Advances in Aquaculture and Fisheries Management Vol. 1 (1), pp. 001-004, April, 2013. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Editorial

Publisher's Note: A cursory look at Aquaculture in Canada

Tonukari Ochuko

Accepted 06 March, 2013

INTRODUCTION

Aquaculture is the farming of fish, shellfish or aquatic plants in either fresh or saltwater, or both.[1] The farmed animals or plants are cared for under a controlled environment to ensure optimum growth, success and profit. When they have reached an appropriate size (often once they reach maturity), they are harvested, processed, and shipped to markets to be sold.[2] Aquaculture is practiced all over the world and is extremely popular in countries such as China, where population is high and fish is a staple part of their everyday diet.

Aquaculture in Canada plays a prominent role in Canada's ecological, social and economic stage.[3] With Canada having the world's longest coastline, as well as the world's largest freshwater system and tidal range,[4] aquaculture is an obvious choice for Canada. Many different types of fish are farmed in Canada which helps to implement ecological sustainability among many different types of fish such as Atlantic Salmon, Cod, Arctic Char, Halibut, Tilapia and Rainbow Trout.[5]

Economic Value of Aquaculture in Canada

Aquaculture provides a notable amount of revenue for the Canadian economy as well as many job opportunities for Canadians. Seafood is Canada's single largest exported food commodity, exporting 85% of production, making Canada the seventh largest seafood exporter in the world.[6] In 1986, Canadian aquaculture production amounted to only 10,488 tonnes, valued at $35 million,[7] and then in 2009 it had a value of 800 million dollars, 69% of which was exported.

British Columbia is the fourth largest producer of salmon in the world and is Canada's leader in aquaculture production with 52.3% of total production value, followed by New Brunswick with 20.7% in 2009. The main species of fish farmed in Canada is led by salmon with 70.5% of all fish in aquaculture followed by mussels with 15.1%. Aquaculture makes a significant contribution to Canada's economy totaling 2.1 billion dollars in revenue and jobs in Canada in 2009. The total gross domestic product of farmed fish in Canada totaled $1,005,180,000 dollars in 2009 and $14,495,000 dollars in total employment in Canada.[8] the value accumulated from aquaculture solely for employment is exceptionally important for the members employed in this industry. Over 90% of all jobs (both direct and indirect) are located in rural, coastal, and Aboriginal communities where the human population is low and employment opportunities are scarce. Aquaculture in Canada has proven to revitalize both social and economic factors in these small communities.[9] Over 8,000 Canadians are directly employed in aquaculture – most of them full-time. The aquaculture supply and services sector creates an additional 8,000 jobs. Two-thirds of all workers are under the age of 35.[10] [11] [12]

Output by Province in 2009	Percentage
British Columbia	52.3%
New Brunswick	20.7%
Newfoundland	11.7%
Nova Scotia	7.7%
P.E.I	3.9%
Ontario	1.2%
Prairies	0.7%

Output by Species	Percentage
Salmon	70.5%
Mussels	15.1%
Trout	5.8%
Oysters	5.5%
Other Finfish	1.6%
Clams	1.1%
Other Shellfish	0.4%

Technology Used in Aquaculture

To reduce the environmental impact of aquaculture and especially of salmon farming, researches are being conducted to find alternatives to existing technologies. For the time being the marine net-pens is the only technology that dominates the aquaculture system in Canada. Lately, new alternatives such as closed-containment systems have generated lots of interest. Culturing fish in a closed environment not only can help fish farmers to better control the rearing conditions but also improve the quality of the fish. Closed containment systems could reduce the environmental impact of the salmon farming industry's current practices. Some of the benefits of these systems are: reduced fish escapes, minimized predator interactions, reduced disease transmission, lower feed inputs, higher stocking densities, and improved waste management capabilities.[13][14]

Conventional net pen aquaculture

Canada has been using the net pen system since the 1970s.[15] The conventional net-pen is an open mesh net that is suspended within a framework constructed of steel, wood or plastic, that floats at the surface and held in place by anchors. The system consists of 10 net-pens, each with 30-m sides and a depth of 20m.[16] Natural currents bring fresh, oxygenated water to the net pens and dissolve soluble wastes. The organic fecal material and uneaten feed settle to the ocean bottom near the cage site.[17]

Closed-containment systems with rigid walls

This system is the first alternative culture system. Named SARGO™ Fin Farm System, the system was established in 1994 for intensive finfish production in both marine and freshwater environment.[18] The system consists of six circular bags that are made of a heavy-gauge plastic installed in a steel frame floating at the surface and held in place by anchors in the same way as the net-pens. Electrical upwelling pumps continuously pump fresh seawater into the bags, and portable liquid oxygen tanks are used to provide oxygen to the cultured fish. A specially designed outlet is used to exit the waste-water and entered the marine environment untreated.[19][20]

Closed-contained systems with flexible walls

Closed-contained systems with flexible walls, another alternative technology known as the SEA systems developed by the Future SEA Technologies, consists of flexible round enclosures made out of a waterproof heavy-gauge polyvinyl chloride. These bags are suspended in the water from a flotation system. SEA systems operate on a flow-through basis. Regarding the waste management, Future SEA has also developed a patent, based on a double drain concept to trap the waste. While, clear water is discharged from the upper part of the tank, the waste water is collected from the concentric drain found at the bottom of tank. Even though the Future SEA claims that this waste trap can eliminate 75% of solids, it is still a new technology that needs further testing at commercial scales.[21]
[22]

Land-based technologies

Land-based systems unlike the other technologies operate on land. There are two types of land-based systems.

Land-based saltwater flow-through system

The land-based saltwater flow-through system is mainly based on the culture of Atlantic salmon. Atlantic salmon is cultured in circular concrete tanks where the fresh seawater is continuously pumped into the tanks from a nearby ocean channel and wastewater piped back into the channel untreated. Like in the floating bag system, portable oxygen tanks provide supplemental oxygen to the fish.[23]

Land-based freshwater recirculating system

The land-based freshwater recirculating system similar to the saltwater flow-through system consists of a series of circular concrete tanks, however it is build inside a warehouse. The water is pumped into the tanks from an on-site freshwater well, and almost 99% of the water is recirculated back into system through a mechanical and bio-filtration process. The solid waste is collected in a holding tank to be used as fertilizer for plants.[24] Two operations in Canada are now in commercial operation - Namgis in northern Vancouver Island, and Sustainable Blue in Nova Scotia.

Environmental Impacts of Aquaculture

The first environmental impact derived from aquaculture is the pressure put on wild fish stock of small “feed fish” such as anchovies and mackerel. The large quantities of fish in fish farms results in a high demand for fish feed. The feed is made from wild fish, such as the ones just previously mentioned, which in turn depletes wild fish stocks.[25] It is not uncommon for farmed salmon to escape from the net pens they are contained in while living in open waters. This can occur for a number of different reasons, the most common causes being:

- infrastructure failure (e.g. a result of extreme weather damage)
- boat operations (e.g. collisions and propeller damage)
- predation (e.g. seals, sea lions)
- vandalism
- fish handling errors
- technical deficiencies (inadequate or damaged parts in cage systems)[26]

When farmed salmon escapes into the wild, interbreeding between wild and farmed salmon can occur which results in a decrease of genetic diversity of wild salmon. Also, whenever wild salmon escape it must be reported to British

Columbia’s Ministry of Agriculture and Lands, which requires the cost of reporting and paying someone to do the reports, as well as the cost of valuable time spent on the reports.[27] Another environmental impact is increased parasitic infections on wild fish that live near fish farms. Farmed fish, living in confined high density areas, are more prone to having and contracting parasites and diseases such as sea lice (Lepeophtheirus salmonis); the high density of farmed fish contributing to high counts of parasitic infections make it extremely easy for wild fish living near the farms to contract any of the parasites and diseases carried by the farmed fish. As well as wild fish being affected, the environment also is negatively affected by fish farms. Fish waste, uneaten food, antibiotics, chemicals, pesticides, and dead organisms, along with numerous other waste materials, pollute the surrounding water and contaminate it.[28]

References

1. Robson, P.A. Salmon Farming - the whole story, 2006
2. [Matthews, R, “Aquaculture in Canada” 2006]
3. Government of Canada - Fisheries & Oceans Canada[dead link]
4. Canadian Aquaculture - Industry Alliance
5. [3. http://www.dfo-mpo.gc.ca/aquaculture/reg/stats/aqua-ff-fc-2009-eng.htm#sum]
6. Government of Canada - Aquaculture in Canada
7. Canadian Aquaculture - Industry Alliance
8. [3. http://www.dfo-mpo.gc.ca/aquaculture/reg/stats/aqua-ff-fc-2009-eng.htm#sum]
9. Government of Canada - Aquaculture in Canada
10. Canadian Aquaculture - Industry Alliance
11. http://www.dfo-mpo.gc.ca/aquaculture/reg/stats/aqua-ff-fc-2009-eng.htm#sum
12. http://www.dfo-mpo.gc.ca/aquaculture/reg/stats/aqua-ff-fc-2009-eng.htm#sum
13. Ayer, N.W. & Tyedmers, P.H. Journal of Cleaner Production, 2008
14. [1]
15. Government of Canada - Fisheries & Oceans Canada
16. Ayer, N.W. & Tyedmers, P.H. Journal of Cleaner Production, 2008
17. [2]
18. Mariculture Systems, Inc. 2007. SARGOTM Fin Farms. Investment prospectus and technical specifications, p.105
19. Ayer, N.W. & Tyedmers, P.H. Journal of Cleaner Production, 2008

20. Masser, M.P. Bridger, C.J. A review of cage aquaculture: North America. In M. Halwart, D. Soto and J.R. Arthur (eds). Cage aquaculture – Regional reviews and global overview, pp.102–125. FAO Fisheries Technical Paper. No. 498. 2007
21. Government of Canada - Fisheries & Oceans Canada
22. [3]
23. Ayer, N.W. & Tyedmers, P.H. Journal of Cleaner Production, 2008
24. Ayer, N.W. & Tyedmers, P.H. Journal of Cleaner Production, 2008
25. Government of British Columbia
26. Government of British Columbia
27. Robson, P.A. Salmon Farming - the whole story, 2006
28. Robson, P.A. Salmon Farming - the whole story, 2006