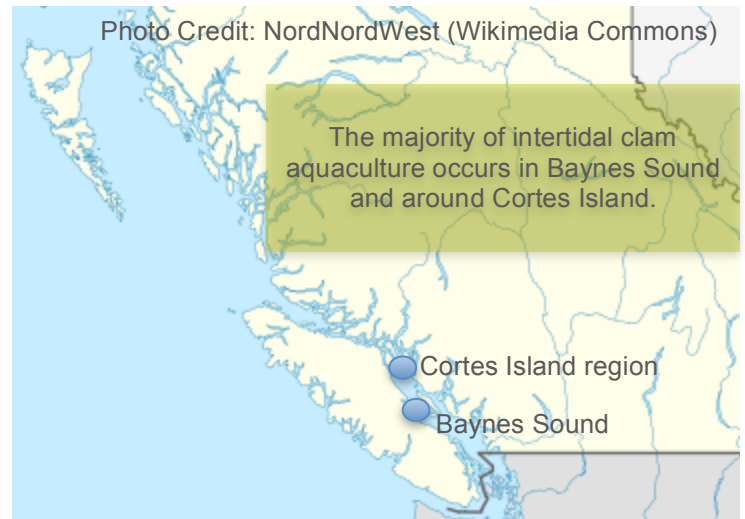
¹ BC Ministry of Agriculture. (2011). 2010 Year in Review: British Columbia Seafood Industry. Victoria.

2.0 OVERVIEW OF INTERTIDAL CLAM AQUACULTURE IN BRITISH COLUMBIA

The rich waters of the coast of British Columbia provide excellent opportunity for individuals and corporations to participate in intertidal clam aquaculture. An analysis of this opportunity follows.

2.1 LOCATION

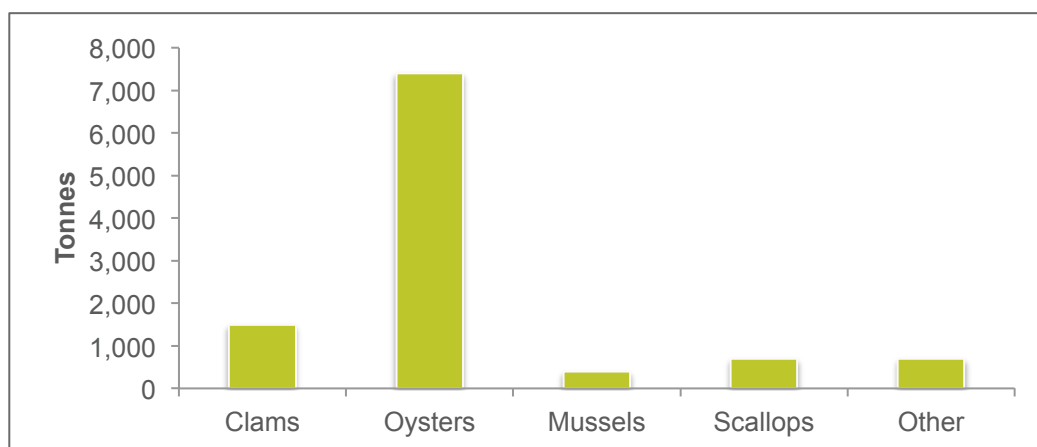
The shellfish industry is located along the coast of British Columbia. There are distinct differences in commercial shellfish aquaculture activity from south to north. The majority of clam aquaculture occurs south of Campbell River on the east coast of Vancouver Island where water temperatures are warm enough to support Manila clam growth.



2.2 INDUSTRY AND MARKET OPPORTUNITIES

In 2010, approximately 2,200 tonnes of clams were commercially harvested in British Columbia with a total farmgate value of \$8.1 million. As indicated in Figure 1, clams follow well behind oysters as the most cultured shellfish in the province. The predominant clams harvested for market are Manila clams.²

Figure 1 – Cultured Shellfish Production in British Columbia in 2010³



² Province of BC. (2011). Shellfish Aquaculture in British Columbia. Retrieved June 25, 2012, from Aquaculture Statistics: <http://www.env.gov.bc.ca/omfd/fishstats/aqua/shellfish.html>

³ Fisheries and Oceans Canada. (2012). Production Quantities and Values. Retrieved June 25, 2012, from Aquaculture: <http://www.dfo-mpo.gc.ca/stats/aqua/aqua10-eng.htm>

CAPTURED VS CULTURED

Cultured clam harvests in BC are more than double the province's wild clam harvests. In 2010, of the 2,200 tonnes of clams commercially harvested, 1,500 tonnes were harvested from aquaculture operations as opposed to 700 tonnes from wild capture. In fact, cultured clam harvests are growing at about 15% per year, while wild clam harvests have decreased by about 12%. Additionally, the total wholesale value of cultured clams was approximately four times greater than commercially captured wild clams in 2010. This is due to the fact that cultured clams are high value, non-native Manila clams while wild, native clams have much less value in the market.⁴

DEMAND AND PRICING

The market demand for intertidal clams is quite robust with demand outstripping supply. The landed value and wholesale value⁵ of clams has increased for cultured shellfish in particular. Pricing of intertidal shellfish depends on market demand and supply from shellfish harvesters. Prices of Manila clams fluctuate year on year. According to the latest data, the average farmgate price⁶ of Manila clams has been \$2.15 from 2005 to 2010. Mac's Oysters in Fanny Bay currently pays \$1.55 for Manila clams.^{7,8}

CUSTOMERS

Almost all of the shellfish produced in BC is exported, with the U.S. being the number one market. Pentlatch Seafoods in Courtney, for example, exports 95% of its clams to the East Coast of the United States and California. After the U.S., Asia is the largest importer of BC seafood, with Japan, China, and Hong Kong leading the Asian continent. Consumers prefer to purchase clams live or frozen in the shell.^{9,10}

COMPETITION

The intertidal shellfish industry is highly fragmented with many individual growers. In BC, there are currently 40 commercial intertidal clam growers registered with the BC Shellfish Growers Association (BCSGA). Much of the production takes place in Baynes Sound, with processing undertaken by five companies on Vancouver Island and two in the Vancouver area. According to the BCSGA, the majority of clam seed is imported from Hawaii and Washington State.¹¹

For prospective aquaculturalists, a secure seed supply is essential to be competitive. Hatcheries are having difficulty keeping up with demand for seed as the industry continues to expand. Hatcheries are also seeing increased mortality

⁴ BC Ministry of Agriculture. (2011). 2010 Year in Review: British Columbia Seafood Industry. Victoria.

⁵ Landed value is the price paid by wholesalers for fish harvested. Wholesale value is the price wholesalers charge retailers for fish.

⁶ The price of the product when sold by the farm (landed value).

⁷ BC Ministry of Environment (2012). British Columbia Aquaculture Farmgate Prices. Retrieved August 23, 2012, from Aquaculture Statistics: <http://www.env.gov.bc.ca/omfd/fishstats/aqua/prices.html>

⁸ Kew, S. (2012, July 19). Office Manager at Mac's Oysters. (J. Svanhill, Interviewer)

⁹ Hardy, R. (2012, August 14). General Manager at Pentlatch Seafoods. (J. Svanhill, Interviewer)

¹⁰ BC Ministry of Agriculture. (2011). 2010 Year in Review: British Columbia Seafood Industry. Victoria.

¹¹ Wright, M. (2012, July 10). Communications Manager at BCSGA. (J. Svanhill, Interviewer)

rates in larvae due to rising ocean acidification.¹² In fact, consolidation of the intertidal aquaculture industry is possible in the coming years as internal demand for seed by large vertically integrated companies, such as Taylor Shellfish Farms in Washington State, reduces the seed available to small farmers.^{13,14}

PROFITABILITY

The profitability of an intertidal clam operation will largely depend on the characteristics and market price of the species grown. The initial capital investment is relatively small for all species, with seed being the largest investment. The market price (landed value) for Manila clams, for example, is quite high (\$1.55 per pound) compared to native butter clams (\$0.55 per pound). The market prices for Manila clams and butter clams have remained stable over recent years; however, native littleneck clams have seen their market price reduce significantly in recent years from \$1.50 per pound in 2010 to \$1.00 in 2012.^{15,16}

2.3 SPECIES SELECTION

The British Columbia coast is home to a number of native clam species. Native species include littleneck clams (*Protothaca staminea*), butter clams (*Saxidomus gigantea*), razor clams (*Siliqua patula*), sand clams (*Macoma secta*), soft-shell clams (*Mya arenaria*), and nuttall cockles (*Clinocardium nuttallii*). In addition to native species, there are two common invasive species. The Manila clam (*Venerupis philippinarum*) was brought over from Asia in the 1930's, and the varnish clam (*Nuttallia obscurata*) was introduced to British Columbia in the 1980's.

Native species are found in both the northern and southern waters of BC's coast. However, Manila clams are generally not found north of Campbell River, which is likely due to the colder water temperatures of central and northern BC.

Seed security is critical for any aquaculture project. Manila clam seed is available locally from three hatcheries in British Columbia and a few hatcheries in Washington State and Hawaii. A list of hatcheries is included in Appendix B. Seed for cockles are being produced by Vancouver Island University's Deep Bay Marine Field Station for research, but there is no seed production for other native species. Seed orders are normally made in the fall for spring planting.

A summary of clam species is given in Figure 2.

¹² Welch, C. (2012, June 21). Willapa Bay oyster grower sounds alarm, starts hatchery in Hawaii. The Seattle Times. http://seattletimes.nwsources.com/html/localnews/2018496037_oysters22m.html

¹³ Leask, et. al. (2008). Feasibility of a Shared Shellfish Hatchery for the BC Shellfish Aquaculture Industry. Vancouver Island University: pg. 1.

¹⁴ Tutte, R. (2012, August 13). Sales Manager at Aquatec Seafoods. (J. Svanhill, Interviewer)

¹⁵ Hardy, R. (2012, August 14). General Manager at Pentlatch Seafoods. (J. Svanhill, Interviewer)

¹⁶ Kew, S. (2012, July 18). Office Manager at Mac's Oysters. (J. Svanhill, Interviewer)

Figure 2 – Summary of Intertidal Clam Species in British Columbia

COMMON NAME	SCIENTIFIC NAME	COMMERCIAL POTENTIAL	SEED AVAILABILITY	PRICE PER POUND (2012) ¹⁷	TIME TO HARVEST	NOTES
Butter Clam	<i>Saxidomus gigantea</i>	First Nations, local market, and for crab bait	None	0.55	3 years	- Propensity to hold PSP in siphon - Short shelf life
Littleneck Clam	<i>Protothaca staminea</i>	First Nations, local market, substitute for Manila clams during red tide	None	1.00 ~ 1.15	3 years	Short shelf life
Manila Clam	<i>Venerupis philippinarum</i>	High value for export	Taylor Shellfish Farms in Washington State or WenLian Aquaculture in Courtenay	1.55	2-4 years	- Invasive species - Generally not found north of Campbell River
Cockle	<i>Clinocardium nuttallii</i>	Undeveloped; excellent potential	VIU	-	2-4 years	- Excellent results from VIU's off-bottom experiment - Short shelf life
Varnish Clam	<i>Nuttallia obscurata</i>	Local market	None	1.10	4 years	- Invasive species - DFO is testing Varnish clam aquaculture
Razor Clam	<i>Siliqua patula</i>	Undeveloped	None	-	2-4 years	- Found on west coast of Vancouver Island and Haida Gwaii - Razor clam aquaculture testing being done by DFO and the Haida First Nation.
Sand Clam	<i>Macoma secta</i>	None	-	-	-	-
Soft-shell Clam	<i>Mya arenaria</i>	None	-	-	-	-

2.4 CAPACITY DEVELOPMENT

In order to start and sustain a successful intertidal clam operation, operators will need to have a capable General Manager and a reliable crew to maintain and harvest the operation.

GENERAL MANAGER

The most important role in the development of the aquaculture business will be that of the General Manager (GM). The GM needs to have passion for clam farming, as long hours are required to manage every aspect of the business. Some of the GM's responsibilities include making a strategic plan for the business, making connections with industry partners, applying for funding, arranging for equipment and seed, and hiring supervisors and crew.

¹⁷ Prices are as quoted from processors who purchase clams from harvesters.

SUPERVISORS AND CREW

Supervisors and crew members will be needed to seed the beaches, monitor the grow-out, maintain predator defenses, and harvest the product. The number of supervisors and crew members needed depends on the size of the operation. As an example, a farm with seventy hectares of intertidal space could have a crew of three supervisors and fifteen harvesters.¹⁸

Supervisors generally make \$14.50¹⁹ per hour, working 40 hours per week. Clam harvesters can either be paid per hour or by pounds of clams harvested. Hourly wages for clam harvesters are \$11.50 and piecemeal harvesters can make up to \$27.00 per hour.²⁰

TRAINING

Training for intertidal clam aquaculture will be needed for crew members to learn how to properly maintain a clam beach and harvest the clams. Since much of the work on clam beaches is manual labour, crew members will need minimal training to ensure the work is being done in the most efficient manner. Supervisors will require more training to correctly maintain the clam beaches.

TRAINING PROVIDERS

Vancouver Island University (VIU) has a number of shellfish aquaculture courses for managers, supervisors, and crew. They can also provide customized on-site training upon request. VIU is also able to train potential aquaculturalists at their Deep Bay Marine Field Station. First Nations could also work with the Aboriginal Aquaculture Association (AAA) to organize aquaculture training programs for band members.

2.5 TENURE AND LICENSING

Tenure and licensing applications are filed through the Department of Fisheries and Oceans (DFO). Obtaining tenure and licensing will allow farmers to mark beaches that are to be used solely for their benefit and allow processors to legally buy and distribute clam harvests. For any sites fronting reserve land, special arrangements can be made with the Ministry of Forests, Lands, and Natural Resource Operations and DFO to streamline the tenure and licensing process for sites requested by First Nations. Consultation with FrontCounter BC²¹ will be required to determine the on-reserve/off-reserve status of the beaches being considered for development.²²

In order to obtain tenure for a beach, a site plan and management plan need to be completed and submitted to the Ministry of Forests, Lands and Natural Resource Operations through FrontCounter BC. Forms and assistance can be

¹⁸ Hardy, R. (2012, August 14). General Manager at Pentlatch Seafoods. (J. Svanhill, Interviewer)

¹⁹ Working in Canada: National Occupation Classification (NOC) 2221 – Aquaculture Technician, Vancouver Island and Coast Region.

²⁰ Working in Canada: National Occupation Classification (NOC) 8613 – Shellfish Harvester, Vancouver Island and Coast Region.

²¹ FrontCounter BC assists businesses with tenure and licensing applications in the natural resource sector.

<http://www.frontcounterbc.gov.bc.ca/>

²² Fogtmann, D. (2012 July 10). Intertidal Shellfish Manager at DFO. (J. Svanhill, Interviewer)

obtained from FrontCounter BC and more information can be found from the Department of Fisheries and Oceans.²³ The requirements of each plan are summarized in Figure 3.

Figure 3 – Tenure Application Requirements

SITE PLAN	MANAGEMENT PLAN
• Map of the area applied for • Legal description of the area including exact geographic coordinates • Indication of surface structures • Outline of area to be used for aquaculture and changes to be made	• Project overview • Project description • Environmental Assessment ○ Land impact ○ Atmospheric impact ○ Aquatic impact • Socio-economic Assessment

2.6 SEEDING AND HARVESTING

Seeds can be ordered from a hatchery at various sizes; the smaller the seed, the lower the cost. If small seeds or “spat” (1~2 mm) are ordered, the spat will need to either be reared intertidally in mesh bags and trays or boosted in a nursery to a size of up to 20 mm.

Spat can be placed in mesh bags with holes large enough to allow seawater to flow through, but small enough to not allow spat to escape. The bags are then placed onto trays which are stacked along the intertidal zone.

A nursery suspends the small seed in an upweller system that draws seawater through a container holding the clam seed. The upweller can either be on land in tanks or floating off-shore (FLUPSY²⁴). A FLUPSY is preferred because larger volumes of seed can be added to the system. Large operators have their own upweller system, which has high capital costs due to the need for tanks and water pumps (on-shore) or a floating raft system (FLUPSY). Farmers need to consider the costs and benefits of buying small seeds and transferring them to a nursery as more handling is required, leading to increased mortality rates.



Once the seed grows to 5~20 mm in length in the nursery, it is sprinkled on the beach at recommended densities by hand. Once the clams hit the sand, they take hold and bury themselves into the substrate. Seeding generally occurs in the spring to take advantage of the summer growing season, and is avoided in the fall due to higher seed mortality.²⁵ Harvesting of intertidal clams is usually carried out using rakes, shovels, and by hand. Machines, however, are becoming more commonly used by larger farms on beaches with a sandy substrate. Clams are traditionally harvested

²³ Shellfish Aquaculture Licencing in the Pacific Region: <http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/shell-coq-eng.htm>

²⁴ Floating Upweller System.

²⁵ Toba, D. (2005). Small-Scale Clam Farming for Pleasure and Profit in Washington. The University of Washington, Seattle.

from late October to March when tides are low enough to expose the intertidal zone. During the summer months beaches are open for Manila clam harvests, but may be closed at times if water quality testing determines the possibility of paralytic shellfish poisoning (PSP).

2.7 PROCESSING

Harvested clams are required by the Canadian Food Inspection Agency to go through a licensed processor for distribution. Processing of clams involves washing, bagging, weighing and packing. Depending on water quality, clams may have to be soaked in clean water to remove undesirable particulates.²⁶

The clams must then be processed at a facility approved by the Canadian Food Inspection Agency. There are a dozen licensed processors in BC that process Manila clams, but only a few process native clam species. Fanny Bay and the Pacific Northwest Shellfish Company purchase littlenecks, while Albion Fisheries and Mac's Oysters process butter clams. In order to maintain freshness, a facility in close proximity to the harvest site is desirable (refer to Appendix B for a full list of processors and locations). Cost for processing depends on the extent of processing required, volume of clams to be processed, and contracts with farmers.

2.8 MARKETING

The markets for Manila clams are well developed, with clams being sold to wholesalers (Appendix C) or direct to restaurants and supermarkets. On the other hand, the markets for native clam species are limited to local consumers. For native species, some processors, such as Mac's Oysters and the Pacific Northwest Shellfish Company buy littleneck and butter clams directly from harvesters and sell them to the local market.

In order to give consumers confidence that clams have been produced in an environmentally sustainable and socially responsible way, potential farmers should consider branding their product with the Vancouver Aquarium's Ocean Wise seal or the Aboriginal Aquaculture Association's Aboriginal Certification. Ocean Wise ensures seafood is harvested in a sustainable way. Shellfish grown in deep-water is considered sustainable. To determine the sustainability of a business's intertidal aquaculture operation, an assessment needs to be done by the Vancouver Aquarium. Aboriginal Certification requires an aquaculture business to engage with affected First Nations in close proximity to the proposed farm location. The affected First Nations then have an opportunity to create a Sustainability Plan that ensures dialogue with affected First Nations and upholds First Nations values.

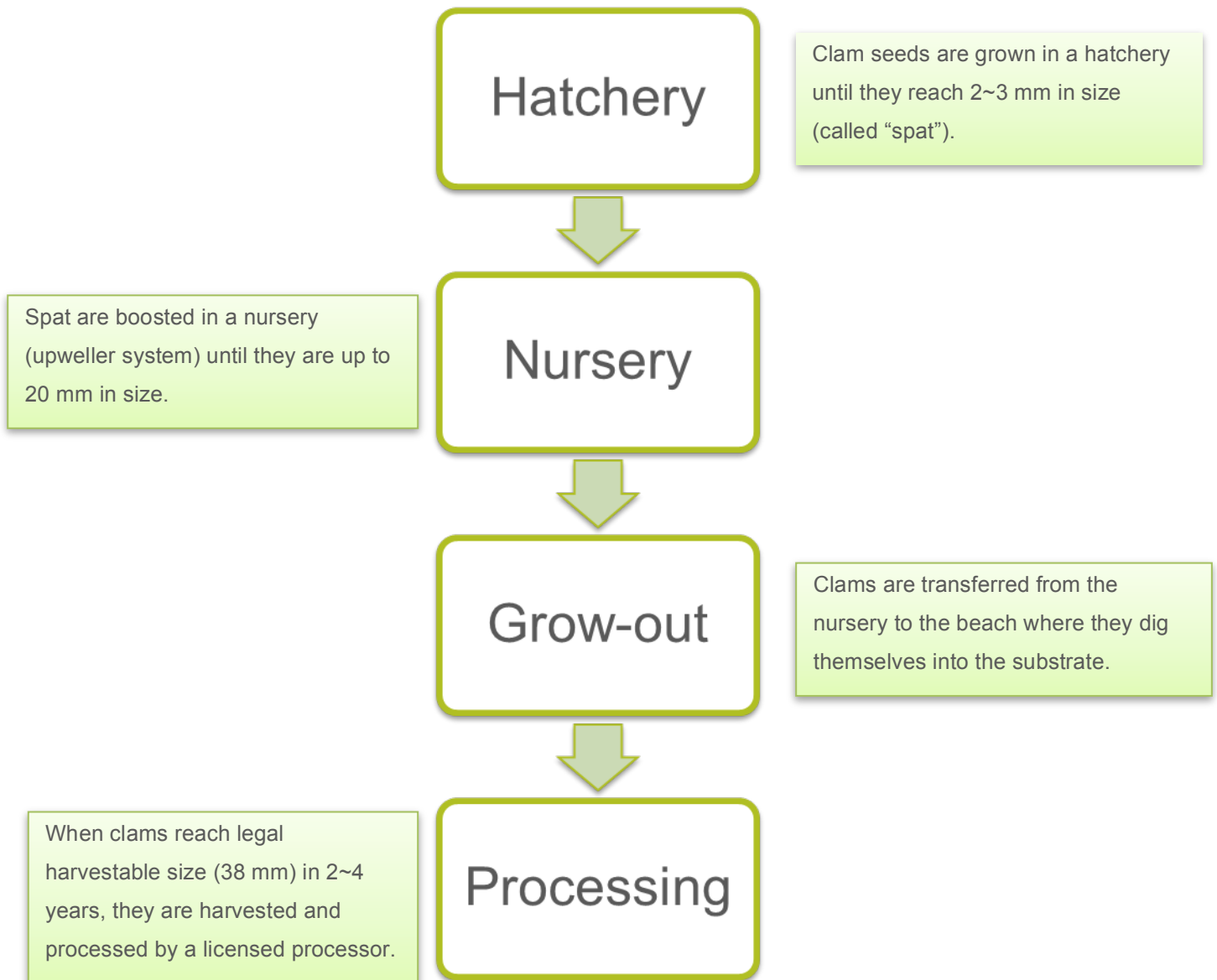
²⁶ This process is also known as depuration.

3.0 CONCLUSION

Intertidal clam farming is an attractive industry due to both the high market demand for clams and its low capital requirements. However, it is important to recognize that clam aquaculture is not easy. There are significant challenges with seed security for all operators and securing tenure for non-First Nations operators. In addition, having a strong General Manager acting as an aquaculture champion, as well as a pool of dedicated crew members, is critical to the sustainability of the business. Finally, it is important to note the inherent risks of clam farming. Red tide and increased mortality rates due to changing ocean conditions are significant threats to annual production volumes. Farmers can hedge against these risks by diversifying into deep water aquaculture with other species, such as oysters, but this would require different equipment and skill sets.

All in all, with thorough strategic planning, determination and a passion for aquaculture, a potential shellfish farm can take advantage of the tremendous market opportunities in North America and beyond.

APPENDIX A: INDUSTRY COMPONENTS



APPENDIX B: CLAM HATCHERIES AND PROCESSORS

HATCHERY	LOCATION
Innovative Aquaculture Products	Lasqueti Island, BC
Island Scallops	Qualicum Beach, BC
WenLian Aquaculture Company	Courtenay, BC
Taylor Shellfish Farms	Washington State
Coast Seafoods Company	Washington State & Hawaii
Lummi Shellfish Hatchery	Washington State

PROCESSOR	LOCATION	CLAMS PROCESSED
Albion Fisheries	Vancouver, BC	Manila clams, butter clams
Evening Cove Oysters	Nanaimo, BC	Manila clams
Fanny Bay Oysters	Fanny Bay, BC	Manila clams, littleneck clams
Mac's Oysters	Fanny Bay, BC	Manila clams, butter clams
Pacific Northwest Shellfish Company	Richmond, BC	Manila clams, littleneck clams
Stellar Bay Shellfish	Bowser, BC	Manila clams
Walcan Seafoods	Quadra Island, BC	Any clam (weighing and packaging only)

APPENDIX C: SEAFOOD WHOLESALERS IN BC

WHOLESALER	LOCATION
Sea World Fisheries	Vancouver
M T Processor Co	Vancouver
Aero Trading Co	Vancouver
Pacific Rim Shellfish Corp	Vancouver
Isobar Pacific Packers	Vancouver
Mac's Oysters	Vancouver
Sung Fish	Vancouver
Lions Gate Fisheries	Delta
Frobisher International Enterprises	Delta
Blundell Seafoods	Richmond
Clear Bay Fisheries	Richmond
Seven Seas Fish Co	Richmond
Wah Loong	Richmond
Yamazaki Enterprise	Richmond
Steveston Seafood Auction	Richmond
Pacific Food	Richmond
Good Harvest Seafood	Richmond
Kenji Seafood	Richmond
Canadian Pacific Seafood	Richmond
Pacific Northwest Shellfish Co	Richmond
Nor-Van Seafood	Richmond
Cap'n Fisher Seafood	Richmond
Hasco Seafoods	Richmond