

AQUACULTURE BASICS

Aquaculture is the farming of aquatic organisms in fresh or salt water. Canadian aquaculturists farm various species of finfish (e.g., salmon, trout, char, sturgeon, tilapia, halibut), shellfish (e.g., oysters, mussels, clams, scallops, shrimp), and aquatic plants. Fish are farmed on land in tanks or ponds and in lakes and oceans in cages or netted pens.

There are fish farms in every province in Canada, as well as the Yukon.¹

Why fish farming? Aren't there enough fish in the wild?

- **Aquaculture takes place in controlled environments.** Fish are protected from predators and health can be carefully monitored.
- **It's a more reliable, consistent way of producing fish.** Fish require about 40 nutrients to be healthy and grow. Farmers are able to provide well-balanced diets to ensure optimal growth.
- **Fish farms can operate year round.** Efficiency and cost savings in production results in lower prices for consumers. Salmon and shrimp, once considered luxury items, have become fairly commonplace on Canadian tables.
- **Farming fish may help conserve wild fish stocks.** Overfishing has resulted in declining numbers of wild fish, e.g., Pacific salmon and Atlantic cod. Consumption of farmed fish may help to decrease the pressure to harvest stocks of wild fish.²

The Department of Fisheries and Oceans Canada and each province are responsible to ensure that aquaculture is managed sustainably across the country.³

Fish farming: issues

As a relatively new industry, fish farming has been faced with challenges and controversies, such as:

- Managing waste from fish farming operations
- The possibility of escaped fish breeding with wild species
- Transmission of diseases among farmed fish to wild stocks
- Using fishmeal and oil made from wild fish for feed, while wild fish stocks are being depleted worldwide
- The impact that new species of fish may have on lake and marine ecosystems

Fishmeal and fish oil (made from fish such as herring, mackerel, anchovies and sardines) are well-balanced, natural sources of nutrients for fish. Globally, aquaculture uses about half a metric ton of wild whole fish combined with other nutrient sources to produce one metric ton of farmed seafood.⁴

Partnerships among the industry, government, and universities are developing innovative solutions to these challenges by:

¹ Fisheries and Oceans Canada. (July 10, 2012). *Aquaculture in Canada 2012: A Report on Aquaculture Sustainability*. <http://www.dfo-mpo.gc.ca/aquaculture/lib-bib/asri-irda/asri-irda-2012-eng.htm# 3.2>

² University of British Columbia Faculty of Law. (2007). *Salmon Farming in British Columbia*. http://www.allard.ubc.ca/sites/www.law.ubc.ca/files/uploads/enlaw/pdfs/salmonfarming04_20_09.pdf

³ Justice Laws Website. (June 30, 2017). *Fisheries Act* (R.S.C., 1985, c. F-14). <http://laws-lois.justice.gc.ca/eng/acts/F-14/>

⁴ Office of Aquaculture, National Oceanic and Atmospheric Administration (USA). (No date). "Feeds for Aquaculture." http://www.nmfs.noaa.gov/aquaculture/faqs/faq_feeds.html#1what

- following strict codes of practice to control waste management and contain fish within pens
- developing vegetable and insect-based proteins and oils for fish feeds
- using selective breeding programs to develop disease resistance in fish
- vaccinating fish to help manage diseases that could potentially affect wild stocks
- closely monitoring fish farms and the surrounding environment with modern technology such as robots, video cameras and smart phones

Fisheries and Oceans Canada works with the Canadian Food Inspection Agency to deliver the **National Aquatic Animal Health Program** to prevent, control and/or eradicate aquatic animal diseases. In order to import aquatic animals and/or move fish within provinces, permits are required from the Canadian Food Inspection Agency to ensure all the requirements are met according to⁵ *Health of Animals Act* and Regulations.

Globally, fish are the primary source of animal protein. Aquaculture accounts for more than 50% of the world's fish consumption.⁶ Due to anticipated population growth and increasing demand for seafood, aquaculture will increasingly be relied on to fill the growing supply-demand gap⁷ because wild fish stocks are currently fished to their limits.

⁵ Fisheries and Oceans Canada. (February 3, 2016). "Fish Health Protection Regulations." <http://www.dfo-mpo.gc.ca/science/environmental-environnement/aah-saa/regulation-reglements-eng.htm>

⁶ Canadian Aquaculture Industry Alliance. (No date.) "Farmers Feed the World." <http://www.aquaculture.ca/farmers-feed-the-world/>

⁷ *FISH TO 2030 Prospects for Fisheries and Aquaculture*. WORLD BANK REPORT NUMBER 83177-GLB. <http://www.fao.org/docrep/019/i3640e/i3640e.pdf>

Farm Photos Suggestions:

- **Salmon Farm**



- Salmon Farm
- **Indoor fish farm (trout or tilapia)**
- Indoor salmon farm (land-based recirculating aquaculture system RAS)
- **Windmill aerator in dugout**
- Indoor Tilapia Farm (land-based recirculating aquaculture system RAS)
- Shellfish Hatchery
- Oyster Farm
- Harvesting Oyster (grown in trays)
- Harvesting Mussels from a Farm
- **Types of fisheries** - <http://www.dfo-mpo.gc.ca/aquaculture/lib-bib/asri-irda/images/asri-irda-2012-eng-03.gif>

References

- The Atlantic Canada Fish Farmers Association (ACFFA). (No date). "Growing Our Fish." <http://www.atlanticfishfarmers.com/growing-our-fish/>
- Canadian Aquaculture Industry Alliance. (No date). <http://www.aquaculture.ca/>
- Fisheries and Oceans Canada. (July 10, 2012). *Aquaculture in Canada 2012: A Report on Aquaculture Sustainability*. <http://www.dfo-mpo.gc.ca/aquaculture/lib-bib/asri-irda/asri-irda-2012-eng.htm# 3.2>
- Fisheries and Oceans Canada. (1998). *Factors Affecting the Health of Farmed and Wild Fish Populations: A Perspective from British Columbia*. http://www.dfo-mpo.gc.ca/CSAS/Csas/DocREC/1998/98_168_e.pdf
- Fisheries and Oceans Canada. (February 3, 2016). "Fish Health Protection Regulations." <http://www.dfo-mpo.gc.ca/science/environmental-environnement/aah-saa/regulation-reglements-eng.htm>
- Food and Agriculture Organization of the United Nations. (FAO). (No date). "Fish and Human Nutrition." http://www.fao.org/fileadmin/user_upload/newsroom/docs/BlueGrowthNutritionRev2.pdf
- Harvard School of Public Health. (2017). "Omega-3 Fatty Acids: An Essential Contribution." <https://www.hsph.harvard.edu/nutritionsource/omega-3-fats/>
- Justice Laws Website. (June 30, 2017). *Fisheries Act* (R.S.C., 1985, c. F-14). <http://laws-lois.justice.gc.ca/eng/acts/F-14/>
- Office of Aquaculture, National Oceanic and Atmospheric Administration (USA). (No date). "Feeds for Aquaculture." http://www.nmfs.noaa.gov/aquaculture/faqs/faq_feeds.html#1what
- Positive Aquaculture Awareness. (No date). "Environment." <http://www.farmfreshsalmon.org/environment%E2%80%9393facts-about-fish-farming>
- Standing Senate Committee on Fisheries and Oceans. (July 2015). *Volume One – Aquaculture Industry and Governance in Canada*. <https://sencanada.ca/content/sen/committee/412/pofo/rep/rep12jul15Vol1-e.pdf>
- University of British Columbia Faculty of Law. (2007). *Salmon Farming in British Columbia*. http://www.allard.ubc.ca/sites/www.law.ubc.ca/files/uploads/enlaw/pdfs/salmonfarming04_20_09.pdf

More information

- Alberta Agriculture and Forestry. (December 1, 1999). "Predator Damage Control in Cultured Fish." [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex821](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex821)
- Davidson, Carla, University of Waterloo. (August 1999). *The Salmon Aquaculture Review: Facing Ecological Complexity and Scientific Uncertainty in the First Policy Level Assessment Under British Columbia's Environmental Assessment Act*. <https://uwaterloo.ca/assessment-planning-project/sites/ca.assessment-planning-project/files/uploads/files/BC%202%20Davidson%20salmon%20aquaculture.pdf>

Fisheries and Oceans Canada. (January 24, 2017). "Aquaculture." <http://www.dfo-mpo.gc.ca/stats/aquaculture-eng.htm>

Government of British Columbia. (No date). "Historical Fish Health Reports." <http://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/fisheries-and-aquaculture/aquaculture/fish-health>

Health Canada. (2011) *Recommended Number of Food Guide Servings per Day*. https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/fn-an/alt_formats/hpfb-dgpsa/pdf/food-guide-aliment/view_eatwell_vue_bienmang-eng.pdf

Justice Laws Website. (June 30, 2017). "Aquaculture Activities Regulations (SOR/2015-177)." <http://www.laws.justice.gc.ca/eng/regulations/SOR-2015-177/index.html>

Kerr, Steven J. and Ruth. E. Grant, Ontario Ministry of Natural Resources (March 2000). *Ecological Impacts of Fish Introductions: Evaluating the Risk*. <http://www.mffp.gouv.qc.ca/faune/peche/ensemencement/Pdf/impacts-ecologiques-en.pdf>

Parliament of Canada. (February 23, 2013). "Aquaculture in Canada." <https://lop.parl.ca/Content/LOP/ResearchPublications/2013-12-e.htm>

Statistics Canada. (November 17, 2016). "Aquaculture Statistics." <http://www.statcan.gc.ca/pub/23-222-x/2015000/part-partie1-eng.htm>

Guide to Intensive Aquaculture in Manitoba
<http://gov.mb.ca/waterstewardship/fisheries/commercial/aqua.pdf>

This spreadsheet has been sorted by licence holder name (last update: August 3, 2017)

| Facility Reference Number | Licence Number | Landfile Number | Licence Holder | Region | Facility Type | Species |
|---------------------------|----------------|-----------------|----------------------------------|------------------------|--|---|
| 508 | AQFW 112608 | | Arthur Watson | Vancouver Island-South | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 434 | AQFW 112626 | | Barry Ellison Bulldozing Ltd. | Vancouver Island-East | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 7373 | AQFW 112640 | | BC 0996791 B.C. Ltd. | Vancouver Island-South | Shellfish Hatchery | |
| 7673 | AQFW 116308 | | Berezan Shrimp Company Ltd | Lower Mainland | Shellfish Hatchery, Growout Operations | Whiteleg Shrimp (<i>Litopenaeus vannamei</i>) |
| 640 | AQFW 112744 | | Bernard A. Chandler | Vancouver Island-South | Finfish Hatchery, Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 8033 | AQFW 114987 | | Blue Roots Farm Inc. | Vancouver Island-South | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 315 | AQFW 112805 | 2403908 | Brad Gustafson | Lower Mainland | Finfish Hatchery, Growout Operations | Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 7093 | AQFW 112605 | | Bryan Bradford | Vancouver Island-South | Growout Operations | Nile Tilapia (<i>Oreochromis niloticus</i>) |
| 52 | AQFW 112610 | | Byron Anderson | Thompson-Nicola | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1602 | AQFW 112723 | | C.H.Baykey Ltd | Thompson-Nicola | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 600 | AQFW 115528 | | Cascade Creek Fish Ltd | Lower Mainland | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 691 | AQFW 115274 | | Cermaq Canada Ltd | Vancouver Island-South | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>) |
| 506 | AQFW 115447 | 1401593 | Cermaq Canada Ltd | Vancouver Island-East | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>) |
| 317 | AQFW 115250 | | Cermaq Canada Ltd | Vancouver Island-East | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 180 | AQFW 115268 | | Cermaq Canada Ltd | Vancouver Island-South | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>) |
| 313 | AQFW 112600 | | Cheryl Zeitner and Ron Zeitner | Lower Mainland | Finfish Hatchery | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 703 | AQFW 112807 | | Chris Teasdale and Mark Teasdale | Kootenay | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 260 | AQFW 112922 | | Cinnabar Valley Farms Ltd. | Vancouver Island-South | Finfish Hatchery, Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 5135 | AQFW 112598 | | Coastal Shellfish Corporation | Prince Rupert District | Shellfish Hatchery | California Sea Cucumber (<i>Parastichopus californicus</i>), Geoduck Clam (<i>Panopea generosa</i>), Japanese Scallop (<i>Mizuhopecten yessoensis</i>), Manila Clam (<i>Venerupis philippinarum</i>), Pacific Oyster (<i>Crassostrea gigas</i>), Pacific Scallop (<i>Patinopecten caurinus</i> x <i>yessoensis</i>), Weathervane Scallop (<i>Patinopecten caurinus</i>) |
| 445 | AQFW 115247 | | Creative Salmon Company Ltd. | Vancouver Island-South | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1610 | AQFW 112689 | | Debra Oakman and Dennis Oakman | Vancouver Island-East | Growout Operations, U-catch Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |

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|---------------------------|----------------|-----------------|------------------------------------|------------------------|--|---|
| 1866 | AQFW 112597 | | Dokey Resources Ltd. | Vancouver Island-South | Growout Operations, U-catch Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1740 | AQFW 112594 | | Donald A. Barnes | Vancouver Island-South | Finfish Hatchery | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 6673 | AQFW 115279 | | Dorocco Developments Ltd. | Okanagan | Finfish Hatchery | Arctic Char (<i>Salvelinus alpinus</i>) |
| 5129 | AQFW 116227 | | Eco Smart Home Improvements Ltd. | Vancouver Island-South | Growout Operations | Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 51 | AQFW 112592 | | Eldon Talbot and Ruth Talbot | Thompson-Nicola | Growout Operations, U-catch Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 8093 | AQFW 115567 | | Emerald Acres Organic Farms Ltd. | South Coast Central | U-catch Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 6941 | AQFW 112944 | | Frederick Vernon Thom | Vancouver Island West | Finfish Hatchery, Growout Operations | Nile Tilapia (<i>Oreochromis niloticus</i>) |
| 1540 | AQFW 112804 | | Garth O. Macdonnell | Okanagan | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1040 | AQFW 112587 | | Gavin A. Tims | Lower Mainland | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 448 | AQFW 112585 | | Gerry Matusky and E. Marie Matusky | Thompson-Nicola | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1449 | AQFW 113807 | | Golden Eagle Aquaculture Ltd. | Lower Mainland | Finfish Hatchery, Growout Operations | Atlantic Salmon (<i>Salmo salar</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1696 | AQFW 116267 | | Golden Eagle Sable Fish Inc. | Vancouver Island-South | Finfish Hatchery, Growout Operations | Sablefish (<i>Anoplopoma fimbria</i>) |
| 1680 | AQFW 115270 | | Grieg Seafood BC Ltd. | Vancouver Island-North | Finfish Hatchery, Growout Operations | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>) |
| 1625 | AQFW 116472 | | Hub City Fisheries Ltd | South Coast | Finfish Hatchery | Sablefish (<i>Anoplopoma fimbria</i>) |
| 7593 | AQFW 112947 | | Hummingbird Cove Lifestyles Ltd | South Coast | Shellfish Hatchery, Growout Operations | Butter Clam (<i>Saxidomus gigantea</i>), California Sea Cucumber (<i>Parastichopus californicus</i>), Eastern Blue Mussel (<i>Mytilus edulis</i>), Eastern Oyster (<i>Crassostrea virginica</i>), European Oyster (<i>Ostrea edulis</i>), Gallo Mussel (<i>Mytilus galloprovincialis</i>), Geoduck Clam (<i>Panopea generosa</i>), Giant Rock Scallop (<i>Crassadoma gigantea</i>), Green Sea Urchin (<i>Strongylocentrotus droebachiensis</i>), Horse Clam (<i>Tresus</i>), Japanese Scallop (<i>Mizuhopecten yessoensis</i>), Kumamoto Oyster (<i>Crassostrea sikamea</i>), Littleneck Clam (<i>Protothaca staminea</i>), Manila Clam (<i>Venerupis philippinarum</i>), Nuttall Cockle (<i>Clinocardium nuttallii</i>), Pacific Oyster (<i>Crassostrea gigas</i>), Pacific Scallop (<i>Patinopecten caurinus</i> x <i>yessoensis</i>), Pink Scallop (<i>Chlamys rubida</i>), Red Sea Urchin (<i>Strongylocentrotus franciscanus</i>), Sea Scallop (<i>Placopecten magellanicus</i>), Spiny Scallop (<i>Chlamys hastata</i>), Weathervane Scallop (<i>Patinopecten caurinus</i>), Western Blue Mussel (<i>Mytilus trossulus</i>) |

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|---------------------------|----------------|-----------------|-------------------------------------|------------------------|--|--|
| 1214 | AQFW 112624 | | Innovative Aquaculture Products Ltd | Vancouver Island-East | Shellfish Hatchery | Eastern Blue Mussel (<i>Mytilus edulis</i>), European Oyster (<i>Ostrea edulis</i>), Gallo Mussel (<i>Mytilus galloprovincialis</i>), Geoduck Clam (<i>Panopea generosa</i>), Giant Rock Scallop (<i>Crassadoma gigantea</i>), Green Sea Urchin (<i>Strongylocentrotus droebachiensis</i>), Japanese Scallop (<i>Mizuhopecten yessoensis</i>), Manila Clam (<i>Venerupis philippinarum</i>), Nuttall Cockle (<i>Clinocardium nuttallii</i>), Pacific Oyster (<i>Crassostrea gigas</i>), Purple Sea Urchin (<i>Strongylocentrotus purpuratus</i>), Red Sea Urchin (<i>Strongylocentrotus franciscanus</i>) |
| 164 | AQFW 112635 | | Island Scallops Ltd. | Vancouver Island-South | Finfish Hatchery/Shellfish Hatchery | Sablefish (<i>Anoplopoma fimbria</i>), Brown Rockfish (<i>Sebastes auriculatus</i>), California Sea Cucumber (<i>Parastichopus californicus</i>), Copper Rockfish (<i>Sebastes caurinus</i>), Dungeness Crab (<i>Cancer magister</i>), Eastern Blue Mussel (<i>Mytilus edulis</i>), Eastern Oyster (<i>Crassostrea virginica</i>), European Oyster (<i>Ostrea edulis</i>), Gallo Mussel (<i>Mytilus galloprovincialis</i>), Geoduck Clam (<i>Panopea generosa</i>), Giant Rock Scallop (<i>Crassadoma gigantea</i>), Green Sea Urchin (<i>Strongylocentrotus droebachiensis</i>), Horse Clam (<i>Tresus</i>), Lingcod (<i>Ophiodon elongatus</i>), Manila Clam (<i>Venerupis philippinarum</i>), Pacific Halibut (<i>Hippoglossus stenolepis</i>), Pacific Oyster (<i>Crassostrea gigas</i>), Pacific Scallop (<i>Patinopecten caurinus</i> x <i>yessoensis</i>), Purple Sea Urchin (<i>Strongylocentrotus purpuratus</i>), Red Sea Urchin (<i>Strongylocentrotus franciscanus</i>), Sea Scallop (<i>Placopecten magellanicus</i>), Spot Prawn (<i>Pandalus platyceros</i>), Weathervane Scallop (<i>Patinopecten caurinus</i>), Wolf Eel (<i>Anarrhichthys ocellatus</i>) |
| 1523 | AQFW 112578 | | Island Sea Farms Inc. | South Coast | Shellfish Hatchery | Eastern Blue Mussel (<i>Mytilus edulis</i>), Gallo Mussel (<i>Mytilus galloprovincialis</i>), Geoduck Clam (<i>Panopea generosa</i>), Manila Clam (<i>Venerupis philippinarum</i>), Pacific Scallop (<i>Patinopecten caurinus</i> x <i>yessoensis</i>) |
| 1456 | AQFW 112688 | | James Charles Mcpike | Lower Mainland | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 641 | AQFW 112625 | | John Neil Nickolichuk | Vancouver Island-South | Finfish Hatchery, Growout Operations | Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>), Signal Crayfish (<i>Pacifastacus leniusculus</i>), Sockeye Salmon (<i>Oncorhynchus nerka</i>) |
| 199 | AQFW 112577 | | Kenneth E. Brown | Thompson-Nicola | Finfish Hatchery, Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 628 | AQFW 112575 | | Kerry Gregg Husson | Vancouver Island-South | Finfish Hatchery, Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 154 | AQFW 113268 | | Kootenay West Aqua Resources Ltd. | Kootenay | Finfish Hatchery, Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 5142 | AQFW 112803 | | Kuterra General Partner Inc | Vancouver Island-North | Growout Operations | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 155 | AQFW 112687 | | Linda L Moss | Thompson-Nicola | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 237 | AQFW 112574 | | Lorraine Van De Weghe | Cariboo | Growout Operations, U-catch Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 6913 | AQFW 112822 | | Magna Pacific Agriculture Ltd. | Lower Mainland | Growout Operations | Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |

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|---------------------------|----------------|-----------------|--------------------------------|------------------------|--|--|
| 1617 | AQFW 116127 | | Manatee Holdings Ltd. | Vancouver Island-East | Shellfish Hatchery, Growout Operations | California Sea Cucumber (<i>Parastichopus californicus</i>), Eastern Blue Mussel (<i>Mytilus edulis</i>), Eastern Oyster (<i>Crassostrea virginica</i>), Gallo Mussel (<i>Mytilus galloprovincialis</i>), Geoduck Clam (<i>Panopea generosa</i>), Giant Rock Scallop (<i>Crassadoma gigantea</i>), Green Sea Urchin (<i>Strongylocentrotus droebachiensis</i>), Horse Clam (<i>Tresus</i>), Kumamoto Oyster (<i>Crassostrea sikamea</i>), Manila Clam (<i>Venerupis philippinarum</i>), Nuttall Cockle (<i>Clinocardium nuttallii</i>), Pacific Oyster (<i>Crassostrea gigas</i>), Pacific Scallop (<i>Patinopecten caurinus</i> x <i>yessoensis</i>), Pink Scallop (<i>Chlamys rubida</i>), Purple Sea Urchin (<i>Strongylocentrotus purpuratus</i>), Red Sea Urchin (<i>Strongylocentrotus franciscanus</i>), Spiny Scallop (<i>Chlamys hastata</i>), Weathervane Scallop (<i>Patinopecten caurinus</i>), Western Blue Mussel (<i>Mytilus trossulus</i>) |
| 1692 | AQFW 115254 | | Marine Harvest Canada Inc. | Vancouver Island-North | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>) |
| 1689 | AQFW 115255 | 5406670 | Marine Harvest Canada Inc. | Cariboo | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>) |
| 1111 | AQFW 112683 | 1405320 | Marine Harvest Canada Inc. | Vancouver Island-North | Growout Operations | Atlantic Salmon (<i>Salmo salar</i>) |
| 447 | AQFW 115253 | | Marine Harvest Canada Inc. | Vancouver Island-East | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 353 | AQFW 112686 | 1404749 | Marine Harvest Canada Inc. | Vancouver Island-North | Growout Operations | Atlantic Salmon (<i>Salmo salar</i>) |
| 271 | AQFW 115267 | | Marine Harvest Canada Inc. | Vancouver Island-South | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 79 | AQFW 115269 | 1403852 | Marine Harvest Canada Inc. | Vancouver Island-East | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>) |
| 47 | AQFW 115271 | | Marine Harvest Canada Inc. | Vancouver Island-East | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>) |
| 5132 | AQFW 112564 | | Matthias Zapletal | Cariboo | Growout Operations | Barramundi (<i>Lates calcarifer</i>), Nile Tilapia (<i>Oreochromis niloticus</i>) |
| 693 | AQFW 115827 | | Miracle Springs Inc. | Lower Mainland | Finfish Hatchery, Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 676 | AQFW 116347 | | Miracle Springs Inc. | Lower Mainland | Finfish Hatchery, Growout Operations | Arctic Char (<i>Salvelinus alpinus</i>), Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 585 | AQFW 116628 | | Northern Divine Aquafarms Ltd. | Lower Mainland | Finfish Hatchery, Growout Operations | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>), White Sturgeon (<i>Acipenser transmontanus</i>) |

This spreadsheet has been sorted by licence holder name (last update: August 3, 2017)

| Facility Reference Number | Licence Number | Landfile Number | Licence Holder | Region | Facility Type | Species |
|---------------------------|----------------|-----------------|----------------------------------|------------------------|--|---|
| 6667 | AQFW 112743 | | Nova Harvest Ltd. | Vancouver Island West | Shellfish Hatchery | California Sea Cucumber (<i>Parastichopus californicus</i>), Gallo Mussel (<i>Mytilus galloprovincialis</i>), Geoduck Clam (<i>Panopea generosa</i>), Giant Rock Scallop (<i>Crassadoma gigantea</i>), Green Sea Urchin (<i>Strongylocentrotus droebachiensis</i>), Japanese Scallop (<i>Mizuhopecten yessoensis</i>), Kumamoto Oyster (<i>Crassostrea sikamea</i>), Manila Clam (<i>Venerupis philippinarum</i>), Nuttall Cockle (<i>Clinocardium nuttallii</i>), Pacific Oyster (<i>Crassostrea gigas</i>), Pacific Scallop (<i>Patinopecten caurinus</i> x <i>yessoensis</i>), Red Sea Urchin (<i>Strongylocentrotus franciscanus</i>), Weathervane Scallop (<i>Patinopecten caurinus</i>), Western Blue Mussel (<i>Mytilus trossulus</i>) |
| 252 | AQFW 113467 | | N'Quatqua Fisheries Inc. | Thompson-Nicola | Finfish Hatchery | Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>), Sockeye Salmon (<i>Oncorhynchus nerka</i>) |
| 504 | AQFW 116447 | | Omega Pacific Hatchery Inc. | Vancouver Island-North | Finfish Hatchery, Growout Operations | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>), Signal Crayfish (<i>Pacifastacus leniusculus</i>), Sockeye Salmon (<i>Oncorhynchus nerka</i>), White Sturgeon (<i>Acipenser transmontanus</i>) |
| 387 | AQFW 114672 | 2402378 | Paradise Trading Corporation | Lower Mainland | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>) |
| 5115 | AQFW 113022 | | R.E.H Fish Farm Ltd | Lower Mainland | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 6717 | AQFW 113527 | | Raincoast Aquaponics | Vancouver Island-South | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>), White Sturgeon (<i>Acipenser transmontanus</i>) |
| 340 | AQFW 112561 | | Redekopp Resources | Vancouver Island-East | Growout Operations | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 210 | AQFW 112802 | | Richard Henly | Lower Mainland | Finfish Hatchery, Growout Operations | Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>), Sockeye Salmon (<i>Oncorhynchus nerka</i>) |
| 7633 | AQFW 113790 | | Richmond Hi-Tech Shrimp Farm Inc | Lower Mainland | Shellfish Hatchery, Growout Operations | Whiteleg Shrimp (<i>Litopenaeus vannamei</i>) |
| 1139 | AQFW 112559 | | Rick Thomson | Omineca | Finfish Hatchery | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1490 | AQFW 112560 | | Robert J. Farrer | Okanagan | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 457 | AQFW 116427 | 2407531 | Saltstream Engineering Ltd. | Discovery | Finfish Hatchery | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>) |
| 8193 | AQFW 116108 | | Save the Oceans Incorporated | Lower Mainland | Growout Operations | Nile Tilapia (<i>Oreochromis niloticus</i>) |
| 6713 | AQFW 112606 | | Sc'ianew First Nation | South Coast | Shellfish Hatchery | California Sea Cucumber (<i>Parastichopus californicus</i>), Eastern Blue Mussel (<i>Mytilus edulis</i>), Gallo Mussel (<i>Mytilus galloprovincialis</i>), Geoduck Clam (<i>Panopea generosa</i>), Giant Rock Scallop (<i>Crassadoma gigantea</i>), Japanese Scallop (<i>Mizuhopecten yessoensis</i>), Manila Clam (<i>Venerupis philippinarum</i>), Pacific Oyster (<i>Crassostrea gigas</i>), Pacific Scallop (<i>Patinopecten caurinus</i> x <i>yessoensis</i>), Western Blue Mussel (<i>Mytilus trossulus</i>) |

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| Facility Reference Number | Licence Number | Landfile Number | Licence Holder | Region | Facility Type | Species |
|---------------------------|----------------|-----------------|---|------------------------|--|---|
| 6718 | AQFW 115387 | | Seed Science Ltd. | Vancouver Island-South | Shellfish Hatchery, Growout Operations | Butter Clam (<i>Saxidomus gigantea</i>), California Sea Cucumber (<i>Parastichopus californicus</i>), Dungeness Crab (<i>Cancer magister</i>), Eastern Blue Mussel (<i>Mytilus edulis</i>), Eastern Oyster (<i>Crassostrea virginica</i>), European Oyster (<i>Ostrea edulis</i>), Gallo Mussel (<i>Mytilus galloprovincialis</i>), Geoduck Clam (<i>Panopea generosa</i>), Giant Rock Scallop (<i>Crassadoma gigantea</i>), Green Sea Urchin (<i>Strongylocentrotus droebachiensis</i>), Horse Clam (<i>Tresus</i>), Japanese Scallop (<i>Mizuhopecten yessoensis</i>), Kumamoto Oyster (<i>Crassostrea sikamea</i>), Manila Clam (<i>Venerupis philippinarum</i>), Nuttall Cockle (<i>Clinocardium nuttallii</i>), Pacific Oyster (<i>Crassostrea gigas</i>), Pacific Scallop (<i>Patinopecten caurinus</i> x <i>yessoensis</i>), Pink Scallop (<i>Chlamys rubida</i>), Purple Sea Urchin (<i>Strongylocentrotus purpuratus</i>), Red Sea Urchin (<i>Strongylocentrotus franciscanus</i>), Sea Scallop (<i>Placopecten magellanicus</i>), Spiny Scallop (<i>Chlamys hastata</i>), Spot Prawn (<i>Pandalus platyceros</i>), Weathervane Scallop (<i>Patinopecten caurinus</i>), Western Blue Mussel (<i>Mytilus trossulus</i>) |
| 6973 | AQFW 112742 | | Shelter Point Farms Ltd. | Vancouver Island-East | Growout Operations | Coho Salmon (<i>Oncorhynchus kisutch</i>) |
| 49 | AQFW 112557 | | Silverbrook Farm | Lower Mainland | Growout Operations, U-catch Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 7653 | AQFW 113267 | | Souvonia Cao | Vancouver Island-South | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 696 | AQFW 113367 | | Stan Webb | Vancouver Island-North | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1588 | AQFW 116148 | | Steve Pafos | Okanagan | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1920 | AQFW 112556 | | Sumas Lake Aquafarm Ltd. | Lower Mainland | Growout Operations | Nile Tilapia (<i>Oreochromis niloticus</i>) |
| 673 | | | Sun Valley Trout Park Inc. | | | |
| 673 | AQFW 112555 | | Sun Valley Trout Park Inc. | Lower Mainland | Finfish Hatchery, Growout Operations, U-catch Operations | Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Steelhead Trout (<i>Oncorhynchus mykiss</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 7793 | AQFW 113548 | | Sunshine Coast Aquaponics Ltd | South Coast | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>), Nile Tilapia (<i>Oreochromis niloticus</i>), White Sturgeon (<i>Acipenser transmontanus</i>) |
| 667 | AQFW 112554 | 2401621 | Sunshine Coast Salmonid Enhancement Society | Lower Mainland | Finfish Hatchery | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 6690 | AQFW 113002 | 2401858 | Super Shell Enterprises Ltd | Lower Mainland | Shellfish Hatchery, Growout Operations | California Sea Cucumber (<i>Parastichopus californicus</i>), Gallo Mussel (<i>Mytilus galloprovincialis</i>), Geoduck Clam (<i>Panopea generosa</i>), Green Sea Urchin (<i>Strongylocentrotus droebachiensis</i>), Manila Clam (<i>Venerupis philippinarum</i>), Pacific Oyster (<i>Crassostrea gigas</i>), Pacific Scallop (<i>Patinopecten caurinus</i> x <i>yessoensis</i>), Red Sea Urchin (<i>Strongylocentrotus franciscanus</i>) |
| 285 | AQFW 112623 | | Susan Eha and Karl Eha | Lower Mainland | Growout Operations, U-catch Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |

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| Facility Reference Number | Licence Number | Landfile Number | Licence Holder | Region | Facility Type | Species |
|---------------------------|----------------|-----------------|--|------------------------|--|--|
| 1594 | AQFW 112630 | | Taste Of BC Aquafarms Inc. and H. Steve Atkinson | Vancouver Island-South | Finfish Hatchery, Growout Operations | Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>), White Sturgeon (<i>Acipenser transmontanus</i>) |
| 5116 | AQFW 112783 | | Teresa Erb | Vancouver Island-South | Finfish Hatchery, Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 608 | AQFW 114067 | | Thomas Reuter | Lower Mainland | Finfish Hatchery, Growout Operations, U-catch Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1502 | AQFW 113043 | | Tim Thurston and Pat Thurston | Thompson-Nicola | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 6731 | AQFW 112762 | | Tran Aquaculture Ltd | Lower Mainland | Finfish Hatchery, Growout Operations | Barramundi (<i>Lates calcarifer</i>), Nile Tilapia (<i>Oreochromis niloticus</i>) |
| 7113 | AQFW 112550 | | Tree To Me Agricultural Products Inc | Okanagan | U-catch Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |
| 1582 | AQFW 112549 | | Unique Sea Farms Ltd. | Vancouver Island-South | Shellfish Hatchery | Butter Clam (<i>Saxidomus gigantea</i>), California Sea Cucumber (<i>Parastichopus californicus</i>), Eastern Blue Mussel (<i>Mytilus edulis</i>), Gallo Mussel (<i>Mytilus galloprovincialis</i>), Geoduck Clam (<i>Panopea generosa</i>), Green Sea Urchin (<i>Strongylocentrotus droebachiensis</i>), Horse Clam (<i>Tresus</i>), Manila Clam (<i>Venerupis philippinarum</i>), Nuttall Cockle (<i>Clinocardium nuttallii</i>), Pacific Oyster (<i>Crassostrea gigas</i>), Pacific Scallop (<i>Patinopecten caurinus x yessoensis</i>), Red Sea Urchin (<i>Strongylocentrotus franciscanus</i>) |
| 275 | AQFW 112548 | | Unique Sea Farms Ltd. | South Coast Central | Growout Operations | Atlantic Salmon (<i>Salmo salar</i>), Sablefish (<i>Anoplopoma fimbria</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Steelhead Trout (<i>Oncorhynchus mykiss</i>), Lingcod (<i>Ophiodon elongatus</i>), Pacific Halibut (<i>Hippoglossus stenolepis</i>), Wolf Eel (<i>Anarrhichthys ocellatus</i>) |
| 6733 | AQFW 112908 | | Vancouver Island University | Vancouver Island-South | Shellfish Hatchery | Eastern Oyster (<i>Crassostrea virginica</i>), European Oyster (<i>Ostrea edulis</i>), Geoduck Clam (<i>Panopea generosa</i>), Japanese Scallop (<i>Mizuhopecten yessoensis</i>), Littleneck Clam (<i>Protothaca staminea</i>), Nuttall Cockle (<i>Clinocardium nuttallii</i>), Pacific Oyster (<i>Crassostrea gigas</i>) |
| 6709 | AQFW 116387 | | Vancouver Island University | South Coast | Finfish Hatchery, Growout Operations | Atlantic Salmon (<i>Salmo salar</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>), Nile Tilapia (<i>Oreochromis niloticus</i>), White Sturgeon (<i>Acipenser transmontanus</i>) |
| 218 | AQFW 115248 | | Virginia Ann Heath and John Heath | Vancouver Island-South | Finfish Hatchery, Growout Operations | Chinook Salmon (<i>Oncorhynchus tshawytscha</i>) |
| 1893 | AQFW 115848 | | Viva Aquaculture and Seafood Distribution Ltd | Lower Mainland | Growout Operations | Nile Tilapia (<i>Oreochromis niloticus</i>), Whiteleg Shrimp (<i>Litopenaeus vannamei</i>) |
| 1200 | AQFW 112682 | 2404177 | West Coast Fishculture (Lois Lake) Ltd. | Lower Mainland | Growout Operations | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>), Sockeye Salmon (<i>Oncorhynchus nerka</i>) |

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| Facility Reference Number | Licence Number | Landfile Number | Licence Holder | Region | Facility Type | Species |
|---------------------------|----------------|-----------------|--|------------------------|--|--|
| 1128 | AQFW 115487 | 2403659 | West Coast Fishculture (Lois Lake) Ltd. | Lower Mainland | Finfish Hatchery, Growout Operations | Atlantic Salmon (<i>Salmo salar</i>), Chinook Salmon (<i>Oncorhynchus tshawytscha</i>), Coho Salmon (<i>Oncorhynchus kisutch</i>), Rainbow Trout (<i>Oncorhynchus mykiss</i>), Sockeye Salmon (<i>Oncorhynchus nerka</i>), White Sturgeon (<i>Acipenser transmontanus</i>) |
| 6666 | AQFW 112546 | | William Gary Vermeer | Lower Mainland | Growout Operations | Barramundi (<i>Lates calcarifer</i>), Nile Tilapia (<i>Oreochromis niloticus</i>) |
| 7493 | AQFW 116388 | | You Grow Food Aquaponics | Lower Mainland | Shellfish Hatchery, Growout Operations | Signal Crayfish (<i>Pacifastacus leniusculus</i>), Nile Tilapia (<i>Oreochromis niloticus</i>) |
| 6676 | AQFW 116292 | | Zeljko Djuric | Vancouver Island-South | Shellfish Hatchery, Growout Operations | Signal Crayfish (<i>Pacifastacus leniusculus</i>) |
| 5114 | AQFW 116488 | | Zeljko Djuric | Vancouver Island-South | Shellfish Hatchery, Growout Operations | Signal Crayfish (<i>Pacifastacus leniusculus</i>) |
| 7353 | AQFW 113287 | | Zentra-Group-Canada Trading and Development Ltd. | Vancouver Island-South | Growout Operations | Rainbow Trout (<i>Oncorhynchus mykiss</i>) |

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REPRESENTATIVE GROUPS/ASSOCIATIONS

- BC Salmon Farmers Association (BCSFA), www.salmonfarmers.org
- Aboriginal Aquaculture Association, www.aboriginalaquaculture.com
- Freshwater Aquaculture Association of BC
- Land Based Aquaculture Association of Western Canada
- Pacific Organic Seafood Association, www.pacificorganicseafood.com

INDUSTRY DESCRIPTION

- Many of BC's finfish aquaculture companies are vertically integrated; operating hatcheries, grow-out facilities and processing plants.
- BC is the largest producer of farmed salmon in Canada. Canada is the 4th largest producer of farmed salmon in the world, after Norway, Chile and the UK.
- 96% of finfish aquaculture production is Atlantic salmon farmed in marine net pens. Chinook, coho and sablefish are also grown in sea water whereas sockeye, trout, sturgeon, Arctic char, tilapia and some coho are grown in freshwater systems.
- Modern ocean-based salmon farms are now designed with a production capacity of 3,000 tonnes (average) per two-year cycle.
- Currently there are 126 marine finfish licences with an estimated 60-70 are in operation at any one time.
- The typical area of a marine finfish farm lease is 41 hectares. In 2016, a total 5,145 hectares of Crown Land was allocated for production on BC finfish farms, or 0.1 % of available coastal waters within one km of shore.

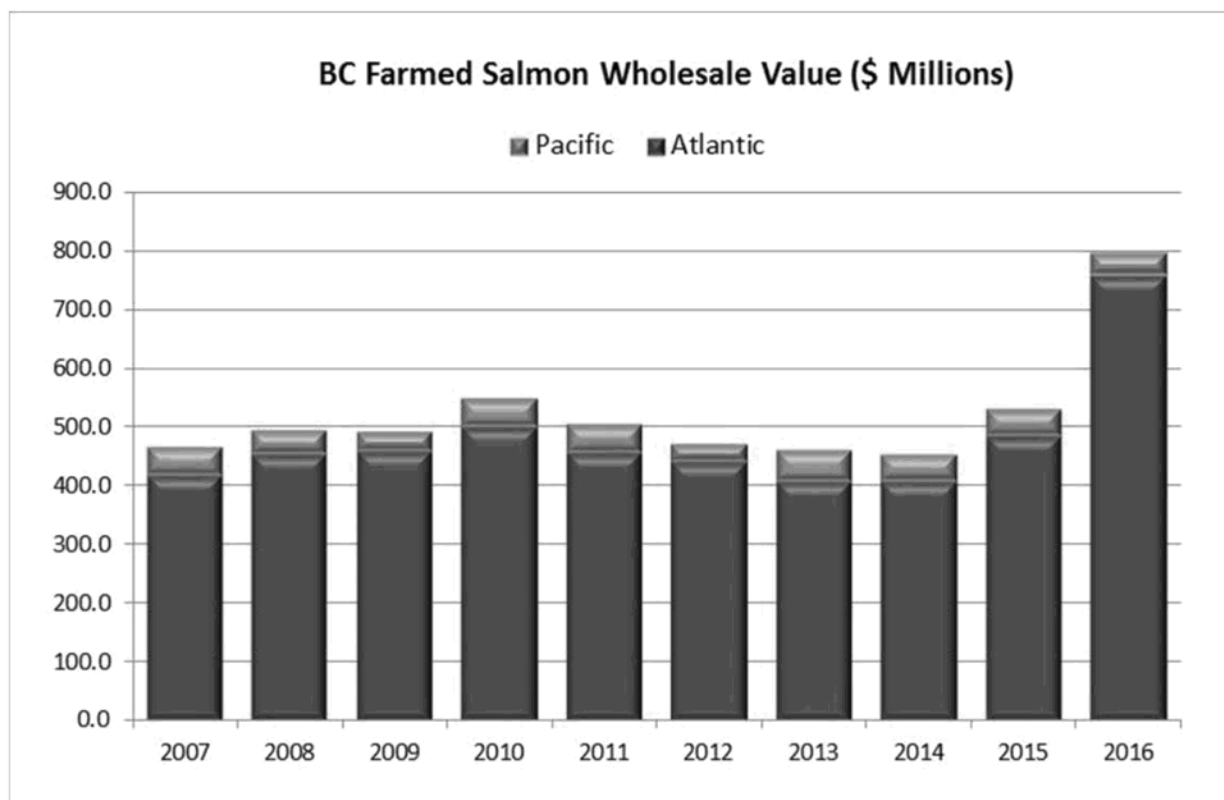
FIRST NATIONS

- Salmon farms are currently located in the traditional territories of at least 28 First Nations (taking into account overlap of territories), with 20 economic and social partnerships in place with BC salmon farmers.
- 78% of BC salmon production comes from areas covered by partnerships with First Nations.
- First Nations communities provide approximately 30% of the workforce on the farms of BC's four largest salmon farming companies.
- Innovations being actively pursued by First Nations include a certification program for Aboriginal Principles for Sustainable Aquaculture and the production of market-size Atlantic salmon in land-based recirculating systems at a commercial scale.

STATISTICS

- In 2016, the wholesale value of farmed salmon was \$796.6 million, amounting to 46% of the total wholesale value of all BC seafood products. Farmed Atlantic salmon is BC's number one seafood species in terms of wholesale value and is the provinces top agricultural export in terms of value.
- Emerging species, including trout, sablefish, Arctic char, sturgeon (including caviar) and tilapia had a wholesale value of approximately \$31 million in 2016.

- Direct employment in all aquaculture sectors is around 1,800 Full Time Equivalents (FTE), mostly in rural coastal communities, with many jobs being held by women and First Nations.



MARKETS

- The top markets were the US, Japan and China. The top BC finfish aquaculture export in 2016 was farmed Atlantic salmon at \$524.2 million.
- BC also exported \$20.0 million in farmed chinook salmon, \$0.5 million in farmed trout and \$0.2 million in farmed coho salmon in 2016.
- Participation in international tradeshow is very important for BC's finfish aquaculture industry, as a large proportion of sales are to foreign markets. BC seafood is served in approximately two billion meals annually in more than 80 countries.

STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS

Strengths

- Global demand for farmed finfish aquaculture products, farmed salmon in particular, far exceeds supply. Prices remain very strong.
- Excellent growing conditions, clean water and environment.
- Proximity to the US and Asian markets which have a strong demand for finfish products.
- 1st major region to receive Monterey Bay Aquarium Sea Food Watch “Good Alternative” rating.
- High degree of involvement with First Nations & associated marketing opportunities.
- Access to research and development resources available locally.

Weaknesses

- Stagnant growth (harvest tonnage) over the last 10 years.
- Complex regulatory framework coupled with a high degree of uncertainty.
- Access to new crown land tenures. Impact of implementing United Nations Declaration on Rights Indigenous People (UNDRIP) unknown with respect to tenure renewal.
- Moratoriums on new farmed salmon sites on the North Coast & Discovery Islands.
- Regulatory costs are higher and more complex in BC relative to other regions in Canada.

Opportunities

- Export demand to the US continues to be strong due to the weak Canada dollar.
- Commitment by the BCSFA to be regionally certified by the Aquaculture Stewardship Council by 2020.
- Production costs are higher than Norway, suggesting there is room to improve competitiveness through innovation.
- Increased access to sites on the North Coast and land-based farms offer growth potential.
- Continued support for First Nations opportunities will improve social licence.
- Promise of a [new] Federal *Aquaculture Act* may reduce regulatory complexity and uncertainty.
- New species & technology development.
- Expanding domestic and Asian markets offers growth potential.

Threats

- Growing investment deficit relative to other regions in Canada and globally.
- Lack of federal funding support relative to the East Coast.
- Poor access to public funds for industry-based research, development and innovation.
- Recovery of the Canada dollar may affect export demand from the US.
- Uncertainty and diminishing returns of wild salmon.
- The sector has a high media profile fuelled by a highly vocal environmental lobby.
- Perceived & potential risks from pathogens, both exotic and endemic.
- Uncertainty and potential impacts from climate change.

Ministry of Agriculture Fact Sheet

FINFISH AQUACULTURE

MINISTRY ALLOCATION

Full Time Equivalents

1 FTE Industry Specialist, Aquaculture & Seafood, as well as support from Inter-governmental relations, licencing, and food safety, Processing Specialist, and Regional Agrologist Network.

AREAS FOR FOCUS 2018/19

- Implement MAACFA recommendations.
- Work with other Ministries to address Crown land issues.
- Represent Provincial interests at the Federal level to address regulatory complexity and uncertainties.
- Work with Regional Districts/Local Governments to support finfish aquaculture development.
- Work directly with industry to promote opportunities and address constraints.
- Support research, development and innovation funding initiatives.
- Continue efforts to develop funding envelopes for industry innovation and capacity building with a view to strengthening the Ministry's industry support role.
- Industry diversification to increase production of new and emerging species (sablefish, trout, sturgeon, land-based aquaculture) and production technologies (land-based).

Prepared by

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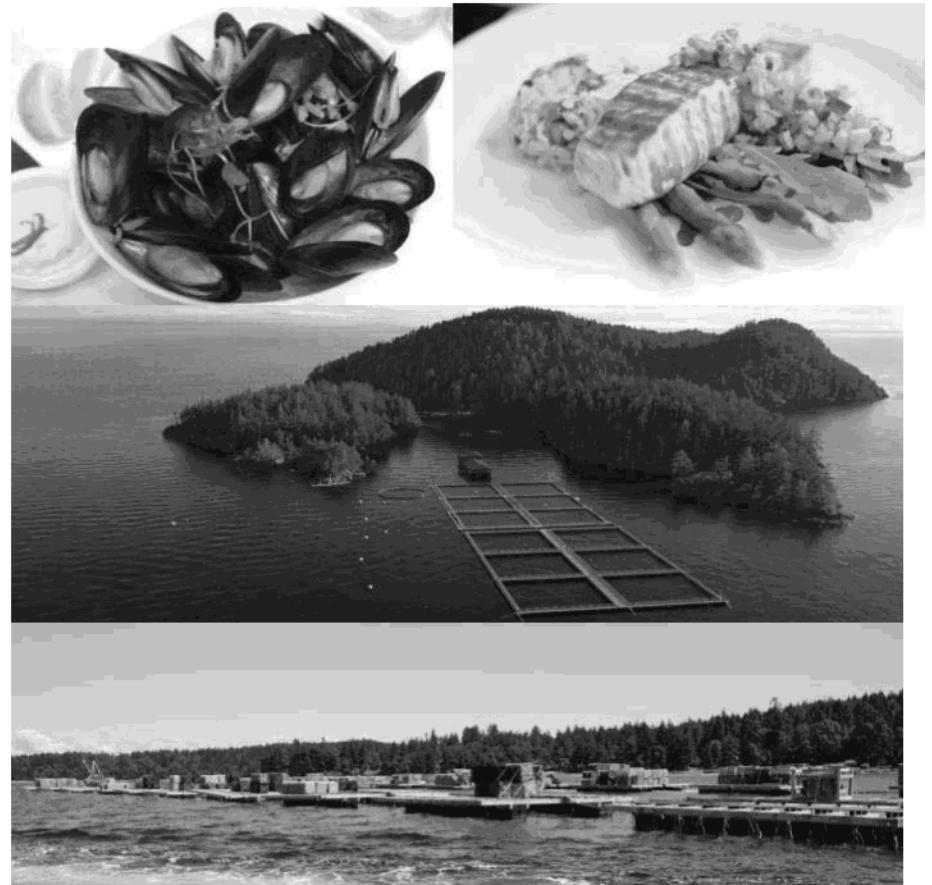
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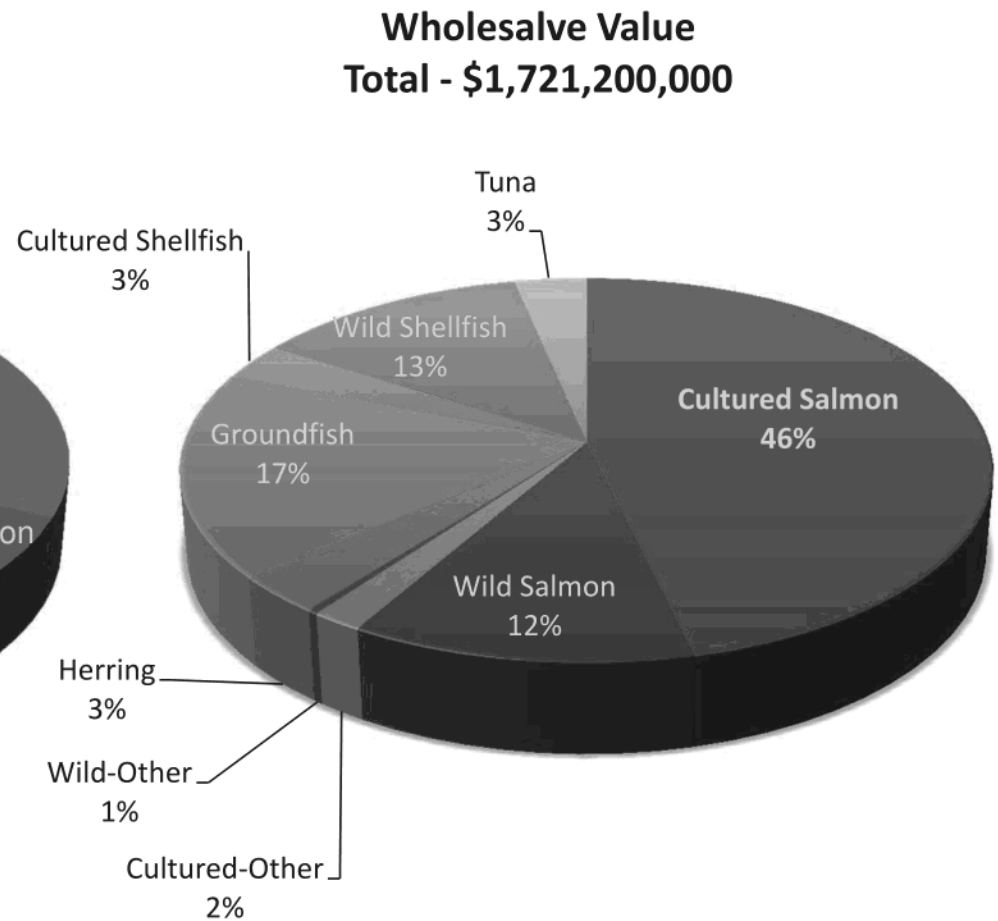
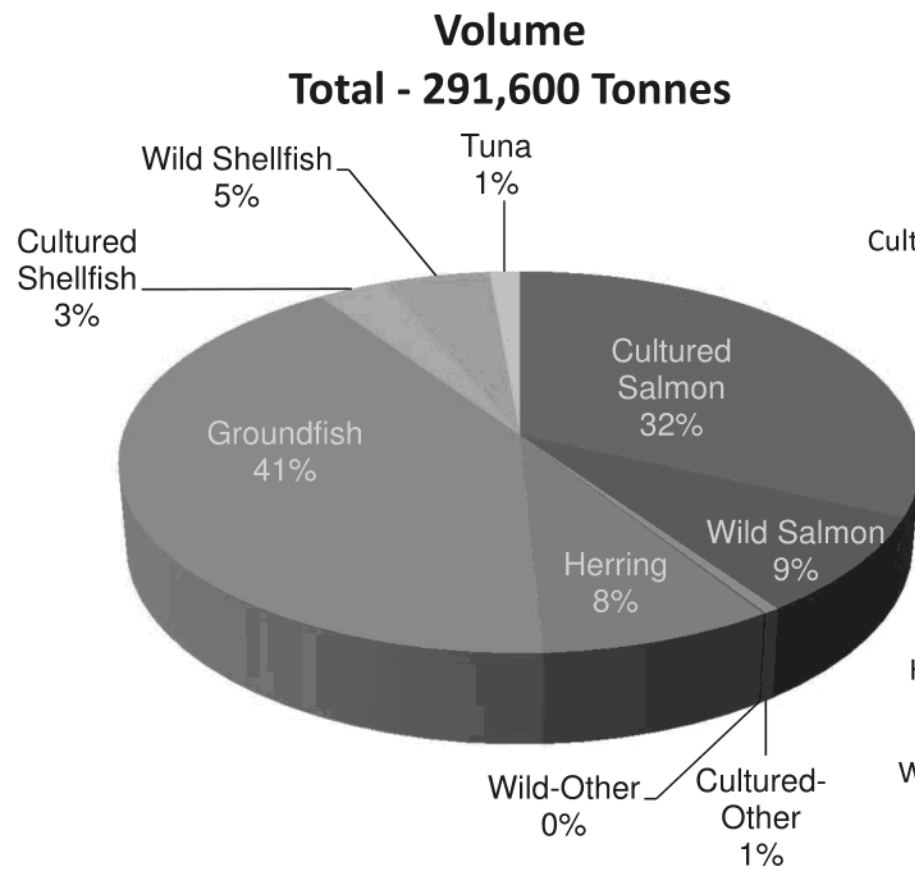
BC Aquaculture

....Current State of Affairs

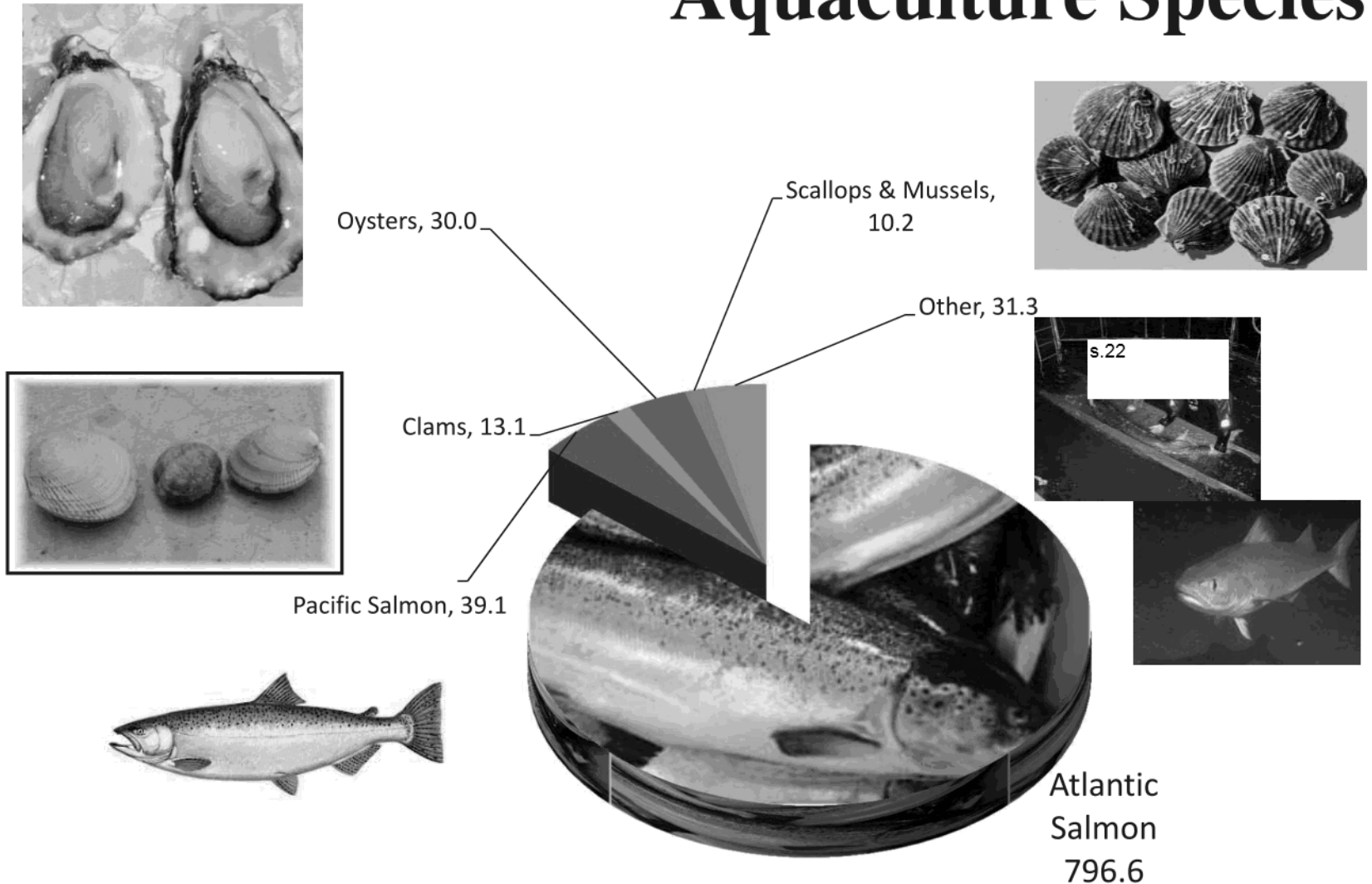
Myron Roth

Industry Specialist - Aquaculture & Seafood
Sector Development Branch

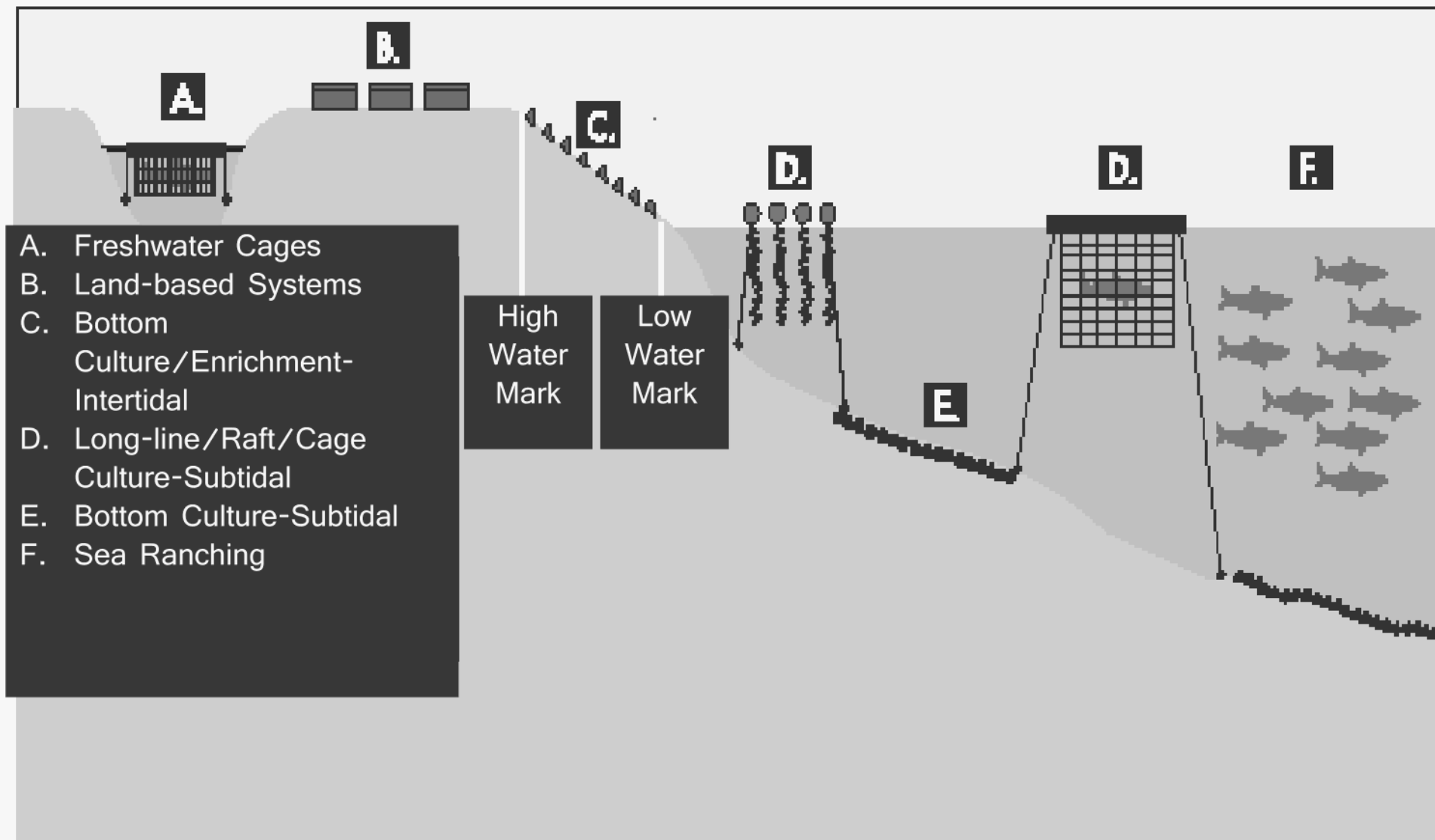




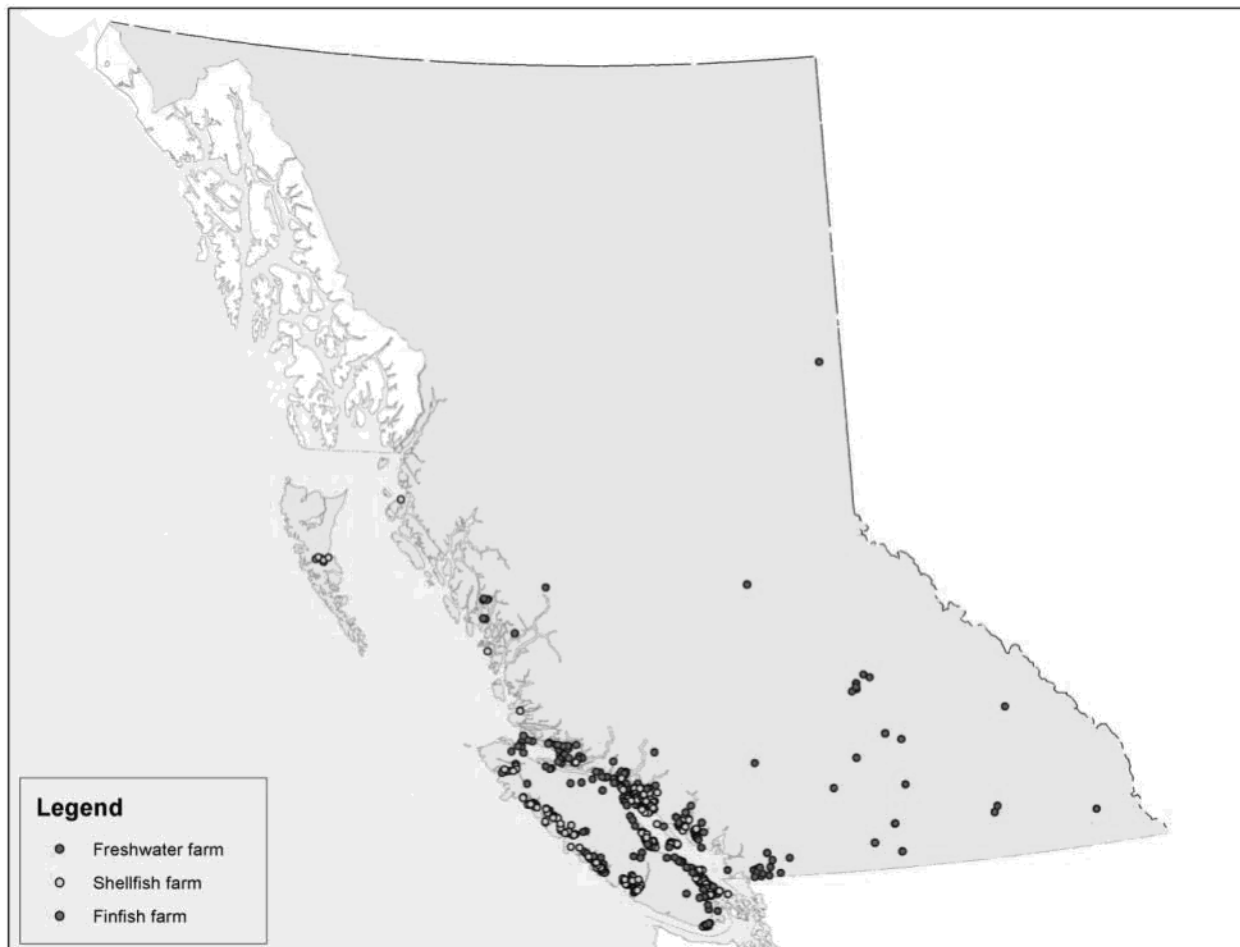
Aquaculture Species



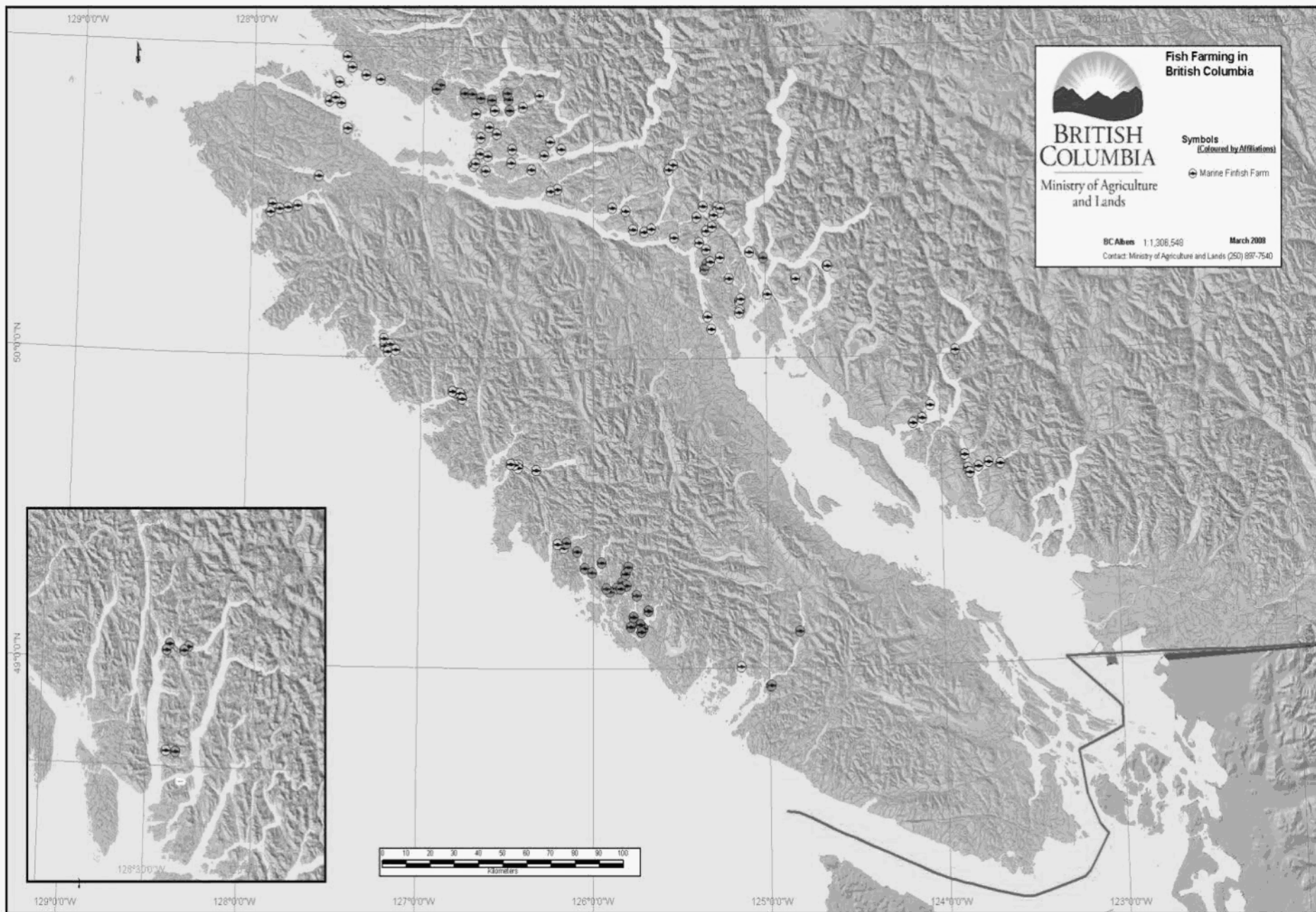
Wholesale Value (\$M) – 2015 – 881,200,000



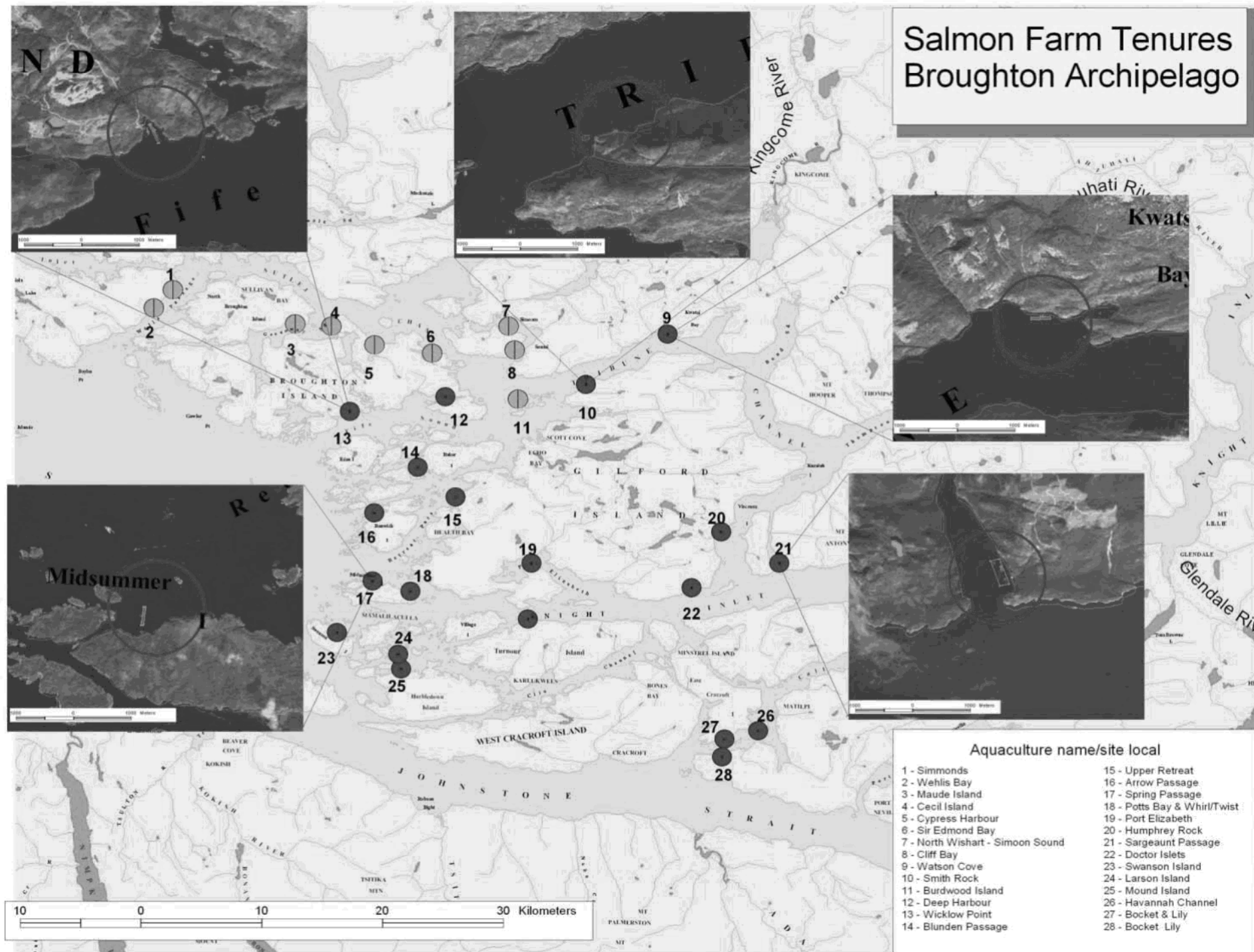
Distribution of B.C. Aquaculture Industry

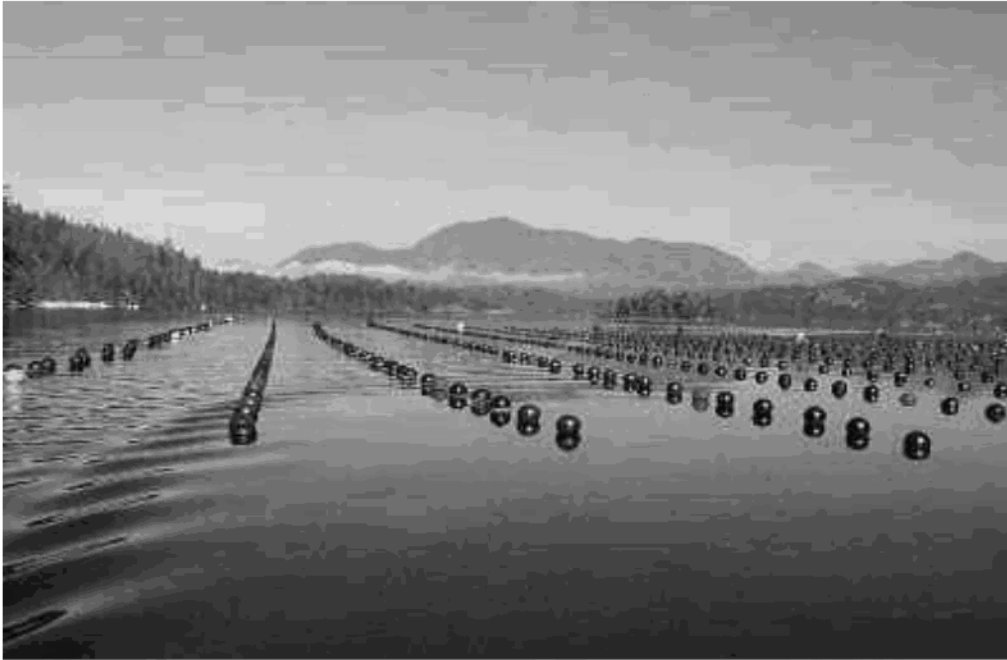






Salmon Farm Tenures Broughton Archipelago





Ministry of Agriculture

Federal Agencies

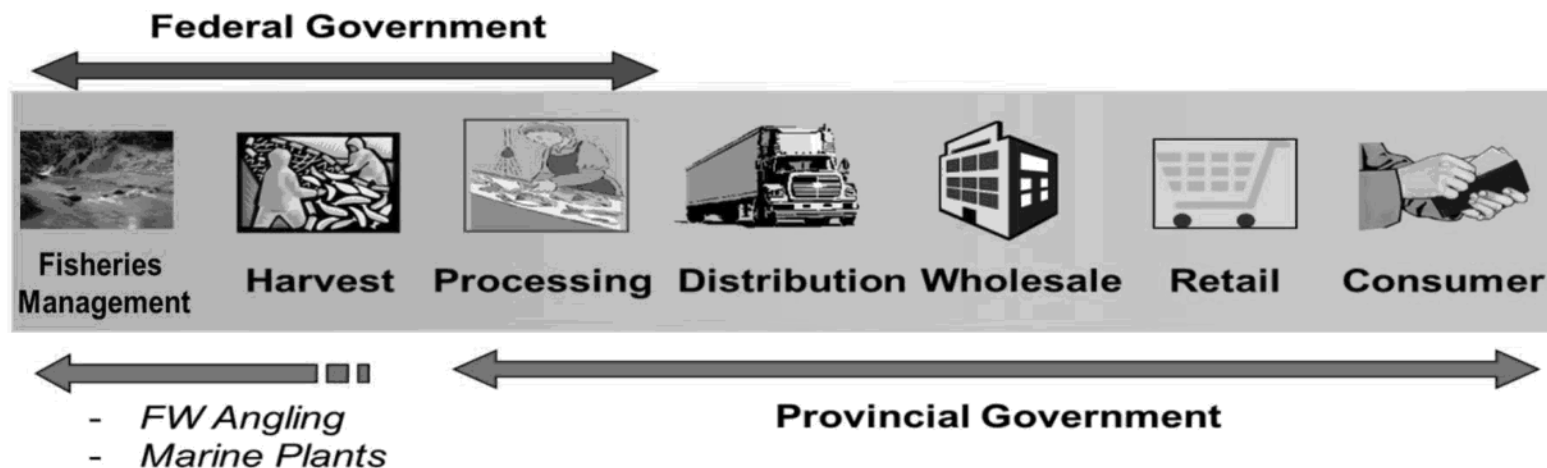
Fisheries & Oceans Canada
Transport Canada
Environment Canada
Canadian Food Inspection Agency

Provincial Agencies

Ministry Agriculture
Ministry Forests Lands & Natural Resource Operations & Rural Development
Ministry of Environment
Local Government (Municipal/Regional Districts)
BC Farm Industry Review Board

Regulatory/ Governance

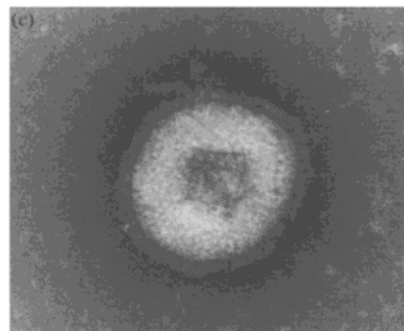
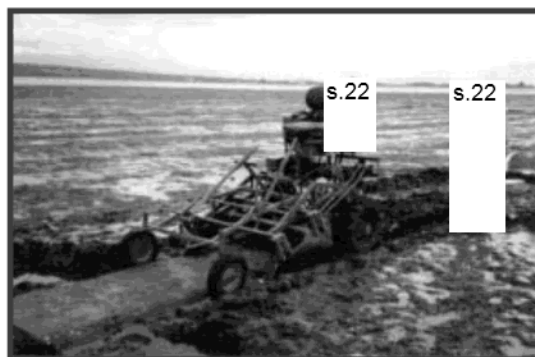
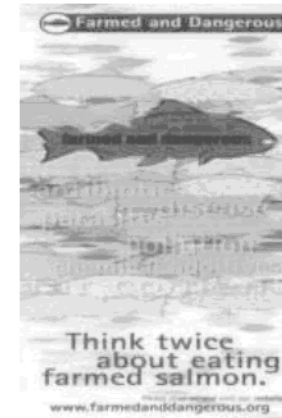
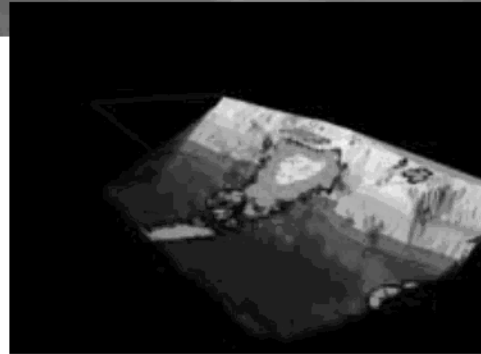
First Nations



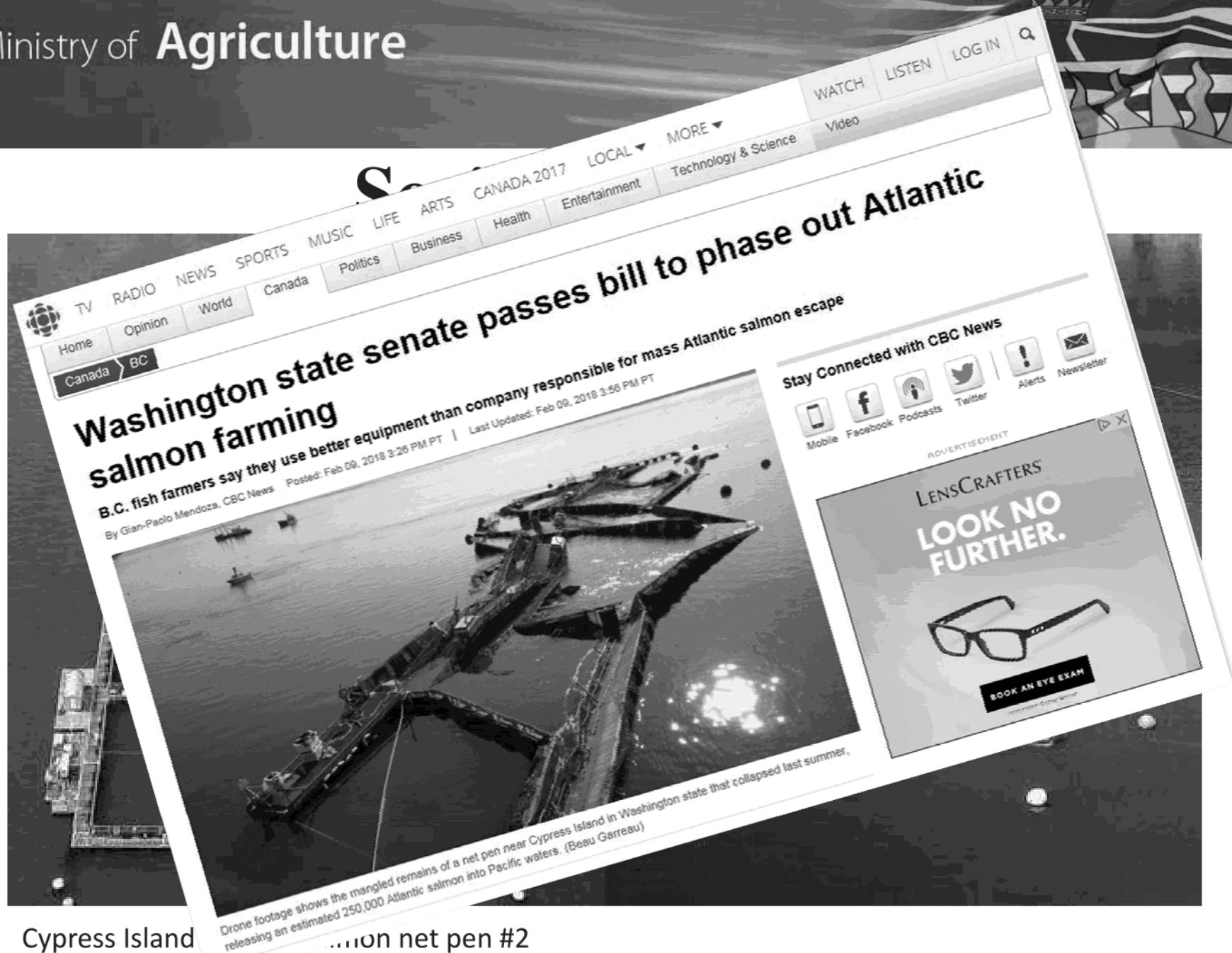
Province of BC – Key Responsibilities (Legislation)

- 1. Seafood Industry Development**
- 2. Commerce, Trade and Processing (*Fish & Seafood Act*)**
- 3. Marine Plant Harvest and Aquaculture Licences (*Fish & Seafood Act*)**
- 4. Issues Crown Land Tenures for finfish and shellfish aquaculture (*Land Act*)**
- 5. Issues Water Use Permits (*Water Sustainability Act*)**
- 6. Issues permits for sewage discharge (*Environmental Management Act*)**
- 7. Issues permits for pesticide use (*Integrated Pest Management Act*)**
- 8. Issues permits for the collection of freshwater fish for scientific and research purposes (e.g. broodstock) (*Wildlife Act*)**
- 9. Issues permits for fish movements within the province (Introduction and Transfer Permit) (*Wildlife Act*) – jointly with Fisheries & Oceans Canada**
- 10. Dispute Resolutions – Nuisance Complaints (*Farm Practices Protection (Right to Farm) Act*)**

Ministry of Agriculture

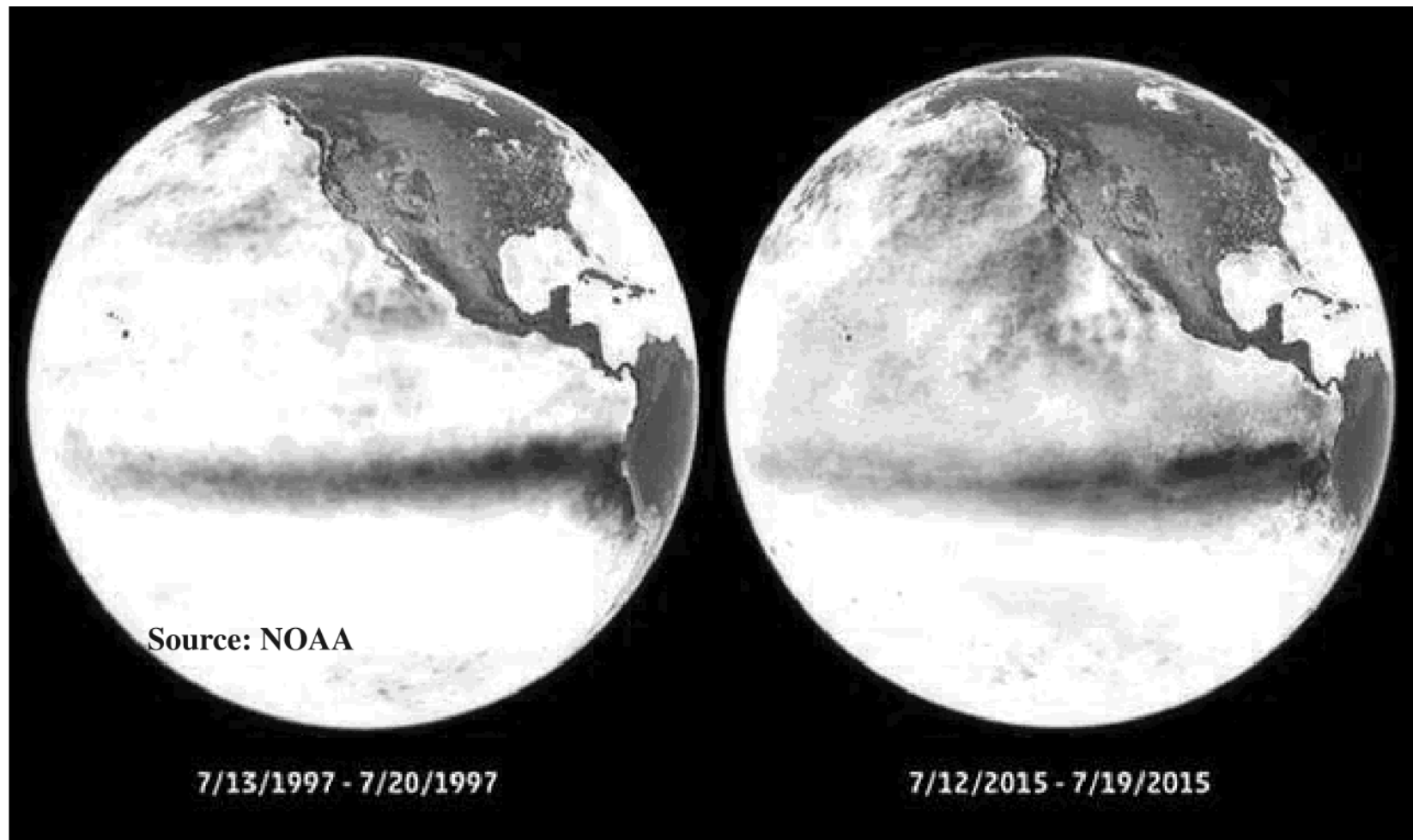


Ministry of Agriculture



Cypress Island salmon net pen #2
Source: Beau Garreau/The Bellingham Herald

Climate Change ?



OASISS + BaSEIC

Ocean Acidification Shellfish Industry Seed Supply

Baynes Sound Environmental Intelligence Collaboration



**BC SHELLFISH
GROWERS ASSOCIATION**

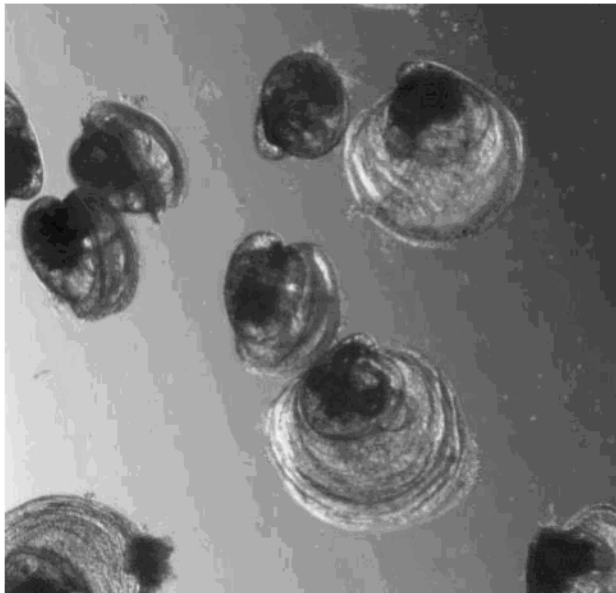


**VANCOUVER ISLAND
UNIVERSITY**



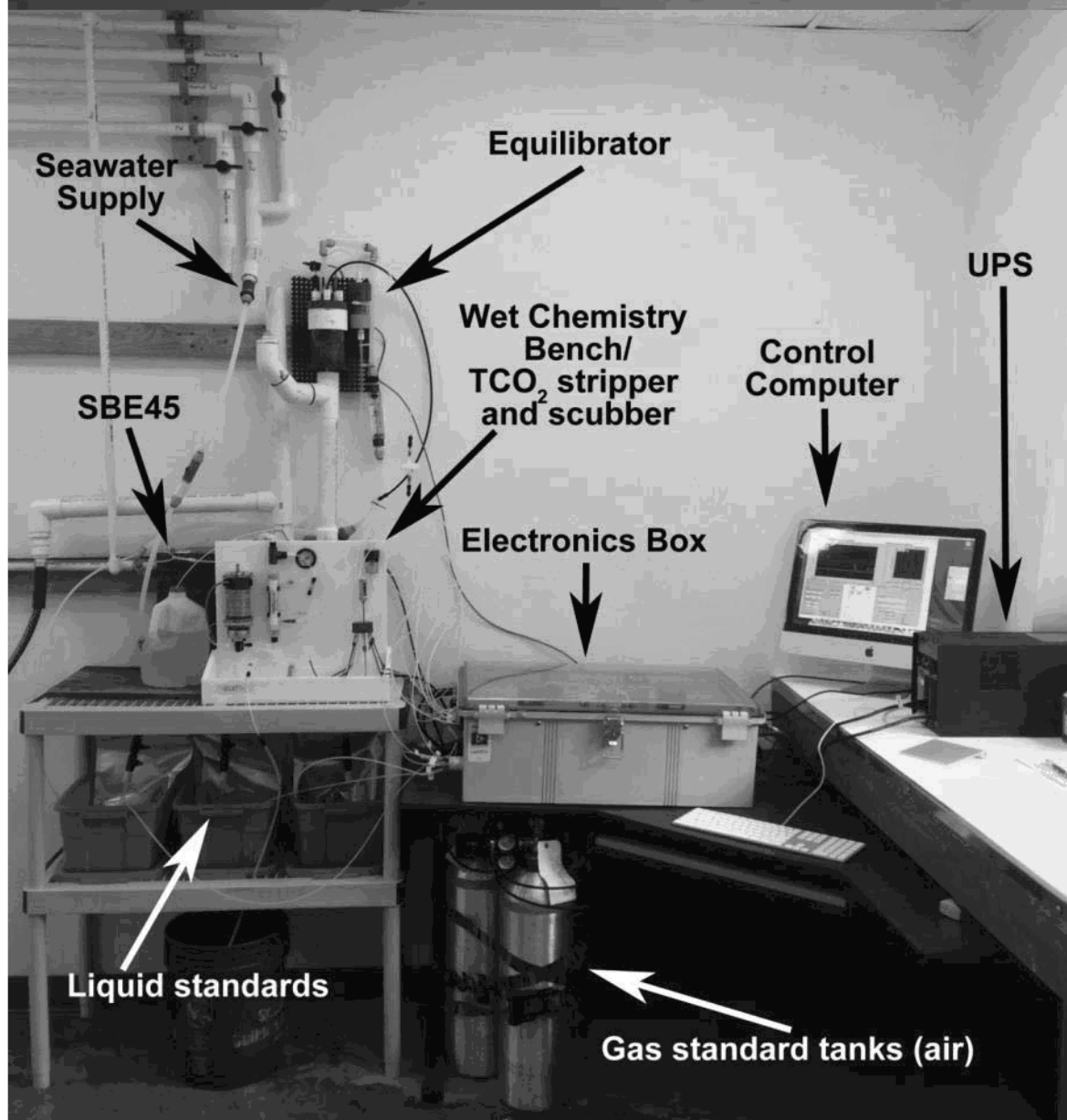


OASISS



s.22



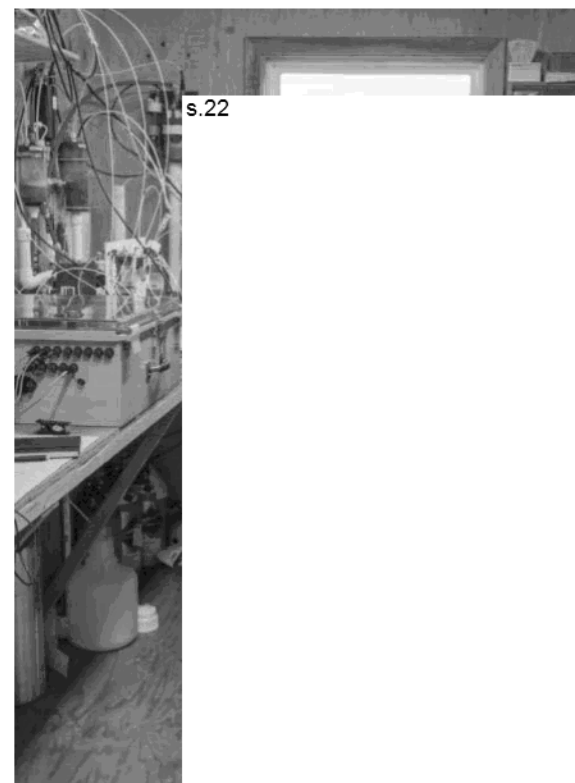


Measurement Suite:

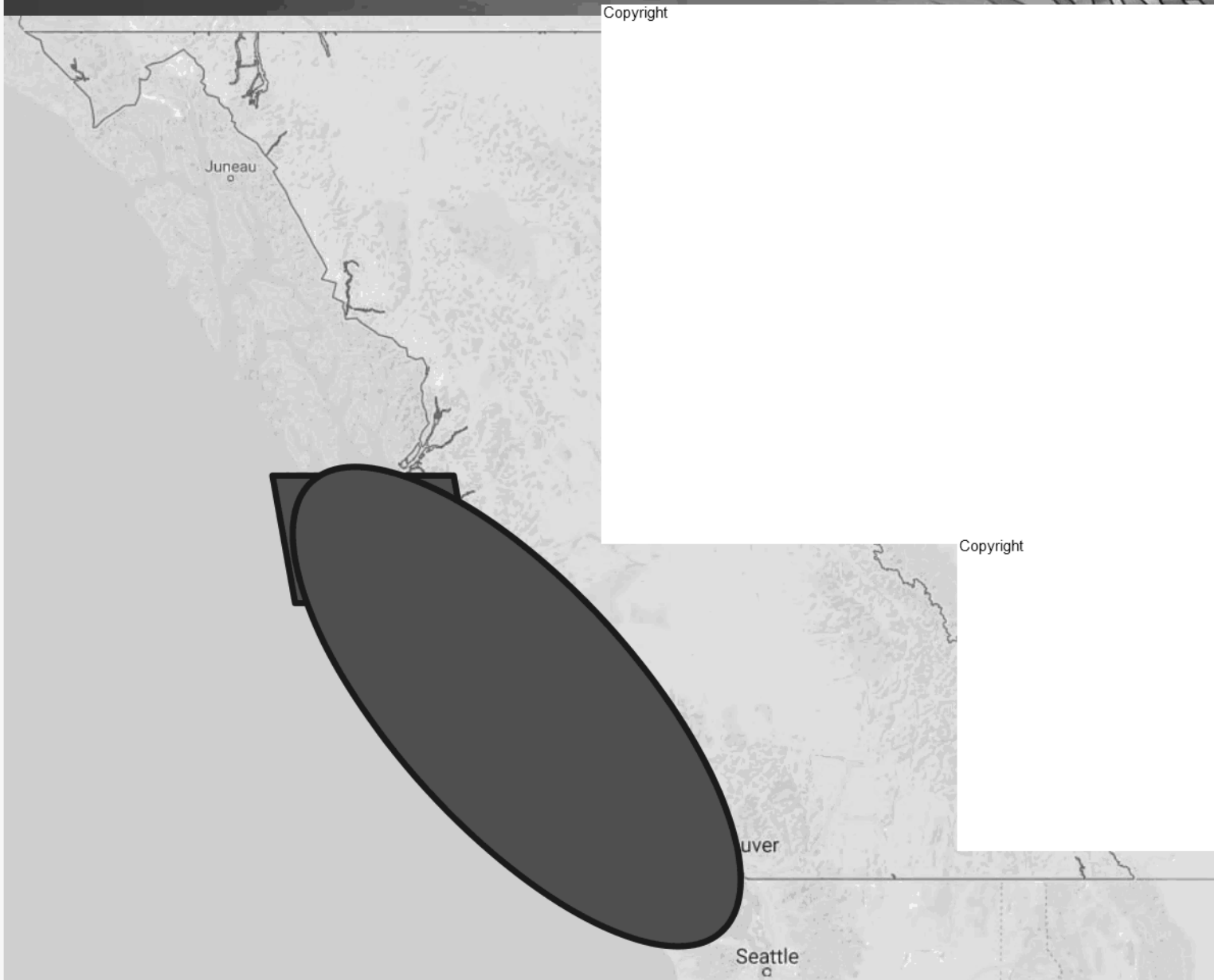
- (1) Total dissolved inorganic carbon; TCO_2
- (2) Carbon dioxide partial pressure; pCO_2
- (3) Temperature
- (4) Salinity

Extras: e.g. dissolved oxygen, chlorophyll fluorescence

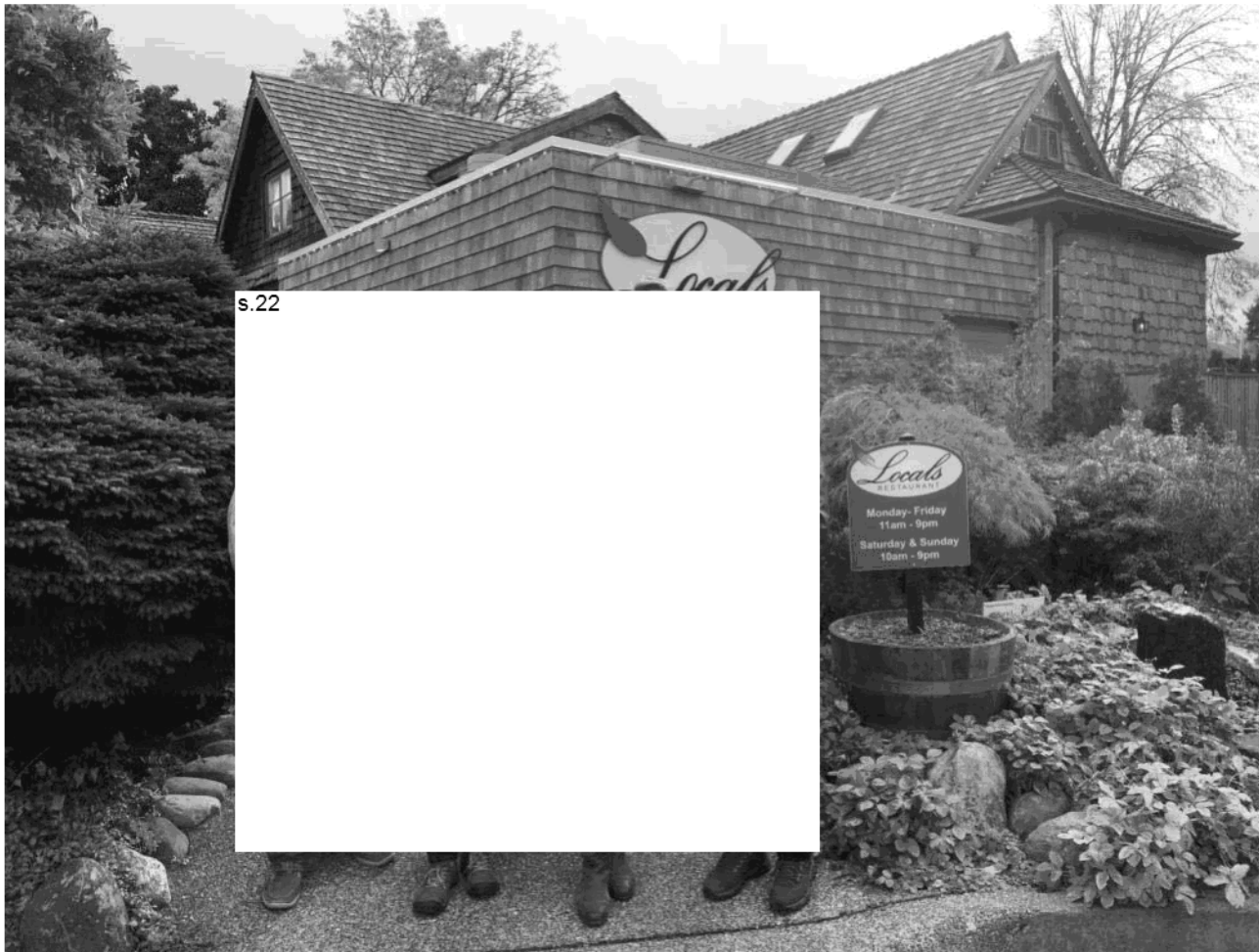
From 1, 2, 3, and 4, calculate pH and Ω



Ministry of **Agriculture**



Thank You!



s.22



s.22

Myron Roth
myron.roth@gov.bc.ca

s.22



[Marketplace \(/advocate/category/marketplace\)](#).

Monday, 7 November 2016

By Nicki Holmyard

As sturgeon farming grows, demand concerns emerge

Global farmed caviar production set to double by 2020

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Margerison, Elizabeth AGRI:EX

From: Witter, Allison AGRI:EX
Sent: Tuesday, January 23, 2018 8:54 AM
To: Roth, Myron AGRI:EX
Subject: RE: Urgent KM updates for binder
Attachments: KM Jan 2018 Aquaculture DRAFT_AW.docx

Hi Myron,

A few edits and comments on the KMs are attached here.

Let me know if I can help any further with this.

Cheers,
Ali

Allison Witter, MSc | Industry Specialist – Marine Fisheries & Seafood
p: 250-356-5362 | c: 250-893-0260

From: Scott, Cristina AGRI:EX **On Behalf Of** Austin, Matt AGRI:EX
Sent: Monday, January 22, 2018 3:21 PM
To: Roth, Myron AGRI:EX; Witter, Allison AGRI:EX
Cc: Schur, TJ AGRI:EX
Subject: FW: Urgent KM updates for binder
Importance: High

Hi Myron and Ali,

Can you please review the relevant Key Messages for SDB in the attached package. Due back to me at 2pm on Wednesday, January 24.

Let me know if you need anything further.

Thank you,
Cristina

From: Townsend, Dave H GCPE:EX
Sent: Monday, January 22, 2018 2:38 PM
To: Easton, Joan E AGRI:EX; Hrycuik, Lorie AGRI:EX; Austin, Matt AGRI:EX
Cc: Wong, Jane T AGRI:EX; Skogstad, Holly AGRI:EX; North, Gail AGRI:EX; McRae, Meghan GCPE:EX
Subject: Urgent KM updates for binder
Importance: High

Hi Joan, Lorie and Matt,

The MO will need all of the KM's and IN's for session so they can start building their binder.

We will be sending you the updated IN's soon. Attached are the updated KM's.

Can you please start sending these through to the appropriate staff in your branches for review. We just want to ensure everything is still accurate and if there are any updated stats. The deadline we have for the KM's back from you is EOD Wednesday. We will then continue the KM's through approvals (to ADM's and DM).

Please let me know if you have any questions.

Here are the KM's attached (11 in total).

- ALC and ALR
- Animal Welfare
- Aquaculture
- Emergency Response – BRM – Climate Change
- Fish Diseases
- Fruit Wine Treefruit Sectors
- Mandate Letter
- Policies supporting economic development
- Support for bees
- Support for ranchers
- Working with AAFC

Thanks,

Dave Townsend

Government Communications and Public Engagement

Ministry of Agriculture

s.22

Email: dave.h.townsend@gov.bc.ca

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- Support for ranchers
- Working with AAFC

Thanks,

Dave Townsend

Government Communications and Public Engagement
Ministry of Agriculture

s.22

Email: dave.h.townsend@gov.bc.ca

KEY MESSAGES

MINISTRY OF AGRICULTURE

AQUACULTURE

NOV 2017

FINFISH AQUACULTURE

FEDERAL – PROVINCIAL ROLE IN AQUACULTURE

PROTESTERS AT AQUACULTURE SITES

UNDRIP (MIRR)

STATUS OF TENURE ISSUING / MAACFA

SALMON FINFISH TENURE REPLACEMENTS (FLNRO)

CLOSED CONTAINMENT FISH FARMS

ATLANTIC SALMON ESCAPE - WASHINGTON STATE

SEAFOOD GENERAL

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Withheld pursuant to/removed as

s.13



Date: April 12, 2018

To: Arif Lalani

File:

Cc: Matt Austin, James Street

Re: Elevate- "Fish Hatchery Feasibility Study" Proposal Review

Arif,

Further to your request for a review of the Elevate "Fish Hatchery Feasibility Study". I have reviewed the information presented by Elevate and can provide the following comments.

Document/information reviewed includes:

1. Agriculture Project Plan – Fish Hatcheries Feasibility Study.docx
2. Continuous Improvement Planning Guidebook 20180323.docx
3. Problem Solving Framework_Fish Hatcheries.docx
4. Notes from my meeting with Rob Jawanda, Lisa Maker (Elevate) & Ray Parks (Bim consulting) on December 14, 2017.

The first document provides a work plan, but apart from stating a broad project outcome, doesn't provide much information/context about the project. The second document describes an administrative process approach for planning and continuous improvement, which is more methodical/philosophical in nature and I'm not sure what it has to do with the project. It may have been more informative to have included the team's résumés and project history to assess qualifications/suitability for the proposed work. The third document is framework that best describes the proposal and what my comments focus on. In addition, I met with Rob and two other representatives on December 14, 2017. During that meeting we discussed the third document and the conceptual idea for the project in detail.

The key issues the project proposes to address are reversing declining wild fish in the province using production alternatives, support ethical food production activities that are socially and ecological responsible and engaging First Nations in food production initiatives. No information is provided on what "production alternatives" might entail. The short term outcome is a feasibility study to define the terms of reference for a larger study involving a series of pilot projects, but also to assess funding opportunities/models.

Short term deliverables include;

1. Problem definition
2. Overview & Focus for Research
3. Jurisdictional Scan
4. Stakeholder Analysis

5. Feasibility Study
6. Recommendations

A key element of the feasibility study is broad consultation with stakeholders including provincial ministries, municipalities, First Nations, federal government agencies and other partner associations.

The long term outcomes are:

- 1) Sustainable seafood production with no negative environmental impacts;
- 2) Job creation;
- 3) First Nations engagement consistent with UNDRIP.

Essentially they propose to review all of BC's fisheries programs and come up with what appears to be new and improve hatchery model that supports recreational fish, First Nations engagement and increased seafood production.

Issues with the Proposal:

1. Scope & Mandate for Agriculture

First and foremost the project purports to review and reshape BC fisheries – wild, recreational and First Nations. As such, it doesn't align with the Ministries mandate and in particular a direct link to Grow, Buy, Feed BC. Fisheries management in BC is under the jurisdiction and responsibility of the Fisheries and Oceans Canada (DFO), the Ministry of Forest Land, Natural Resource Operations & Rural Development, and the Freshwater Fisheries Society of BC (FWFSBC, a non-for-profit Society that delivers BC freshwater stocking program under contract to FLNRORD). In particular, DFO and FWFSBC operated all of the non-commercial hatcheries in BC (i.e. those that release fish for conservation, enhancement and recreation). It is therefore unclear why Agriculture would take the lead on funding and/or coordinating this project.

2. Clear focus on fisheries enhancement/restoration projects

Innovative ideas cited include tourism and sport fishing, stream cleaning and enhancement hatchery production, including the identification of opportunities beyond finfish such as shellfish. These are activities that are well outside the jurisdiction of agriculture. Further, salmon, trout and, to a much lesser extent, sturgeon, are essentially the only species that are supported by hatcheries, shellfish and marine finfish in particular are not¹. From a food perspective these fisheries form a very small percentage of BC seafood production in terms of volume (8.5%) and wholesale value (12%). The link between the Ministries mandate letter to support innovation in processing, packaging and marketing, help producers expand local markets and adopt UDRIP (as noted in the Creative Problem Solving Framework) is not clear with respect to how a new, innovation hatchery program would help to achieve increases in food fisheries. It is possible that an expanded/new hatchery model may increase sport fisheries and therefore tourism, but it would be expensive requiring a lot of research to assess non-salmonid species and develop hatchery technology. Further, the potential for ecological impacts from intervention at this scale would also have to be considered (see also point 3). Food production,

¹ Although it could be argued that there has been some enhancement-type augmentation of geoduck fishery over the last couple of years.

commerce of seafood (marketing and sales) and providing seafood to BC institutions is not discussed.

3. Limitations of wild fisheries for growth

There are clear limitations for growth of the wild fishery sector to produce seafood, especially where enhancement is concerned. We know this from the long-history of salmon enhancement. In fact, more and more information is being published in the scientific literature to suggest that salmon enhancement may have negative impacts (e.g. reduced fitness and diversity of hatchery fish; overproduction of some species (e.g. pink salmon) at the expense of others (e.g. chinook salmon). Global statistics from the FAO (Food and Agriculture Organization) clearly show that world capture fisheries peaked in the early 1980s (100 million metric tons) and have not increased since; for many species global catches have declined. Since then, all gains in global seafood production have come from aquaculture. However, aquaculture is not mentioned in the proposal yet forms a significant portion of the volume (36%) and wholesale value (51%) of BC's seafood production. Further, while many First Nations wish to develop seafood economic opportunities, these opportunities are in aquaculture since sustainable wild allocations will not meet a commercial demand for seafood. This has been recognized for some time now through several funding initiatives in place to increase First Nations access to commercial fisheries. The DFO's Pacific Integrated Commercial Fisheries Initiative (PICFI) is a good example. Nonetheless, more could be done to develop First Nations capacity and participation in seafood production.

4. Scope and Timelines for a Feasibility Study

Given the scope of the project, to review BC's entire fisheries program and then make recommendations to re-develop it through a hatchery program, the time allocated to complete the work (18.75 days) and budget (\$24K) is, in my view, unrealistic. Just meeting with all the agencies, local governments and first nations alone would take many months of concerted effort. Further, what is being proposed is highly technical in nature and will require substantive input from subject matter experts on fisheries biology, ecology and hatchery technology.

Recommendation:

I would not recommend funding this proposal as written. It lacks understanding of how fisheries are managed and operated in BC – which questions the suitability of the proponents to complete the proposed work in a satisfactory fashion. It also lacks clarity and clear objectives that align with the Ministries of Agriculture's jurisdiction with respect to BC fisheries and the processing, distribution and commerce of seafood.

If, however, MLP is excited about this project and wishes to fund it, it should be re-directed to the Seafood Secretariat. The Seafood Secretariat was specifically formed to deal with multi-agency issues/projects dealing with seafood. Given that the project would need to involve several provincial ministries in addition to DFO and possibly others. The Secretariat can coordinate a review of the relevant ministries, namely Agriculture, FLNRORD, Environment & Climate Change, Indigenous Relations & Reconciliation, and DFO and is therefore better positioned to provide guidance for the proposal and oversee any contract(s) that might emanate from it.

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Shoemaker, Wes AGRI:EX

From: Zacharias, Mark ENV:EX
Sent: Monday, March 26, 2018 12:24 PM
To: Kennedy, Christine PREM:EX; Shoemaker, Wes AGRI:EX; Sheldon, Tim FLNR:EX; Caul, Doug D IRR:EX
Subject: s.12,s.13,s.16

Thanks Christine: This looks good. Some nerdy comments below for consideration:

s.13,s.16

s.12,s.13,s.16

Regards, MZ

From: Kennedy, Christine PREM:EX
Sent: Monday, March 26, 2018 11:12 AM
To: Shoemaker, Wes AGRI:EX; Sheldon, Tim FLNR:EX; Caul, Doug D IRR:EX; Zacharias, Mark ENV:EX
Subject: s.12,s.13,s.16
Importance: High

s.12,s.13,s.16

s.12,s.13,s.16

Please let me know if you see any major gaps or anything that should be changed. I would like to get this off to TBS this afternoon if possible.

Christine