PACIFIC REGION

SHELLFISH

INTEGRATED MANAGEMENT OF AQUACULTURE PLAN

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Fisheries and Oceans Canada
Pêches et Océans Canada
Canada

This Management Plan is intended for general purposes only.
Where there is a discrepancy between the Management Plan and the regulations, the regulations are the final authority.

FOREWORD

The purpose of the shellfish Integrated Management of Aquaculture Plan (SF-IMAP) is to identify the main objectives and requirements for the management of shellfish aquaculture in British Columbia, as well as the management measures that will be used to meet these objectives. The document serves to communicate basic information about shellfish aquaculture and its management to federal and provincial agencies, local government, industry, First Nations, stakeholders, and the public.

The SF-IMAP will be reviewed every two years in order to ensure it is current and to incorporate changes in the management approach as required (e.g. new scientific or other information, adoption of management tools, policies or approaches, and changing dynamics in the sector).

The SF-IMAP is not a legally binding instrument which can form the basis of a legal challenge. The SF-IMAP can be modified at any time and does not fetter the discretionary powers of the Minister of Fisheries and Oceans as set out in the *Fisheries Act, Species at Risk Act,* and the *Oceans Act;* as well as the *Fishery (General) Regulations* or the *Pacific Aquaculture Regulations.* The Minister can, for reasons of conservation or for any other valid reasons, at any time modify any provision of the SF-IMAP in accordance with the powers granted pursuant to the *Fisheries Act,* the *Oceans Act, or the Species at Risk Act* and supporting regulations.

Where Fisheries and Oceans Canada is responsible for implementing obligations under land claim agreements, the SF-IMAP will be implemented in a manner consistent with these obligations. In the event that an SF-IMAP is inconsistent with obligations under land claims agreements, the provisions of the land claims agreements will prevail to the extent of the inconsistency.

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DEPARTMENTAL CONTACTS

Aquaculture Resource Management

Regional Manager	March Klaver	250-754-0334
Senior Aquaculture Mgmt Coord. - IMAPs	Brenda McCorquodale	250-949-6434
Senior Aquaculture Mgmt Coord. - Shellfish	Jennifer Mollins	250-754-0394
Senior Aquaculture Mgmt Coord. - First Nations	Todd Johansson	250-902-2683

Aquaculture Environmental Operations

Regional Manager	Gary Taccogna	250-286-5817
A/Senior Shellfish Biologist	Steve Schut	250-703-0914

Aquaculture Programs

Regional Manager	Corey Jackson	604-658-8379

Conservation and Protection

Chief	Brian Atagi	250-754-0367
Detachment Supervisor	Denver Marraty	250-286-5816

BC Aquaculture Resource Management Program

Director	Diana Trager	604-666-7009

Reporting Violations Observe, Record and Report (Enforcement Line)

1-800-465-4336

1. BACKGROUND AND OVERVIEW OF THE SECTOR

1.1 Background

In December 2010, the Government of Canada assumed primary responsibility for the regulation and management of aquaculture in British Columbia (BC). As the lead federal agency, Fisheries and Oceans Canada (DFO, the Department) is responsible for regulating, monitoring and licensing all shellfish aquaculture operations in the province.

In order to carry out these responsibilities, the *Pacific Aquaculture Regulations* (http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-270/) were developed under the *Fisheries Act* to govern the management and regulation of the aquaculture industry in BC. The regulations aim to ensure that aquaculture in BC is operated in a sustainable manner so that the marine environment is protected for future generations. The Department also established the British Columbia Aquaculture Regulatory Program (BCARP) to support implementation of the regulations and day-to-day management of the sector.

While the DFO is the lead federal authority, other federal departments and provincial agencies also have roles in the managing and regulating various aspects of aquaculture in BC. For example, Transport Canada is responsible for reviewing applications with respect to the protection of navigable waters and the Canadian Food Inspection Agency has jurisdiction related to aspects of shellfish sanitation, fish health and processing.

The Province of British Columbia remains responsible for authorizing the occupation of provincial aquatic Crown land associated with aquaculture operations. Aquatic Crown land refers to land below the visible high tide water mark of a body of water, extending offshore to the recognized limit of provincial jurisdiction, including the foreshore. In some cases zoning, administered by local governments, also applies in marine and foreshore areas.

Under the *Pacific Aquaculture Regulations* aquaculture is defined as “the cultivation of fish.” The shellfish Integrated Management of Aquaculture Plan (SF-IMAP) is concerned with the cultivation of any shellfish within a marine environment, including the foreshore, intertidal, and deep water (suspended or on the ocean floor) areas. Shellfish are considered cultivated when there is human intervention in the rearing process to enhance production, such as regular seeding or stocking, feeding, or protection from predators. Cultivation also implies individual or corporate ownership, control, and responsibility for the stock being cultivated. The shellfish IMAP includes aspects related to the culture of molluscs, crustaceans, and echinoderms, but not algae or marine plants.

The SF-IMAP outlines the management framework for shellfish aquaculture in BC in marine waters. In some cases, where more than one culture method is used, the process of culturing shellfish throughout a life cycle may fall under more than one IMAP (e.g. shellfish and freshwater/land-based). This includes the situation where shellfish may be spawned and reared for some time in land-based hatcheries prior to being transferred to the marine environment at some stage of their life cycle.

Consistent with DFO’s management of other fisheries, the Department has established advisory processes to support the development of IMAPs, as well as broaden engagement with First Nations, industry and stakeholders regarding the management of aquaculture in BC. The Shellfish Aquaculture Management Advisory Committee (SF-AMAC) is comprised of First

Nations, shellfish aquaculture licence-holders, industry associations, environmental interests and local government. DFO and the Province of British Columbia are ex-officio participants in the advisory process. The Terms of Reference for the SF-AMAC, along with contact information and a schedule of meetings, are available on the DFO Pacific Region consultations webpage (http://www.pac.dfo-mpo.gc.ca/consultation/index-eng.html). Meetings of the SF-AMAC are open to the general public.

The SF-AMAC reviews the SF-IMAP on a regular basis and provides advice and recommendations to DFO with respect to the management of shellfish aquaculture in BC. In addition to the SF-AMAC process, the Department consults with a range of various interests and sectors. DFO also undertakes bilateral consultation with First Nations and works with First Nation organizations such as the First Nations Fisheries Council and others to engage First Nations in the management of aquaculture in BC.

1.2 Sector Overview

The shellfish aquaculture sector has a long history in BC. Shellfish aquaculture sites span the geography of BC's coast and include a variety of species and culture methods. The shellfish aquaculture industry provides employment and a variety of economic opportunities ranging from smaller, family-owned operations to larger, corporate entities with a variety of aquaculture sites and processing capacity. In recent years, an increasing number of First Nations have also engaged in shellfish aquaculture.

1.2.1 Background and Sector History

Marine species have been cultivated in BC for many years. For example, there is evidence related to the historical use of clam beds by First Nations dating back hundreds (or in some cases thousands) of years.

In BC the origins of commercial shellfish aquaculture date back to the introduction of the Pacific oyster from Asia in 1912. The organized importation of oyster seed began during the early 1930s, with these oysters becoming naturally established in areas such as Ladysmith Harbour and Pendrell Sound. While the first commercial oyster farms appeared around this time, it was not until the 1950s when a true "industry" developed, including the local collection of wild seed/spat.

Manila clams were inadvertently introduced to the province along with oyster seed in the 1930s. These clams spread quickly in the wild; however, focused cultivation of manila clams did not begin until the mid-1980s with the increase in market demand and improvements in culture techniques.

DFO and the Province of BC approved the introduction of the Japanese scallop in the 1980s. Since then, other species of scallops, clams, oysters, mussels, and more recently, geoduck clams have joined the list of species cultivated on a commercial basis BC.

1.2.2 Industry Structure

The shellfish aquaculture industry in BC is comprised of less than 300 producers. Unlike marine finfish aquaculture, the majority of shellfish operations are small, family-run business. However, in recent years, larger and more diversified have emerged and the number of active producers has declined slightly.

The majority of shellfish aquaculture licensees focus on the grow-out phase of the aquaculture cycle, purchasing their seed/spat from hatcheries and selling grown animals to processors for final production (cleaning, grading, shucking, packing, etc.) and marketing.[1] There are approximately 40 companies currently processing shellfish products, a quarter of which sell internationally. Most shellfish processors are small operations that supply local markets.

1.2.3 Current Status of Licences and Locations

DFO currently licenses approximately 440 shellfish aquaculture facilities (2012) with the approximate production by species, as follows:

	Production (in tonnes)			
Species	**2009**	**2010**	**2011**	**2012**
Clams	1359	1,485	1,300	1,113
Oysters	5735	7,550	7,500	7,165
Mussels	312	364	300	237
Scallops	385	695	300	163
Other Shellfish	530	26	0	na
TOTALS:	**8321**	**10,120**	**9,400**	**8,678**

Shellfish aquaculture is generally concentrated in areas around the southern coast of BC, including the west coast of Vancouver Island and the Georgia Basin (particularly Baynes Sound, Cortes Island, and Okeover Inlet). There are also a small number of farms located in the Central Coast, near Haida Gwaii and Prince Rupert.

Altogether, the shellfish aquaculture industry occupies approximately 3,300 hectares in BC. The average shellfish aquaculture facility occupies less than 8 hectares and many farms are two hectares or less. Of the approximately 500 shellfish tenures in BC, about half are licensed for deepwater culture activities. A list of all current shellfish aquaculture licence-holders is available on the DFO website: http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/shell-conch-processors-transformateurs-eng.pdf.

1.2.4 Cultured species

Today many of the shellfish cultured in BC are either introduced species or the progeny of native and introduced species. Prior to considering the introduction of any new non-native species, considerable review takes place to ensure that any potential risks associated with the introduction are mitigated. The following species are the shellfish most actively cultivated within BC.

- Oysters: The Pacific oyster is the most widely cultivated shellfish in BC and the Pacific Northwest. The Kumamoto oyster (a different species [*C. sikamea*] closely related to the Pacific oyster) is also cultivated in BC, albeit in small amounts.
- Clams: The Manila clam is the most commonly cultured clam in BC, and one of the most farmed clam species globally. Lower-value native species of butter clams and littleneck

[1] According to Statistics Canada's industry classifications, aquaculture includes hatcheries and grow-out facilities, but processing belongs to a separate industry.

clams are often present on shellfish leases and may be harvested along with Manila clams. The varnish, or savory clam, is considered an invasive species that is licensed for incidental harvest, but may not be actively cultivated on intertidal leases.

- Geoduck clams: Interest in geoduck clam culture began in the 1990s with cultivation taking place at several experimental sites. The number of sites culturing geoduck has expanded, and DFO is currently in the process of developing a management approach for the species.
- Mussels: The native Western blue mussel and two recent imports, the Eastern blue mussel and Gallo, or Mediterranean mussel, are cultured on a small scale in BC.
- Scallops: The main farmed species is the progeny of the Japanese scallop and the native weathervane scallop, known as the Pacific or Qualicum Beach scallop. Other scallops, including pink, spiny and giant rock scallop, have also been cultivated in small quantities in BC.
- Other Species: New species are being explored for culture because of their potential high value in international markets and/or due to their significance as traditional food for First Nations. These include red and green sea urchin, spot prawn, California sea cucumber, and Nutall's cockle.

Different types of shellfish culture may be used, depending on the species, life stage, site characteristics, and other factors. The following provides a list of species of interest to shellfish aquaculture licensees in BC, with a summary the most common culture types.

Common Name †	**Latin Name**	**Culture Type**
Butter Clam	*Saxidomus giganteus*	Bycatch in Intertidal
California Sea Cucumber	*Parastichopus californicus*	Subtidal bottom and container
Eastern Blue Mussel	*Mytilus edulis*	Suspended
Gallo Mussel	*Mytilus galloprovincialis*	Suspended
Geoduck Clam	*Panopea generosa*	Intertidal and subtidal bottom, suspended container (experimental)
Giant Rock Scallop	*Crassadoma gigantea*	Suspended
Green Sea Urchin	*Strongylocentrotus droebachiensis*	Suspended, container
Horse Clam	*Tresus capax*	Bycatch in intertidal
Japanese Scallop	*Patinopecten yessoensis*	Suspended
Pacific Scallop	*P. caurinus x yessoensis*	Suspended
Kumamoto Oyster	*Crassostrea sikamea*	Suspended
Littleneck Clam	*Protothaca staminea*	Bycatch in intertidal
Manila Clam	*Tapes philippinarum*	Intertidal bottom
Nutall's Cockle	*Clinocardium nuttalli*	Bycatch in intertidal, subtidal bottom
Pacific Oyster	*Crassostrea gigas*	Intertidal, subtidal bottom, suspended

Common Name †	**Latin Name**	**Culture Type**
Pink Scallop	*Chlamys rubida*	Suspended
Spiny Scallop	*Chlamys hastata*	Suspended
Weathervane Scallop	*Patinopecten caurinus*	Suspended
Western Blue Mussel	*Mytilus trossulus*	Suspended

Shellfish Species Licensed for Aquaculture in BC, September 2011.

† DFO is current revising the way that cultivated species are listed on shellfish aquaculture licenses and this list may be subject to change.

1.2.5 Culture Types

1.2.5.1 Intertidal Culture

Intertidal systems comprise both bottom (beach) culture, where shellfish are planted directly in the substrate, and near-bottom (epibenthic) culture, where they are suspended over the substrate by means of racks, bags, and other equipment. The latter approach is often used when substrate conditions are unsuitable for cultivation (e.g. soft mud or silt). Oysters may be farmed in the intertidal zone, including their nursery rearing on shell cultch before grow-out in deeper water. Most clams are grown in the intertidal area.

1.2.5.2 Subtidal Bottom Culture

Some shellfish, for example geoduck clams, can be bottom cultured in the intertidal or subtidal areas. In subtidal operations, geoduck clam seed may be raised to a certain size in a hatchery/rearing environment and then transferred onto the seabed by hand, using an underwater mechanical seeder, or placed in tubes that are buried in the substrate.

1.2.5.3 Suspended or Deepwater Culture

Increasingly, oyster and other bivalve culture have been moving to off-bottom systems which utilize floating rafts, buoys, and longlines to suspend shellfish above the ocean floor. Deepwater oysters can grow at a faster rate than intertidal oysters, although they are typically moved to the beach for defouling and hardening prior to sale. In BC, currently all commercial mussel and scallop farming is done using suspended culture systems.

1.2.6 Culture Techniques

1.2.6.1 Seed Production

Shellfish culture begins with the production of seed/spat. While some oyster spat is collected in the wild, the trend is towards greater production of seed/spat through hatcheries, from broodstock. Most clam, mussel, and scallop spat in the province are hatchery-sourced. Growers can acquire their seed pre-set (e.g. attached to cultched shell or tubes), or aquaculturalists can set larvae on site in tanks, with seed collectors. Seed are usually acquired in the spring or early summer, to maximize growth.

Much of the oyster seed and larvae and clam seed purchased today by BC shellfish growers are imported from the United States. Federal regulations prohibit the unauthorized introduction and transfer of shellfish into fish habitat when seeding an aquaculture site (see the *Fishery (General) Regulations*, Sections 54 to 57).

Under the National Code on Introductions and Transfers of Aquatic Organisms, Introductions and Transfers (I&T) licences are issued by DFO (and jointly with the Province of BC in the case of freshwater species). The federal-provincial I&T Committee reviews all licence applications to assess the ecological, disease, and genetic risks, and may stipulate mitigation measures as a Condition of Licence. The National Code provides uniform guidelines for application reviews and risk assessments. Further information can be found at the following website: http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/intro-trans/index-eng.html .

1.2.6.2 Nursery Rearing

Once set, the seed are moved to nursery rearing systems designed to protect juveniles from fouling, disease, and predation. These systems can be intertidal, deepwater, land-based, or floating with seawater flow-through (upwellers and downwellers).

1.2.6.3 Grow-out

When seed have reached a certain size (species dependent) they are transferred for final grow-out to intertidal, subtidal, or deepwater areas. Depending on the facility, a variety of grow-out methods can be used, including beach planting, near-bottom bags and cages, or ropes and trays suspended from longlines or rafts. Key issues related to grow-out include controlling the impacts of predators, siltation, and ensuring the integrity of the site in rough water conditions.

1.2.6.4 Harvesting

Mature shellfish are harvested by both manual and mechanized means. Intertidal clams and oysters, as well as geoduck are largely hand harvested (e.g. with rakes, wands), although some cultivation employs the use of mechanical harvesters. A number of BC oyster farmers have developed their own harvesting machines for suspended culture, using equipment such as hydraulic hoists and winches.

1.2.6.5 Storage and Handling

Before being shipped for processing, shellfish may be temporarily stored at a licensed facility approved for this purpose. Wet storage can take place in intertidal areas using mesh bags or pouches and in deepwater storage may utilize nets, bags, or sink floats. Mussel growers may also wash and de-clump their product prior to shipping. All bivalve shellfish are required by law to be landed at a federally regulated processing plant.

1.2.6.6 Containment and Suspension Techniques

Various equipment are used for containing shellfish during the nursery rearing and grow-out phases, including mesh bags and cages, trays, tubes and string, socks, and lantern nets. These may be hung from rafts or longlines or laid on or anchored to the substrate.

Longlines are an efficient suspension method for a range of culture species, and tend to be more stable than rafts in rough water. Rafts are not suitable for scallop farming due to their motion sensitivity and lower stocking densities. Sink floats provide wet storage and may also be used in harvesting mussels suspended from rafts.

1.2.6.7 Transportation of Shellfish

Aquaculture licences issued under the *Pacific Aquaculture Regulations* generally allow for movements of licensed shellfish within zones subject to the Conditions of Licence. Under

certain circumstances, shellfish aquaculture licence-holders may also transfer shellfish between different geographic locations as noted below.

For geoduck and sea cucumber, an Introductions and Transfers (I&T) Licence is required even for within zone transfer activities such as taking broodstock to the hatchery or planting juvenile stock on the licensed tenure.

For transfers between shellfish transfer zones not outlined in the licence, for transfer of a species not listed on the licence, or in circumstances where the licence conditions cannot be met, a separate I&T licence is required. A map indicating shellfish transfer zones can be found online at: http://www.pac.dfo-mpo.gc.ca/aquaculture/maps-cartes-eng.html#Shellfish_Transfer.

Applications for I&T licences are made to the Introductions and Transfers Committee at famitc@dfo-mpo.gc.ca.

More information on shellfish transfer zones, and/or Introductions and Transfers is available on the internet: http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/intro-trans/index-eng.html.

1.2.6.8 Imports of Shellfish

In addition to an I&T permit, the Canadian Food Inspection Agency requires that aquaculturalists importing shellfish obtain an import permit under the *Health of Animals Regulations* for shellfish seed and larvae of listed "susceptible species." Ten of BC's licensed shellfish culture species are now on the list, including Pacific oysters, Manila clams, and blue and Gallo mussels. This permit requirement took effect March 1, 2011.

Importers are also responsible for ensuring they comply with all federal, provincial, and municipal requirements for importation. See further information regarding the importing process and CFIA's requirements at: http://www.inspection.gc.ca/animals/aquaticanimals/imports/eng/1299156741470/1320599337624 .

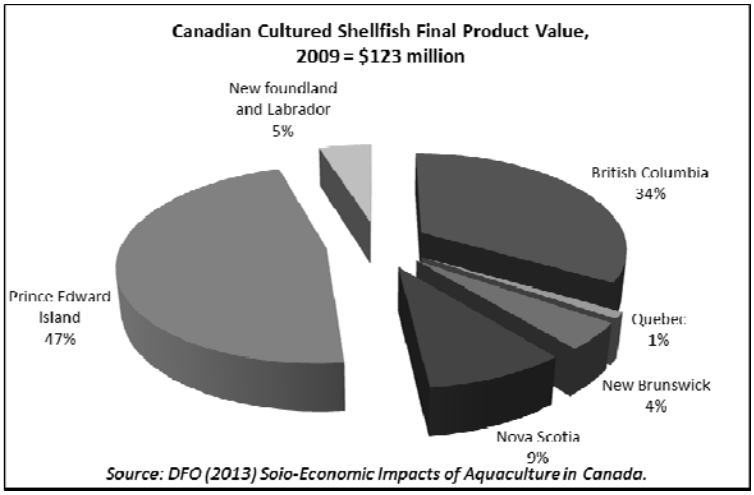
1.3 Economic Profile of the Shellfish Aquaculture Sector

Canada is the 27th largest producer of aquaculture products in the world, primarily due to finfish production.[2] Aquaculture occurs across Canada, although the bulk of production is in the Atlantic Provinces and BC. In 2010, Canadian aquaculture production had a final product value of approximately $1.1 billion; shellfish accounted for about 11% of the value. [3,4]

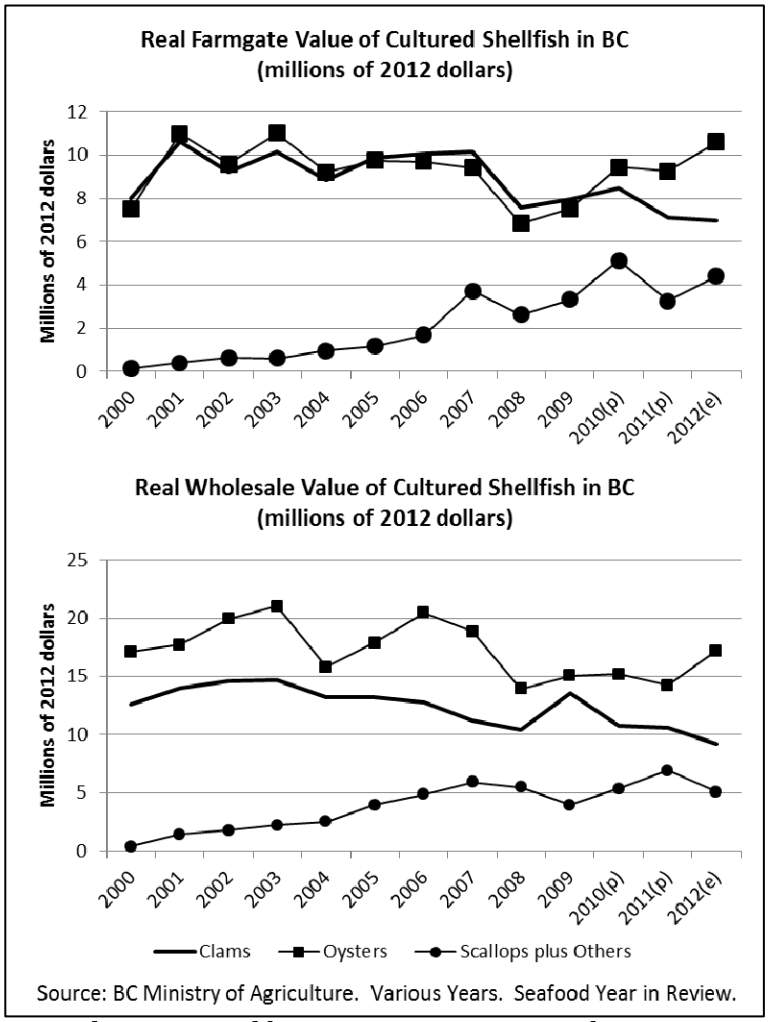
BC is the second largest producer of farmed shellfish in Canada, after PEI, accounting for about a third of the final product value for shellfish. BC is also the largest Canadian producer of cultured clams, oysters, and scallops.

[2] Food and Agriculture Organization of the United Nations (FAO). Global Aquaculture Production. Online dataset available at: http://www.fao.org/fishery/statistics/global-aquaculture-production/en. Accessed: August 2013.
[3] Final product value is equal to the farmgate value plus the value-added from basic processing of the shellfish by the aquaculture operation.
[4] Fisheries and Oceans Canada (DFO). 2013. Socio-Economic Impact of Aquaculture in Canada, 2013 Edition. Available: http://www.dfo-mpo.gc.ca/aquaculture/sector-secteur/socio/index-eng.htm. Accessed: August 2013.

In 2011, shellfish aquaculture production contributed almost $16 million in GDP to BC economy from expenditures (e.g. equipment).[5,6] This is about 9% of the GDP contribution from aquaculture in the province but less than 0.01% of the GDP from all industries. While detailed estimates are not available, aquaculture also has additional indirect impacts on the economy due to expenditures by suppliers and induced impacts as employees of aquaculture companies and their suppliers spend their earnings. Processing beyond the farmgate also provides economic benefits.



Cultured shellfish production in BC has grown considerably over the past two decades. Despite this growth, cultured shellfish still only accounts for 3% of the landed/farmgate value BC's total seafood harvest and about 4% of the farmgate value of marine aquaculture in the province. Shellfish culture has grown relative to the wild fishery now accounting for about 15% of the landed/farmgate and wholesale values for shellfish in the province, and about 40% of volume.



The growth of the cultured shellfish sector in BC was particularly rapid in the 1990s. Between 1990 and 2000, production rose from 4,000 tonnes to 6,500 tonnes (up 63%), while the real (inflation adjusted) farmgate value increased by over two times as markets

[5] Gross Domestic Product (GDP) from measures the value added to the economy and includes wages, owner profits, returns to invested capital, changes in inventories and depreciation.
[6] BCStats. 2013. British Columbia's Fisheries and Aquaculture Sector, 2012 Edition. Available: http://www.bcstats.gov.bc.ca/Publications/AnalyticalReports.aspx. Accessed: August 2013.

strengthened and prices increased.[7] Growth continued a slower pace from 2000 to 2012; production volume increased by 48% and the real farmgate value increased by 40% to $22 million (2012 dollars).

Between 2000 and 2012, the real wholesale value of cultured shellfish increased by 4% to $31.5 million. A substantial part of the growth in the sector was in species other than oysters, in particular clams. In 1990, clams accounted for 1% of production and 4% of the farmgate value. By 2000, clams accounted for 15% of production and 49% of farmgate value. Over the following decade, other shellfish species expanded such that, in 2012, clams continued to account for 15% of production, but only 32% of the farmgate value. In 2012, these other species accounted for 8% of production and 20% of value. Oysters continue to account for the majority of wholesale value from cultured shellfish, averaging over 50% over the past 10 years. The difference in shares between farmgate value and wholesale value reflects the greater degree of processing for a major share of oyster production.[8]

1.4 Employment

The aquaculture sector in BC provided an average of about 1,600 jobs per year between 2007 and 2011; an allocation between shellfish and finfish is not available.[9,10] A 2003 survey of provincial aquaculture employment has provided the basis for past estimate of jobs and full-time positions in aquaculture in BC.[11] Compared to other resource-based industries, including salmon aquaculture, shellfish farming is labour-intensive, but the employment tends to be seasonal. Based on this methodology, shellfish culture would have generated 320 person-years (PYs) of direct employment per year between 2007 and 2011, about 20% of the aquaculture employment.[12]

While employment in aquaculture as a whole tends to be year-round compared to other sectors (e.g. the wild fishery), shellfish culture generally has more seasonal workers than finfish culture. Roughly half of all aquaculture jobs are held by workers under the age of thirty. Shellfish farming is estimated to employ directly over 100 people within the Baynes Sound area.[13]

In addition to direct employment, the expenditures of aquaculture companies result in indirect impacts in the economy. Estimates for these impacts range from a low of about 60 based on

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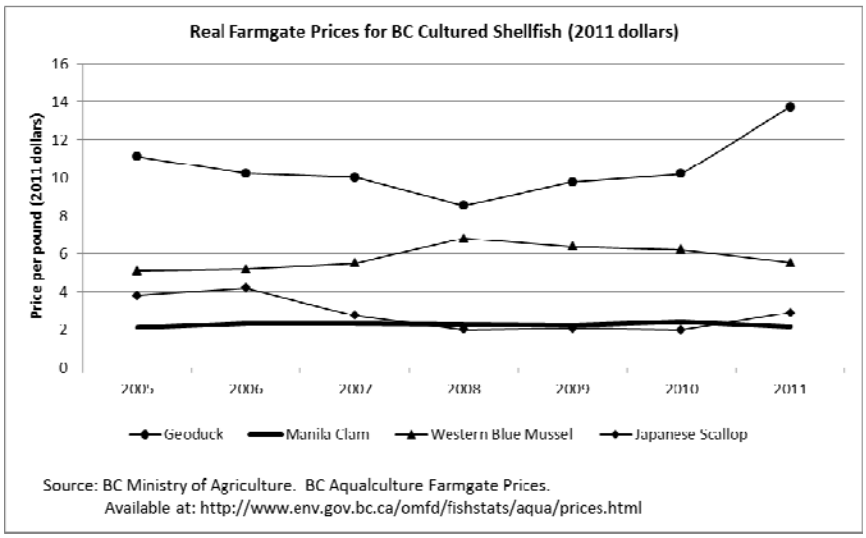
[7] BC Ministry of Agriculture. Various Years. British Columbia Seafood Industry Year in Review. Available at: http://www.al.gov.bc.ca/stats/YinReview/Seafood-YIR-2012.pdf. Accessed November 2013.
[8] About half of BC oysters are shucked and packed into containers, which is a labour-intensive process.
[9] BCStats. 2013. British Columbia's Fisheries and Aquaculture Sector, 2012 Edition. Available: http://www.bcstats.gov.bc.ca/Publications/AnalyticalReports.aspx. Accessed: August 2013.
[10] During this same period, the average for the capture fishery in BC was about 2,000 jobs (BCStats, 2013).
[11] B.C. Seafood Sector and Tidal Water Recreational Fishing - A Strengths, Weaknesses, Opportunities, and Threats Assessment, GS Gislason & Associates Ltd., February 2004.Summary Available at: http://www.env.gov.bc.ca/omfd/reports/SWOT/SWOT_6.0.pdf. Accessed: November 2013.
[12] These FTE estimates are based on assumed labour intensities of 36.5 PY per 1,000 tonnes of production for shellfish and 16.5 PY per 1,000 tonnes for marine finfish. Available at: http://www.env.gov.bc.ca/omfd/fishstats/aqua/employ-03.html. Accessed: November 2013.
[13] Community Profile: Comox Valley, British Columbia. 2012. Available at: http://www.dfo-mpo.gc.ca/aquaculture/sector-secteur/commun/comox-eng.htm. Accessed: November 2013.

general multipliers to approximately 600 jobs.[14] The vast majority of direct and indirect jobs are located in rural, coastal, and First Nations communities. Since these areas have been most hard hit by the by the downturn in forestry and fishing, aquaculture can play a role in revitalizing economic development and keeping youth in their communities.

1.5 Markets and Prices

BC shellfish culture is export-oriented, with more than three-quarters of farmed clams and oysters going to foreign markets, primarily on the US West Coast. Shellfish markets tend to be regional in scope due to the high unit transportation costs and challenges shipping a live product. However, higher-value species, such as geoduck, are sold to China and Japan.



BC is only a minor player on the world stage for cultured shellfish exports, and producers face competition from the US Pacific Northwest and globally from countries such as China, Chile, Mexico, and New Zealand. Washington State's shellfish aquaculture industry, for example, is around six times the size of that of BC.

Shellfish prices vary significantly by species, as indicated in the figure above. Some of the species for which cultivation has only been recently introduced, including geoducks, receive higher prices than primary species, such as Manila clams. Prices have been relatively flat for the main culture species of Pacific oysters and Manila clams.[15] This reflects the commodity nature of these products, in particular oysters which sell into highly competitive US markets.

Due to a reliance on export sales, pricing is sensitive to exchange rate fluctuations. Recently, the prices and production values for cultured shellfish have declined due to the appreciation of the Canadian dollar against the US dollar, which has eroded profit margins for BC producers.

[14] See BCStats (2013) for the multiplier method, and for the higher estimate see: Vancouver Island University – Centre for Shellfish Research at: http://www.viu.ca/csr/industry/industrybackground.asp .

[15] Pacific oysters are not shown in the graphic because data are not complete for farmgate prices expressed in dollars per unit weight. Prices are typically in $/US gallon for shucking oysters and in $/dozen for in-shell product. The average price for 2008-2011 has been about $2.70 per pound (in 2011 dollars); however, the price has declined in every year since 2008.

2. LEGISLATIVE, GOVERNANCE & POLICY FRAMEWORK

DFO's aquaculture management approach in BC is guided by the broader mandate and strategic priorities of the Department. DFO is the lead federal agency responsible for developing and implementing legislation, regulations, policies and programs in support of Canada's scientific, ecological, social and economic fisheries interests in oceans and fresh waters. For the purposes of aquaculture in BC, the most relevant pieces of legislation are:

- The *Fisheries Act* which provides, among other things, broad powers to the Minister for the proper management and control of commercial, aboriginal, and recreational fisheries, and the activity of aquaculture. As part of various long-standing arrangements, the provinces have assumed administrative responsibility for the management of most inland fisheries.
- The *Oceans Act*, among other things, provides authority to the Minister to lead the development and implementation of plans for the integrated management of activities affecting estuaries, coastal and marine waters, and the coordination of oceans issues. The *Act* also establishes the Minister's responsibility for Coast Guard services, as well as responsibility for marine science services such as the Canadian Hydrographic Services' nautical charts and publications.
- While the Minister of Environment has primary responsibility for the administration of the *Species at Risk Act*, the Minister of Fisheries and Oceans is the minister responsible for aquatic species. The purpose of the *Act* is to "prevent wildlife species from being extirpated or becoming extinct, and to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity and to manage species of special concern to prevent them from becoming endangered or threatened."

DFO supports strong economic growth in the aquaculture and capture fisheries sectors and contributes to a prosperous economy through global commerce by supporting exports and advancing safe maritime trade. The Department supports the innovation needed for a knowledge-based economy through research in expanding sectors such as aquaculture and biotechnology. The Department contributes to sustainable aquatic ecosystems for Canadians through habitat protection, oceans management, and ecosystems research. A safe and secure Canada relies on the maritime security, safe navigation, presence on our waters, and effective search and rescue services that the Canadian Coast Guard provides.

DFO's Mission and Vision, along with additional information on the organization, is provided on the Department's web pages (http://www.dfo-mpo.gc.ca/us-nous/vision-eng.htm).

> <u>DFO's Mission:</u> Through sound science, forward-looking policy, and operational and service excellence, Fisheries and Oceans Canada employees work collaboratively toward the following strategic outcomes:
>
> - economically prosperous maritime sectors and fisheries;
> - sustainable aquatic ecosystems; and
> - safe and secure waters.

> DFO's Vision: To advance sustainable aquatic ecosystems and support safe and secure Canadian waters while fostering economic prosperity across maritime sectors and fisheries.

The Department's goals are to increase the economic benefits associated with Canada's maritime sectors, fisheries, and aquaculture and to enhance the competitiveness of these sectors in existing areas, as well as in emerging areas such as Canada's North.

Other federal agencies also have important legislation governing aquaculture – for example the Canadian Food Inspection Agency is responsible for the *Health of Animals Act*; Health Canada the *Food and Drug Act* and the *Pest Control Products Act*, and Transport Canada the *Navigation Protection Act*.

In British Columbia, provincial legislation relates to business and labour aspects, processing of fish, as well as the tenuring of Crown land.

2.1 Regulation

The *Fishery (General) Regulations* and the *Pacific Aquaculture Regulations* are the main *Fisheries Act* regulations governing the activity of shellfish aquaculture activities in BC. These regulations frame the management and regulation of aquaculture activities on the Pacific coast, including the establishment of a licensing regime consistent with other fisheries managed by DFO but tailored to address the unique aspects of the aquaculture sector.

Conditions of Licence developed under the *Pacific Aquaculture Regulations* incorporate aspects of aquaculture that were covered in the former provincial regulations and licensing regime, and also include those aspects previously managed federally, for example: introductions and transfers of fish, marine mammal interactions, and habitat protection.

2.2 Policy

While legislation and regulations provide a legal framework for the management of aquaculture in BC, DFO policies and management approaches provide more specific context and guidance regarding how that framework is translated into management of the sector. The scope of these policies can be applied at the national or regional level.

DFO's Aquaculture Policy Framework provides a high level overview of DFO's approach to aquaculture management. Numerous other policies relate to DFO's approach on specific diverse aspects of aquaculture management, such as introductions and transfers of fish, broodstock collection, compliance and enforcement approaches, and interaction with wild species designated under the *Species at Risk Act*.

2.2.1 Fisheries and Oceans Canada Aquaculture Policy Framework

As the lead federal agency for aquaculture development, and consistent with its Departmental mandate, DFO discharges its responsibilities in a manner that adheres to the following Aquaculture Policy Framework principles:

- DFO will support aquaculture development in a manner consistent with its commitments to ecosystem-based and integrated management, as set out in Departmental legislation, regulations and policies.

- DFO will address issues of public concern in a fair and transparent manner, based on science and risk-management approaches endorsed by the Government of Canada.
- DFO will communicate with Canadians and seek their input on issues pertaining to aquaculture development.
- DFO will respect constitutionally protected Aboriginal and treaty rights and will work with interested and affected Aboriginal communities to facilitate their participation in aquaculture development.
- Recognizing that aquaculture is a legitimate user of land, water and aquatic resources, DFO will work with provincial and territorial governments to provide aquaculturists with predictable, equitable and timely access to the aquatic resource base.
- DFO will strive to ensure that its own legislative and regulatory frameworks enable the aquaculture sector to develop on an even footing with other sectors.
- In consultation with other federal departments, the provinces and territories, the academic sector and industry, DFO will support responsible development of the aquaculture sector.
- DFO will make every effort to understand the needs of the aquaculture industry and to respond in a manner that is solutions-oriented and supportive of aquaculture development.
- DFO will work with other federal departments, and with provincial and territorial governments, to coordinate policy development, integrate regulatory frameworks, and improve service delivery.

Through this policy framework, DFO is committed to being both an enabler and a regulator of aquaculture development, affirming its role as a Department engaged in sustainable resource development. In this context, “enabling” means improving the business climate for aquaculture development to benefit Canadians. DFO achieves this by:

- ensuring that DFO's laws and regulations relating to aquaculture are clear, efficient, effective, consistently applied and relevant to the sector;
- investing in aquaculture science and research and development;
- working in partnership with provinces and territories to develop a proactive siting process; and
- considering support for industry development programs consistent with DFO’s mandate and objectives.

Further information regarding DFO’s Aquaculture Policy Framework can be found at the following website: http://www.dfo-mpo.gc.ca/aquaculture/ref/APF-PAM-eng.htm.

2.2.2 National Aquaculture Strategic Action Plan Initiative

A strategy to support sustainable aquaculture growth and development has been set out in the *National Aquaculture Strategic Action Plan Initiative* (NASAPI) (2009). NASAPI was endorsed by the Canadian Council of Fisheries and Aquaculture Ministers (CCFAM) in November 2010 and outlines a strategic vision for the sustainable development of this sector, based on the principles of environmental protection, social well-being and economic prosperity.

The *National Aquaculture Strategic Action Plan* is available online here: http://www.dfo-mpo.gc.ca/aquaculture/lib-bib/nasapi-inpasa/index-eng.htm. To achieve the overall vision, the plan includes three key areas for collaborative action:

- Governance,
- Social Licence and Reporting, and
- Productivity and Competitiveness.

In addition, five strategic action plans have been developed to support the Action Plan. The *National Aquaculture Strategic Action Plan Initiative 2011 – 2015: West Coast Shellfish* sets out specific actions related to supporting the growth of sustainable shellfish aquaculture in BC. A copy of the National Aquaculture Strategic Action Plan Initiative 2011 – 2015: West Coast Shellfish can be found at: http://www.dfo-mpo.gc.ca/aquaculture/lib-bib/nasapi-inpasa/shellfish-west-mollusques-ouest-eng.pdf.

Flowing from NASAPI, DFO has been working through the National Aboriginal Fisheries Forum on an economic development initiative specifically targeting First Nations aspirations to participate in aquaculture. Additional information on this initiative is available through the Aboriginal Aquaculture Association: http://www.aboriginalaquaculture.com/.

2.2.3 Sustainable Aquaculture Program

The Canadian aquaculture industry operates responsibly within rigorous environmental standards, the strongest in the world. These standards, based on the best available scientific research, are in place to safeguard the environment and wild fish stocks.

The Government of Canada undertakes numerous initiatives in order to secure a successful and sustainable aquaculture industry across Canada. These initiatives streamline the regulatory process, strengthen science to create performance-based environmental standards, spur innovation to enhance the sector's competitiveness and productivity, and support the development of certification schemes to meet rigorous quality standards in international markets.

The guiding principles of the renewed Sustainable Aquaculture program (2013 – 2018) are as follows (http://www.dfo-mpo.gc.ca/aquaculture/programs-programmes/sustainable-durable/renewed-renouvele-eng.htm):

- Regulatory Science;
- Regulatory Reform and Governance; and
- Aquaculture Public Reporting.

2.2.4 British Columbia Aquaculture Regulatory Program

The British Columbia Aquaculture Regulatory Program was established in 2010 in order to carry out DFO's responsibilities related to aquaculture in BC. In particular, the Program is designed to implement federal regulations under the *Fisheries Act* and carry out the day-to-day management of the fisheries and environmental aspects of aquaculture, including marine finfish, shellfish and freshwater / land-based aquaculture.

These responsibilities include a number of areas previously managed by the Province of British Columbia (until December 2010) such as aquaculture licensing, environmental monitoring, and the approval of management plans, as well as matters historically managed by DFO such as habitat protection, introductions and transfers of fish, and marine mammal interactions.

DFO's aquaculture-related responsibilities are carried out by staff both located in both Ottawa and Pacific Region. The majority of program staff is located in Vancouver and various communities on Vancouver Island (e.g. Campbell River, Courtenay, Comox, Port Hardy).

Under the Program, DFO is responsible for a range of aquaculture activities, including:

- developing operational policies and Integrated Management of Aquaculture Plans;
- reviewing licence applications, setting appropriate licence conditions, issuing licences, and reviewing licensee/ facility management plans;
- liaising with stakeholders, other governments and First Nations;
- reporting publicly on the performance of the aquaculture industry;
- conducting compliance evaluations for environmental protection;
- reviewing and analyzing environmental and compliance data; and
- evaluating the effectiveness of environmental protection.

Consistent with the legislative, regulatory and policy framework outlined above, DFO has identified the following as the key management objectives of the British Columbia Aquaculture Regulatory Program:

- maintaining healthy and productive aquatic ecosystems;
- supporting an aquaculture industry that is environmentally, economically and socially sustainable;
- supporting economic opportunities through sustainable growth and development of the aquaculture sector in BC;
- ensuring sound environmental performance on the part of the aquaculture industry;
- providing an efficient and effective regulatory system for aquaculture in BC;
- supporting First Nations participation in aquaculture;
- meeting obligations related to First Nations consultation;
- engaging First Nations, industry, other levels of government and stakeholders in management of the aquaculture sector;
- taking an open and transparent approach to the management of aquaculture in BC; and
- maintaining a high level of compliance with DFO regulations and licence conditions.

DFO employs a range of management measures which support Departmental objectives related to aquaculture. These are intended to work in concert with the jurisdictions of other agencies with regulatory authority over aspects of aquaculture management such as the Canadian Food Inspection Agency under the *Health of Animals Act*.

2.3 Compliance and Enforcement

Monitoring, audit and enforcement are an integral part of DFO's approach to management of the aquaculture industry. DFO's Conservation and Protection (C&P) staff (Fishery Officers) and other DFO staff play key roles in this approach.

The Aquaculture Management Directorate C&P unit is also part of the broader C&P sector in BC. This unit was established with the primary role of enforcing compliance with the *Fisheries Act*, the *Pacific Aquaculture Regulations*, the *Marine Mammal Regulations*, the *Species at Risk Act*, and other relevant legislative responsibilities. Fishery Officers responsible for aquaculture enforcement are stationed on Vancouver Island in Campbell River and Nanaimo.

DFO Fishery Officers conduct investigations and take enforcement actions based on C&P site inspections, information from inspections undertaken by DFO staff who monitor and manage industry reporting, or based upon information from the public.

In collaboration with the enforcement activities conducted by Fishery Officers, DFO has a team of dedicated veterinarians, biologists, fish health technicians, and resource managers who verify that aquaculture facilities comply with the *Pacific Aquaculture Regulations* as well as all Conditions of Licence. The data gathered by DFO staff through site inspections and technical audits provide information related to the environmental and operational performance of the aquaculture industry in BC.

As a part of the BC enforcement approach, DFO staff and Fishery Officers perform three main enforcement activities:

- Education and Shared Stewardship: The Department promotes compliance with the *Fisheries Act* and the *Pacific Aquaculture Regulations* through education and awareness activities directed at both industry and the public. Public education and awareness activities encourage Canadians to protect fishery resources and habitats.
- Monitoring, Control and Surveillance: Enforcement activities are carried out by Fishery Officers who conduct regular patrols on the land, on the water and in the air. Fishery Officers conduct inspections to validate licence reporting, and to determine compliance with aquaculture licences, Conditions of Licence and other applicable legislation.
- Investigations: Fishery Officers respond to complaints and conduct investigations. Additional information about Fishery Officer duties is available on the DFO website: http://www.dfo-mpo.gc.ca/fm-gp/enf-loi/officer-agent-eng.htm .

2.4 Science in Support of Aquaculture

DFO undertakes a science-based approach while the implementing the *Pacific Aquaculture Regulations* and the British Columbia Aquaculture Regulatory Program. DFO's scientific research informs regulatory decision-making. This research also improves our understanding of the interactions of farmed and wild finfish and shellfish, as well as the environment on which these species depend.

DFO is involved in a number of aquaculture science and research activities designed to:

- better understand and regulate the potential environmental interactions of aquaculture activities;
- develop new and enhanced tools and technologies to ensure optimal fish health; and
- establish sustainable, ecosystem-based practices.

Results of this research help inform regulatory and policy development and decision-making (within the Department and other government departments and agencies), and supports the responsible growth of Canada's aquaculture industry.

DFO's aquaculture research activities fall mainly under two key programs within the Sustainable Aquaculture Program: the Program for Aquaculture Regulatory Research (PARR), and the Aquaculture Collaborative Research and Development Program (ACRDP).

The PARR supports research activities that build understanding and the knowledge base that is used to inform DFO's aquaculture and fisheries protection regulations and policy decision making. This includes the Department's ecosystem-based and environmental regulations. More information on PARR can be found at the following website: http://www.dfo-mpo.gc.ca/science/enviro/aquaculture/parr-prra/index-eng.asp.

The ACRDP is a DFO initiative designed to increase the level of collaborative research and development activity between the aquaculture industry and the Department. The ACRDP teams industry with DFO researchers to undertake research that lies within DFO's mandate, but is based on the needs and priorities of the aquaculture industry. More information regarding ACRDP can be found at the following website: http://www.dfo-mpo.gc.ca/science/enviro/aquaculture/acrdp-pcrda/index-eng.htm.

Other related programs and activities include Science Peer Review (http://www.dfo-mpo.gc.ca/aquaculture/sci-res/spr-eng.htm), Canadian Integrated Multi-Trophic Aquaculture Network (http://www.dfo-mpo.gc.ca/aquaculture/sci-res/imta-amti/index-eng.htm), and Aquatic Animal Health Science (http://www.dfo-mpo.gc.ca/science/aah-saa/index-eng.htm).

The broad range of aquaculture research initiatives currently being undertaken by the Department, as well as other individuals and institutions (e.g. universities, environmental groups, private consultants, First Nations), and those completed in recent years are summarized in the biennially published *Canadian Aquaculture Research & Development Review*. More information regarding the Review can be found at: http://www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm.

The Department has undertaken a number of comprehensive science reviews that evaluated the state of knowledge and research needs in the area of aquaculture-environment interactions. These include:

- State of Knowledge Initiative (2003-2006): Peer reviewed reports examining the potential environmental effects of aquaculture activities (finfish and shellfish) including interactions between farmed and wild species (e.g. disease transfer, genetic and ecological effects) and the impact of wastes (e.g. fate and effect of nutrient and organic matter release): http://www.dfo-mpo.gc.ca/science/enviro/aquaculture/index-eng.htm .
- National Advisory Process: Shellfish Aquaculture (2006): Coordinated through the Canadian Science Advisory Secretariat (CSAS), this process reviewed the potential impact of shellfish aquaculture on fish habitat, environmental indicators of impacts at a range of spatial scales, and modeling techniques to predict these impacts: http://www.dfo-mpo.gc.ca/csas/Csas/status/2006/SAR-AS2006_005_E.pdf
- Aquaculture Pathways of Effects (2009): This CSAS peer review process evaluated the state of knowledge associated with a broad range of potential aquaculture-

environment interactions: http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2009/2009_071-eng.htm

In addition to these broad review processes, individual CSAS processes are routinely undertaken to evaluate emerging issues and science developments. The resulting Advisory Reports, as well as *Research* documents and *Proceedings* documents, are posted on the CSAS website: http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm .

The Department recognizes the importance of research on aquaculture-environmental interactions (and broader marine ecosystem and fisheries issues) that is conducted by individuals and institutions (e.g. universities, environmental groups, private consultants, First Nations). The reports and publications resulting from these studies are also included and evaluated through CSAS review processes. This includes participation of external experts at CSAS peer review process workshops and active involvement in the formulation of Science Advisory documents.

2.5 Developing Science and Research Priorities

As advisory processes associated with aquaculture management in the Pacific Region develop, DFO will work collaboratively with First Nations, industry, and stakeholders to identify ongoing science and research priorities. Regional priorities will then be considered within a national context.

Nationally, aquaculture regulatory priorities for shellfish aquaculture have generally focused on the following themes:

- Cumulative Effects and Ecosystem Management Strategies (e.g. carrying capacity frameworks, aquatic invasive species risks, ecosystem assessment to support potential boundary delineation and development of area based indicators);
- Interactions with Wild Populations (e.g. shellfish transfer zones and shellfish hatchery protocols, risk assessment for review of new aquaculture species and techniques);
- Canadian Shellfish Sanitation Program (e.g. improvements to coordination and implementation of CSSP).

The Department seeks input into science and research priorities through advisory committee processes. Science and research will benefit from the collaborative engagement of governments, First Nations, industry, and other stakeholders, working collaboratively to identify priorities and to carry out initiatives.

2.6 Integration of Traditional and Local Knowledge

In developing and implementing its aquaculture management approach, the Department is committed to working with First Nations, other levels of government, industry, and stakeholders in order to gather and integrate traditional and local knowledge. Through collaborative processes with First Nations and local communities, DFO will continue to improve its understanding of how traditional and local knowledge can be effectively utilized to improve the management of aquaculture.

2.7 Engagement and Advisory Processes

In order to facilitate open and transparent communication relating to the management of shellfish aquaculture, DFO has worked with First Nations, industry, and other stakeholders to establish the Shellfish Aquaculture Management Advisory Committee (SF-AMAC). The SF-AMAC is a multi-stakeholder forum which is tasked with providing feedback to DFO on the coast-wide management of shellfish aquaculture. Further information on the SF-AMAC, including the Terms of Reference, currently in draft form, and other information is available on the DFO consultation webpage: http://www.pac.dfo-mpo.gc.ca/consultation/aquaculture/index-eng.html.

The SF-AMAC is a mechanism which brings together a range of interests related to aquaculture to provide coordinated analysis and advice to DFO with regard to aquaculture management in BC. AMACs provide a venue for discussion and dialogue, both between and among First Nations, industry, stakeholders and other levels of government. This advice plays an important role in the ongoing development of the SF-IMAP, and provides a transparent opportunity for interested groups to better understand and participate in the management and planning process for aquaculture.

In addition to this integrated forum, DFO has also established bilateral processes with First Nations and the aquaculture industry. These processes are designed to complement, inform and support the discussions taking place at in the AMAC process and allow for more focused discussions on specific issues relevant to both interests/sectors.

Through programs like the Aboriginal Aquatic Resource and Oceans Management (AAROM) and the Pacific Integrated Commercial Fisheries Initiative (PICFI), DFO has invested in building First Nations capacity and engagement related to aquaculture. These funds have been used to improve communications and information sharing among First Nations on aquaculture issues, and to support technical capacity for First Nations to effectively engage in discussions related to aquaculture.

In addition to consultation and engagement with individual First Nations and other AAROM bodies, DFO continues to work closely with the First Nations Fisheries Council (FNFC) to seek advice and assist with coordination of First Nations' engagement on a broader, province-wide basis. This includes processes and capacity for First Nations to engage with one another, with DFO and with other interests through the AMACs and other processes.

To further inform our management approach, the Department also participates in bilateral discussions with other interests such as environmental non-governmental organizations, as well as recreational and commercial fishing interests.

2.8 First Nations Consultation

Consultation with First Nations is a key part of DFO's aquaculture licensing and review process. Consistent with legal obligations and the federal duty to consult, DFO consults with First Nations on new aquaculture licence applications, renewals and amendments where there is the potential to impact claimed and/or established Aboriginal rights and title.

The Province of BC (Front Counter BC) coordinates the receipt and distribution of information when an aquaculture application is submitted through a "single window" approach. DFO works with the Province of BC and Transport Canada through a harmonized application and review process where practical. The respective agencies are currently working on a process to more

effectively coordinate consultation with First Nations (and other interests) including information sharing and, where appropriate, joint consultation carried out by the respective agencies.

In cases where an application relates only to DFO's area of jurisdiction (e.g. species and production amendment), the Department identifies those First Nations potentially impacted by the decision and provides them with a detailed overview (referral package) of the application, including the proposed site, as well as opportunities and potential timeframes for comments and feedback on the application. All comments are reviewed and carefully considered by the Department, including key issues and potential impacts identified by First Nations through the consultation process.

In addition to consultations undertaken by DFO, the Department also encourages aquaculture proponents (e.g. licence holders, applicants) to engage local First Nations prior to applying for a new licence or amendment.

3. MANAGEMENT APPROACH

3.1 Federal-Provincial Roles and Responsibilities

The regulation and management of aquaculture is an area of shared jurisdiction in BC. In December 2010, DFO and the Province of BC signed an *Agreement on Aquaculture Management* which outlines federal and provincial responsibilities related to aquaculture in BC. A copy of the agreement can be found on the DFO website: http://www.dfo-mpo.gc.ca/media/infocus-alaune/2010/04/agreement-entente-eng.htm.

This agreement lays out the primary roles of the federal and provincial governments related to aquaculture management. The primary responsibilities of the federal government (Fisheries and Oceans Canada) include:

- issuing licences for marine and freshwater aquaculture, including hatcheries;
- assessing modifications to existing aquaculture facilities;
- establishing licence conditions to conserve and protect fish and fish habitat;
- enforcing new aquaculture regulations;
- conducting science and aquaculture research; and
- reporting publicly on environmental and regulatory performance of industry.

The Province of British Columbia remains responsible for:

- issuing tenures for marine or freshwater environments;
- regulating the business aspects of aquaculture (e.g. workplace health and safety); and
- reporting on seafood exports.

Under the Agreement, DFO, Transport Canada and the Province of BC have implemented a harmonized approach to aquaculture-related authorizations and decision-making. To simplify the application and review process for the aquaculture sector, the lead agencies have developed a harmonized application package for the collection of information necessary to apply for federal authorizations under the *Fisheries Act* (*Pacific Aquaculture Regulations*) and the *Navigation Protection Act* and, to apply for provincial authorization under the *Land Act.*

The harmonized application package must be used for all aquaculture applications, including new shellfish and amendment applications, where one or more of the above-noted authorizations are required. Depending on the specifics of the application, there may be other authorizations required (e.g. provincial Water Licence).

In addition to the harmonized application and review process, the lead agencies have also established a number of committees and working groups in order to support implementation of the Canada-BC Agreement.

3.2 Siting Considerations (Criteria)

DFO conducts a thorough review of all new licence and amendment applications for shellfish aquaculture. Depending on the nature of the application, this review may include:

- Fish habitat (e.g. sensitive benthic habitat, water quality);
- Fish resources (e.g. wild fish populations);
- Species at risk;
- Ecosystem effects;
- Commercial, recreational and Aboriginal fisheries;
- First Nations use of land and resources for traditional purposes.

If an aquaculture operation is sited appropriately, it can significantly reduce the potential for impacts on fish and fish habitat. Through both siting and additional mitigation measures (e.g. conditions of licence, environmental monitoring), DFO works with the aquaculture industry to ensure that individual sites and the sector are operated in a sustainable manner.

In some cases zoning recommendations, which are administered by local governments, may relate to the marine and foreshore area.

As the scientific understanding of the relationship between shellfish farming and the environment increases, it is anticipated that the above siting considerations and the mechanisms to evaluate them will continue to evolve.

3.3 National Aquatic Animal Health Program

The National Aquatic Animal Health Program (NAAHP) is a science-based regulatory program, designed to meet international standards for aquatic animal health management. Led by the Canadian Food Inspection Agency (CFIA) with DFO support, the program has a number of components, including the listing of diseases of concern; import controls and export health certification; field sampling for disease surveillance; disease control measures; and laboratory testing, research and development. See further at: http://www.inspection.gc.ca/animals/aquatic-animals/eng/1299155892122/1320536294234 .

3.4 Health of Animals Reporting

The *Health of Animals Regulations* lists a number of “reportable diseases” that are of concern to animal health or the economy of Canada. Requirements under the regulations ensure that aquatic animals and their products, which could pose a risk for the spread of disease, meet the requirements of international standards for national disease management. There is a legal

requirement to report diseases which pose a threat to aquatic animals: http://www.gazette.gc.ca/rp-pr/p1/2009/2009-12-19/html/reg1-eng.html .

3.5 Aquatic Invasive Species

Invasive tunicates and the European green crab threaten BC shellfish culture, through predation and competition for habitat (for more information see: http://www.dfo-mpo.gc.ca/science/enviro/ais-eae/index-eng.htm. The *Canadian Action Plan to Address the Threat of Aquatic Invasive Species* (available here: http://www.dfo-mpo.gc.ca/science/enviro/ais-eae/plan/plan-eng.htm), was developed through the Canadian Council of Fisheries and Aquaculture Ministers Aquatic Invasive Species Task Group and approved by the Canadian Council of Fisheries and Aquaculture Ministers. Canada has outlined a national approach for managing aquatic invasive species, and has enacted regulations in 2006 for managing ship ballast water.

3.6 DFO Environmental Management Approach

The conservation of marine ecosystems and wild fish stocks is a priority for DFO. Together, the *Fisheries Act*, *Fishery (General) Regulations*, and the *Pacific Aquaculture Regulations* (along with other relevant legislation and regulations), a comprehensive suite of related management tools (as outlined in this document), and relevant science and research provide a framework for the effective management of aquaculture in BC.

In particular, this framework enables DFO to effectively manage potential environmental impacts related to aquaculture in both the marine and freshwater environment. Similar to the management of other fisheries, DFO aquaculture licences include specific licence conditions and mandatory requirements, which all licence holders must meet in order to operate. Many of these conditions focus on identifying and mitigating potential impacts on the environment.

DFO staff, including veterinarians, biologists and other aquaculture technical experts, support the development and implementation of the DFO environmental management approach. These staff work closely with aquaculture resource managers, Conservation and Protection staff (Fishery Officers), and the Science Branch in identifying and managing potential risks to the environment, as well as ensuring a high level of compliance with DFO regulations and Conditions of Licence. For example, DFO staff are responsible for:

- Identifying licence conditions aimed at strengthening environmental management;
- Conducting environmental audits and compliance evaluations for environmental performance (e.g. predator net mapping, site marking);
- Reviewing and analyzing environmental and compliance data;
- Evaluating the effectiveness of the management regime.

DFO staff complete a comprehensive schedule of site visits and environmental audits each year to ensure that industry-generated information and reports are accurate. Staff also conduct targeted field operations to better understand potential environmental impacts related to aquaculture, and to support the ongoing development of improved mitigation measures and best practices.

3.7 DFO Shellfish Aquaculture Licensing

Shellfish aquaculture Conditions of Licence are designed to ensure the sustainable operation and development of the shellfish aquaculture sector. The basic template for a shellfish aquaculture licence, as well as the current generic Conditions of Licence, can be found on the following website: http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/shell-coq-eng.html. In addition to the generic Conditions of Licence, site and/or area specific conditions are often added, where appropriate.

Since DFO assumed regulatory responsibility in December 2010, licences for shellfish aquaculture have been issued for periods between 12 and 16 months (currently all shellfish aquaculture licences expire in April of each year). Prior to each renewal, DFO undertakes a comprehensive review of the Conditions of Licence, and where appropriate, makes modifications and improvements. The following sections provide an overview of the current shellfish Conditions of Licence.

3.7.1 General Licence Conditions

3.7.1.1 Application and Licensed Species

The licence face provides an overview of the species which the licence-holder is permitted to cultivate on the site.

3.7.1.2 Site Management Plan

The licence-holder is required to provide a site management plan which includes information about the licence-holder, the location and legal description of sites (including maps), a list of cultivated species, an overview of the types of culture taking place on the site, a description of the culture gear and physical structures, an overview of the licence area layout, and the estimated annual maximum production (or growing cycle production) of cultured shellfish (by species). Elements of the approved site management plan is become part of the licence, and amendments to the plan are submitted for review and approval prior to any changes made on site by the licensee.

3.7.1.3 Facility Installation and Inspection

The Conditions of Licence require that the operator ensure that their facility and structures (other than intertidal growing area) are able to withstand adverse weather conditions. The licence-holder is required to have the facility inspected by a qualified individual who can confirm and attest that the facility is designed and installed in a manner such that the facility will withstand the prevailing oceanographic and meteorological conditions of the licensed location.

Licence-holders are required to inspect their facility as required, or at least once a year, to ensure that the integrity of the facility is maintained.

3.7.1.4 Introduction or Transfer of Fish

Licence-holders are permitted to transfer live seed, spat, and juvenile shellfish (except geoduck, sea cucumber, sea urchin, or varnish clam) to or from the licensed facility, providing that:

- the species being transferred are authorized by the licence;
- the area being transferred to/from holds a valid aquaculture licence;

- the licensed areas are within the same shellfish transfer zone (http://www.pac.dfo-mpo.gc.ca/aquaculture/maps-cartes-eng.html);
- shellfish do not show any signs of any observable symptoms of diseases (*List of Known Shellfish Diseases of Concern*, which is contained as an appendix to the licence) or infectious agents of concern to the Introductions and Transfers Committee.

In cases where these conditions are not met, licence holders are required to obtain a separate Introductions and Transfers Licence prior to the transport of the shellfish.

3.7.1.5 Access to Wild Fish

The Conditions of Licence allow the licence-holder to collect spat within their licensed area. Licence holders may also be permitted to harvest some non-cultivated shellfish as bycatch, provided they are licensed to cultivate those species on their site. In any other situation licence-holders are required to apply for a separate licence authorizing the collection of wild fish prior to collecting or retaining wild fish.

In some cases restrictions may be placed on the collection of wild shellfish, if the licensee has not met a requirement for seeding and growing out cultured product on a site or if the licensee does not have an approved harvest plan for geoduck or sea cucumber.

3.7.1.6 Fish Health

Licence-holders are required, under this Condition of Licence, to ensure that the shellfish cultivated in the licensed area receive care and attention consistent with their biological requirements.

3.7.1.7 Escapes or Releases

Licence-holders are required to take all reasonable precautions to ensure that they prevent the escape or release of cultured shellfish. This includes during periods when product is being transferred or transported to and from the facility.

3.7.1.8 Incidental Catch

Licences are not permitted to retain incidental catch, with the exception of varnish (savory) clams, which are considered an invasive species and may be retained.

3.7.1.9 Predator Control

Conditions of Licence require licence-holders to report immediately, upon discovery, any marine mammal accidental drowning mortality to DFO's Observe, Record, Report Line. If a marine mammal is observed entangled, but not dead, the licence-holder is obliged to make every reasonable attempt to free the animal without harm, and the incident must also be reported to the DFO Observe, Record, Report Line.

All licensed aquaculture facilities are prohibited from using acoustical deterrents. If other types of predator exclusion devices are used on a licensed site, the licence holder is required to ensure that devices are constructed and employed in a manner which avoids potential entrapment and injury to any fish or wildlife, and the licence holder is also responsible for maintaining and repairing the predator control devices on a regular basis.

3.7.1.10 Protection of Fish Habitat

The shellfish aquaculture Conditions of Licence contain a number of conditions which are designed to protect fish and fish habitat. These include general prohibitions against the disturbance of sensitive habitat, including: dredging, infilling, or redistribution of native beach materials; disturb spawning or spawn of herring, sand lance, or squid; or any disturbance of eelgrass.

Operators are also obliged to operate machinery in a manner that minimizes disturbance to intertidal areas and fish habitat. Where machinery is used, it is required to be clean and maintained.

The Conditions of Licence list a number of requirements relating to the mooring anchors and floatation material, and the use and operation of equipment. This section of the licence is designed to ensure that fish and fish habitat are not negatively impacted by the operation of a shellfish culture facility.

3.7.1.11 Harvesting and Handling

The shellfish aquaculture Conditions of Licence require that all shellfish harvested for transport be tagged in a proscribed manner. This section of the licence also provides guidance related to the wet storage of shellfish.

Conditions of Licence also contain a number of clauses that specifically outline measures which are in place to prevent the spread of the European green crab.

3.7.1.12 Records

Shellfish aquaculture licence holders are required to maintain records related to a number of activities which occur throughout the growing cycle. These records must be produced upon request by a Fishery Officer or fishery guardian. Required records include, but are not limited to: the importation or introduction or transfer of shellfish; all shellfish harvested for sale; and site facility attestation records for new installations and alterations.

7.1.13 Annual Aquaculture Statistical Report

Licence holders are required to submit to the Department on an annual basis an Annual Aquaculture Statistical Report, which is outlined in the licence, and sent to all licence-holders. This report includes information on harvest for food sales, processing information, restocking and on growing information, and information on stock on-hand. This information helps DFO, the Province of BC, along with industry, First Nations, and other stakeholders, to better understand the activities of the shellfish aquaculture industry, and to analyze trends over time.

3.7.2 Additional Conditions by Species or Activity

3.7.2.1 General Culture of Bivalve Species

The shellfish aquaculture licence contains a number of conditions which relate to a list of bivalve species. These include the requirement that these species be processed in a federally registered plant and the requirement that beach and foreshore tenures be clearly marked as outlined in the approved Site Management Plan. Requirements are outlined in this section with respect to Pacific oyster spat collection. There are prohibitions relating to proximity to floating living accommodation and marine finfish net pens.

3.7.2.2 General Culture of Sea Urchin/ Sea Cucumber

This section of the licence outlines requirements and prohibitions relating to the seeding, transfer, and harvest of sea urchins and sea cucumber, including the requirement for the submission and approval of a Harvest Plan by DFO, and requirements related to Harvest Notification.

3.7.2.3 General Culture of Geoduck

Shellfish aquaculture licences contain specific requirements related to the cultivation of geoduck clams. This includes requirements related to seeding, the development of harvest plans, harvest notification, harvest container tags, and landing reports. At the present time DFO is undertaking the development of an integrated management framework for geoduck, and when complete the policy will apply to new licences, and will be referenced in the SF-IMAP.

3.8 Management Priorities

In addition to the management tools and measures outlined above, DFO has identified a number of management priorities for shellfish aquaculture. These priorities have been identified based on the broader strategic priorities of the Department, science and ongoing environmental monitoring, as well as consultation and engagement with First Nations, industry, stakeholders and other levels of government.

In some cases, the Department has already initiated work to address these priorities. At the same time, further work is required and the Department will engaging First Nations, industry, stakeholders and other levels of government with respect to these management priorities over the coming months.

It is anticipated these priorities will be revised over time as work is completed and based on new science, monitoring and engagement with various interests. In particular, the SF-AMAC and bilateral aquaculture processes with industry and First Nations will be key vehicles for discussing and evaluating potential changes to our management approach.

The following management priorities and initiatives have been identified by the Department:

- Implementation of licence fees and licensing service standards related to shellfish aquaculture;
- Improved coordination in delivery of the Canadian Shellfish Sanitation Program;
- Multi-year licences for shellfish aquaculture in BC;
- Development of a new geoduck management approach (Integrated Geoduck Management Framework);
- Development of a new sea cucumber management approach; and
- Area-based management.

The following section provides a brief overview of the management issue, DFO's current management approach and potential considerations moving forward.

3.8.1 Licence Fees and Service Standards

DFO is currently in the process of establishing licence fees for aquaculture in BC. Due to requirements under the *User Fees Act*, licence fees have not been implemented since DFO became the primary regulatory authority for aquaculture in December 2010. Discussions regarding the proposed licence fees have been underway with First Nations, industry and stakeholders since 2012. Subject to timelines and steps set out under the *User Fee Act* process, DFO anticipates that licence fees for shellfish aquaculture will come into force in 2015. As per requirements under the *User Fee Act*, service standards have also been developed by DFO with respect to aquaculture licensing and will come into effect when licence fees come into force.

3.8.2 Improved Coordination in Delivery of the Canadian Shellfish Sanitation Program

The Canadian Shellfish Sanitation Program (CSSP) is delivered jointly by DFO, Environment Canada and the Canadian Food Inspection Agency, and contains measures to ensure that bivalve shellfish (e.g. oysters, clams, scallops and mussels) are safe for human consumption. Under this program Conditional Management Plans are required to allow shellfish harvesting in areas that may be periodically at risk for poor water quality. These plans set out the circumstances which would trigger a temporary closure of the area to shellfish harvesting.

In BC, there are currently five Conditional Management Plans in effect. The first four cover harvest areas near wastewater treatment plants in Ladysmith, Chemainus, Crofton and French Creek. In these areas, the Conditional Management Plans are in effect to manage the potential risk of the release/discharge of wastewater materials beyond the normal operations of the treatment plant.

The fifth Conditional Management Plan applies to shellfish harvesting in Baynes Sound; the most active shellfish aquaculture region in BC. In Baynes Sound, water quality may be adversely affected when substantial amounts of rainfall occur over a relatively short period of time leading to runoff from the upland areas into the marine environment. Baynes Sound is divided into three different areas, with each having an established rainfall trigger amount for temporary shellfish harvesting closures.

DFO, Environment Canada, and the Canadian Food Inspection Agency are working together to improve coordination in the delivery of the CSSP. The agencies are also working with industry partners and provincial/ territorial agencies to ensure that the program is responsive to industry needs, while ensuring that Canadian seafood products maintain their safety and high quality. DFO intends to consult with the SF-AMAC as this work develops.

3.8.3 Multi-year Licences

Since assuming the primary regulatory responsibility for aquaculture in BC, DFO has issued shellfish aquaculture licences for periods of up to 16 months. The Department had identified a potential shift toward multi-year licences as a means of increasing certainty, stability and attracting investment for the shellfish aquaculture sector.

The *Fisheries Act* permits licence durations of up to nine years. In considering potential changes to licence durations for all types of aquaculture facilities in BC, DFO anticipates undertaking

further consultation with First Nations, industry and stakeholders, as well as consideration of issues related to the annual payments of fees, maintaining DFO's ability to modify Conditions of Licence as appropriate over time, and maintaining transparency in regulatory requirements.

3.8.4 Geoduck Management Approach

In 2012, DFO initiated a review of the current management approach for geoduck aquaculture, including key opportunities and challenges facing potential growth of the sector. Since then, DFO has been engaging interested First Nations, industry representatives, stakeholders and the Province of BC regarding a new management approach for geoduck. The overarching aim of this work is to provide additional opportunities for geoduck aquaculture while maintaining the long-term viability and sustainability of wild geoduck fisheries. Development of the framework is ongoing, and DFO anticipates having a new management approach in place by 2015.

3.8.5 Sea Cucumber Management Approach

As with geoduck, there is significant interest in sea cucumber aquaculture in BC. Given the range of issues and potential uncertainty regarding sea cucumber aquaculture, DFO is not currently accepting new applications for sea cucumber. The Department is developing a new management approach that will provide additional opportunities for the culture of sea cucumber while managing potential concerns related to environmental impacts and interaction between cultivated and wild stocks. Development of this approach will incorporate a review of current science regarding sea cucumber aquaculture.

3.8.6 Area-Based Management

As outlined above, DFO's aquaculture management approach in BC is framed by a number of policies, regulations and management measures. To a large extent, these are developed and applied at either a province-wide scale (e.g. policy) or on a site-by-site basis (e.g. Conditions of Licence, site management plans). Given the unique context and diverse coastline in BC, the Department is looking at opportunities to move toward an area-based approach. For example, these approaches could include the identification of smaller geographic areas or ecosystems (management zones) that would then form the basis for a more localized planning or management approaches, which could include area-based management measures and objectives (e.g. shellfish health, water quality), additional siting considerations, research, and/or socio-economic considerations.

These options and an eventual approach will be informed by additional science, local and traditional knowledge, as well as consultation with First Nations, industry, stakeholders and other levels of government. No specific timeframe has been set for this exercise and progress will largely depend on available resources and capacity, both for DFO and our partners.

4. REPORTING ON RESULTS

DFO has committed to an open and transparent approach to the management of aquaculture in BC. In part, the Department works to achieve this objective both through the regular release of information reported by the aquaculture industry and data gathered through DFO's own environmental monitoring.

4.1 Public Reporting

Providing access to relevant and transparent information is an important component of aquaculture management in BC. The Conditions of Licence for shellfish aquaculture require licence holders to submit a number of reports on a regular basis which relate to ongoing facility operations. Information contained in many of these reports is released publicly by DFO through its aquaculture public reporting website. In addition to the review of information submitted by industry, both DFO aquaculture staff and the dedicated Conservation and Protection unit provide audit and compliance monitoring and inspections. Publicly released information for shellfish aquaculture is available on the DFO website: http://www.pac.dfo-mpo.gc.ca/aquaculture/reporting-rapports/index-eng.html.

The following types of information are made publicly available:

- General Licence Information: The general shellfish aquaculture Conditions of Licence are provided on-line. More detailed conditions may be added to a licence on a site specific basis or within a particular geographic area.
- Licence Holder Information: Information includes licence holder/operating party name, site and general location, and species licensed for cultivation.
- Summary reports of transfer activities.
- Summary report of Conservation and Protection compliance assessment activities.

In addition, every aquaculture licence holder is required to submit an annual Aquaculture Annual Statistical Report which provides additional information relating to the performance of the aquaculture industry in BC.

4.2 Evaluation of Performance

DFO is committed to a process of adaptive and continuous improvement in the management of shellfish aquaculture. The SF-IMAP sets out general direction and guidance with respect to management objectives, management measures, and public reporting/industry performance. The management of aquaculture takes place within a broader framework of the objective of ensuring sustainability of the aquaculture industry by the Government of Canada.

As the shellfish aquaculture management framework continues to develop, information gained through reporting required by the Conditions of Licence, information compiled from the Aquaculture Annual Statistics Report, along with DFO and provincial agency-collected data, will be used to assist in ongoing reviews of both the performance of shellfish industry and the shellfish management framework.