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"Promoting Canadian Agrifood Exports to Nepal: Final Paper"

Canadian Atlantic Cod

Part I – Product Info

Introduction

This paper was written as an assignment and business proposal, for the Introduction to Agri-Food Systems course at the University of Guelph. This paper was written with the intent of nominating, and exploring a new export opportunity from Canada to a developing nation (Nepal), pertaining to the agriculture food sector that results in mutual benefits to both nations. This paper will summarize and explore the implications of exporting Canadian Atlantic Cod from Canada to Nepal.

Canadian Atlantic Cod

The possible Canadian product being suggested for export to Nepal is Atlantic Canadian Cod or *Gadus morhua*. Atlantic Cod are cold water fish, which weigh 2 to 3 kg in the wild (FAO, 2014). Atlantic Cod were originally found in the Atlantic Ocean, along the borders of both Canada and England and all the way down to the southern U.S. Heavy fishing in these areas, in the late 1800s and early 1900s led to a massive decline in Cod population (Hutchings J.A, 2011). Today, they are grown in onshore temperature controlled, seawater tanks as eggs and eventually taken to sea cages when more developed (CAIA, 2014). The majority of these artificial environments found in Canada, are located in British Columbia, New Brunswick and as well as Newfoundland and Labrador. It takes about 6 months for the fish to hatch followed by a 2 to 3 year period for them to reach their maximize selling size, therefore taking an average of 3 years for a fish to reach market which is 3 to 5kg (CAIA, 2012). According to Fisheries and Oceans Canada (2014) in 2013 1kg of Cod was being sold for on average $7.12 fish (FOC,

2014). Overall, Atlantic Cod are a relatively recent farmed fish, however are gaining popularity due to price, nutrition and feed to growth ratio.

Raising Atlantic Cod

In our modern society almost all fish, including Atlantic Cod, are now produced through aquaculture. Aquaculture is defined as "the rearing (raising) of aquatic animals or the cultivation of aquatic plants for food" (Google Definition, 2014). The raising of Atlantic Cod starts with the selection of the best female stock breed (CAIA, 2012). These fish are selected from previously grown market fish, located in off shore sea cages. They are selected based on weight; typically the heavier the fish the more eggs it can produce. The female fish are breed in onshore tank facilities and can produce 450,000 eggs per kg of body weight. After separating the females, the eggs are incubated in a temperature controlled tank for about 14 days until hatching. The baby cod or 'larvae' are then transferred to larval tanks. During this stage the larvae are feed yolk from a yolk sack for 3 to 4 days. After this period, once the larvae have grown large enough, they are fed tiny planktonic animals (grinded plankton). Then after a duration of 35 to 40 days of being fed planktonic animals, the larvae should have undergo metamorphosis and are now considered fish. They are removed from the larval tanks and put into circular tanks in an onshore facility. They remain in this stage for 6 months or until they are 10 to 20 grams or centimeters in length (CAIA, 2012). After they have reached this, size a microchip is sometimes inserted into the fish to monitor growth and collect information (Robinson A, 2014). Finally the fish are taken to sea cage sites via industrial trucks and barges (CAIA, 2012). In the sea cages the Cod will grow until they reach market weight which can take 24 to 36 months. During that period all fish are fed, and cage sites cleaned on a daily basis to maintain the healthiest standards (CAIA, 2012).

Facilities and Equipment

In commercial aquaculture there are two main areas of farming: the onshore facility and the offshore sea cages. In the onshore facility there are a number of storage tanks that are key to the early development of Cod and many other cold water fish. These livestock storages include: the incubators (where eggs are fertilized and allowed to hatch), the larval tanks (slightly larger tanks where the larvae is grown), the circular tanks (last stage before fish leave the onshore facility, where metamorphosis occurs) and finally storage tanks where the fish can be temporarily stored as they are transported from truck, to boat, to sea site (CAIA, 2012). Before the fish are taken to sea cage sites, some companies insert microchips into the fish to monitor population and patterns in the fish to improve the raising for future generations (Robinson A, 2014). The microchips are removed once fish are ready for market. After being transported to the ocean via private company or government ships, the fish are gently poured into a sea cage (CEAP, 2012). There are many different types of sea cages depending on the location and style of aquaculture. Some common sea containers include: aqua pod (completely sealed bubble), open water (with the hope that the fish will naturally return), sea cages (simple netting tied to the ocean floor), and raceways (often in rivers or ponds) (Robinson A, 2014). Some facilities (non-costal regions) contain land based recirculation where all fish are in an indoor water circulated facility. The most common of these however is the sea cages, due to its inexpensive and ability to hold lots of fish. Finally with any of these sites a vacuum system must be present at the bottom of the water facility to absorb fish feces and to circulate the water (Robinson A, 2014). This prevents any chance of disease and improves water quality.

Labour

In both onshore and offshore facilities Cod require daily maintenance. In the onshore facility an estimated team of 4 or 5 labourers are required for daily tasks, which include: feeding planktonic animals, regulating tank temperatures, monitoring health of fish (removing any sick fish), and general maintenance to the water facilities (CAIA, 2012). One must also consider labour for transport, which would include a truck driver, a machine operator (fork lift/crane for moving fish) and a team operating a sea barge (is located far enough off shore). Transport and sea cage crew included would be an estimated 10 people depending on the size of the operation.

Inputs

As mentioned earlier in the egg stage of development, Cod are fed yolk, followed by planktonic animals (ground plankton) in the larvae stage, and finally a pellet feed after leaving the onshore facility. The pellets fed to Atlantic Cod are mostly grain based, which are made of fish oil, bone meal, vitamins and minerals (CAIA, 2012). Atlantic Cod have a superb 1kg of feed to 1 kg of weight gain ratio (Robinson A, 2014). In some open water environments this ratio is even more efficient, because Cod will eat other small natural organisms in the water. Cod fish are actually carnivorous animals and will even eat each other if prevalent size ratios are available. However aquatic farms have recently been trying to turn Atlantic Cod's carnivorous diet to a more herbivorous one; as already done in chickens (Robinson A, 2014). This would drastically lower the already low price of feed for future generations.

Nutritional Information

Once market size is available Atlantic Cod fish offer a bounty of nutrients including a surplus amount of complete proteins, omega-3-fatty acids, iron and B vitamins (CAIA, 2012). A

serving or 98g of Atlantic Cod offers us 40% of our daily protein intake, while at the same time containing low sodium levels ([1]FAO, 1989). Atlantic Cod when compared to other meat have a much lower level of saturated fat, while still holding a high protein level. In comparison 98g of chicken provides about 18g of protein (under 40%) (Self Nutrition Data, 2014).

Benefits to Canada

Atlantic Cod gives a direct 8000 full time jobs in Canada and this number is growing (CAIA, 2012). More jobs are becoming available due to increase in demand for fish. In 1986 Canadian Aquaculture production was valued at 35 million, by 2006 it was valued at 912 million and this pace is still growing as illustrated in figure 1. The jobs being created by this industry are also 90% located in rural, Aboriginal or small coastal cities. Just one example of this is in B.C, Kitasoo First Nation community, where aquaculture helped reduce unemployment to zero from 80 percent. Also an analysis by Indian and Northern Affairs determined that 61 First Nations could support salmon farms, 130 could develop trout farms and 123 would have access to clam, mussel and oyster farming (CAIA, 2012).

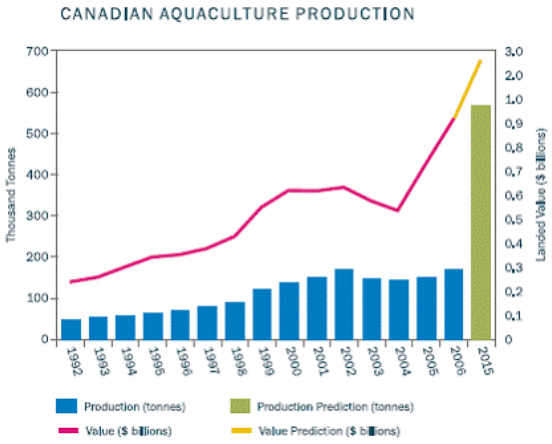

Figure 1 (CAIA, 2014)

Constraints

After the near extinction of natural Atlantic Cod in the wild, strict laws were made to prevent fishing of any sort. This lead to aquaculture. However, the fishing industry in Canada is severely limited and regulated. 73 pieces of federal and provincial legislation regulates what is exactly allowed (CAIA, 2012). Any new aquaculture of any sort is not allowed in Ontario

(Robinson A, 2014). Only costal area like British Columbia, Newfoundland and Labrador or New Brunswick are free to build more fish farms under permission from the government (Robinson A, 2014).

Environmental Sustainability

Aquaculture (fish farming) is used for all Atlantic Cod production, so that the environment and natural (wild) fish species are essentially unaffected. Fish are sold without further processing, so little to none of the animal is wasted. The only environmental concern from Atlantic Cod is excess nutrients produced in their feces (FOC, 2014). If left un-filtered in natural environments, these feces could lead to denitrification. However in almost all commercial fish farms, feces are utilized (via vacuum) as liquid fertilizer, to be used for farm activities. Other beneficial environment factors are: factories are not required for further processing and feed source has minimal requirements from environment (FOC, 2014). Finally aquaculture developments need in-depth environmental review which includes Canadian Environmental Assessment Act (CEAA), to prevent harm from ocean habitats (CAIA, 2012). Organic Atlantic Cod is also available as an alternative product. These fish are prohibited from antibiotics, herbicides, GMOs, parasiticides and practices that minimize negative effects on the environment (CAIA, 2012).

Cooke Aquaculture

Cooke Aquaculture is an independent family-owned aquaculture company based in Blacks Harbour, New Brunswick (CA, 2014). They employ 1500 people in Atlantic Canada and generate more than $270 million in annual sales (CA, 2014). Cooke Aquaculture's headquarters are at 874 Main St W, Blacks Harbour, NB E5H 1E6. They can be contacted by email directly at

their website which is at: http://www.cookeaqua.com/index.php?Itemid=59, or called at 1(506) 456-6600.

Alternative Products

Aquaculture in Canada has a variety of different products to offer. In Canada the top aquaculture products are Salmon and mussels followed by trout. Although these products are popular in North America, they would be too expensive in a developing country. An affordable alternative could be Canadian Arctic Char, or Canadian Farmed Talapia. Both fish are farmed in Canada and have similar environmental friendly regulations and benefits as Atlantic Cod does to Canada.

Part II – Export Potential to Nepal

Nepal

Nepal is an Asian developing country between China and India. Its population is 80% rural and its major religions are Buddhist Muslim and Hindu (Khanal R.K, 2014). Nepal's geography ranges from hilly terraces, to mountainous regions, to low valleys. Nepal's capital is Kathmandu. Some of the other major cities include: Chuchepati, Balaju, Kalanki, Anamnagar, and Pokhara. Almost all agriculture in Nepal is subsistence farming and produce food for their own consumption, not profit (Khanal R.K, 2014). Common crops grown in Nepal for export include: rice, ginger, tea and a variety of dried vegetables (OEC, 2012).

Transportation

This portion of the paper is where further research would be required, if this export was attempted. Many transport companies limited specific pricing and details during research,

therefore the following information is an estimate based on secondary resources. The first transport cost, would be the price of a refrigerated transport truck to deliver the fish from Blacks Harbour, New Brunswick to a shipping port in New York. This was quoted to cost $150 American per day (Ryder, 2014). One would also require permits, insurance and a hired broker to take this truck through the border of Canada and the U.S. Then the fish would need to be taken over seas in an ice filled container on a ship. Transport from New York to an Indian Sea Port (Mumbai) by boat for a 20' container on a bulk carrier would cost a rough estimated $5000 American dollars (calculated through WFR, 2013). Once arriving in the nearest sea port to Nepal, it would once again require a refrigerated truck to take it from the storage at the shipping port to various Nepalese cities where Bhat Bhateni Supermarkets are located. This would be very difficult because Nepal does not have a well-known transport company that has refrigerated trucks, or the most efficient roads.

Storage

In Nepal there is minimal industry organization. There is no commercial distribution, cool storage, equipment, marketing or safety standards (Juraj, 1979). Transportation consists of a 12 hour drive in a van with little to no ice in temperatures up to 45 ℃. Despite these un-safe conditions all fish are sold immediate upon coming to market for twice the purchasing price. There is very limited commercial transport and storage of fish in most urban centers in Nepal as well. 200 to 400 kg of fish are transported in an insulated van, with little to no ice in large plastic containers of 0.5 m^3 capacity. They are packed in plastic bags containing 1.5 to 2.5 kg of fish. The transport takes 12 to 13 hours, in temperatures as high as 45°C (Juraj, 1979). For safe and reliable transport a refrigerated truck would be necessary for transporting the fish from the ship to urban centers in Nepal.

Market Opportunity

Obviously Atlantic Cod is beneficial for Canada, but can the same be said for Nepal? The first thing to be considered is the demand for fish in Nepal. On one hand the demand for fish in rural areas (which make up 80% of the country) is close to none (Khanal R.K, 2014). There is close to no demand for fish in rural population (80% of Nepal), due to: religion, expense and the fact that farmers typically only eat what is on their farm. In Raja's lecture in AGR110 on Nepal he mentioned that "… rural farmers eat only what is on their farm. In Nepal they will only eat meat once a year" (Khanal R.K, 2014). This cuts out a huge opportunity for export to Nepal, however there still are some meat consumers in more wealthy urban areas. In addition to this the price and demand of fish has sky rocketed by 30 to 40 percent in the Kathmandu Valley urban areas (FAOUN, 1999). This is a direct result of the mass bird flu outbreaks in the area (Paudel, Acharya, et al., 2013).

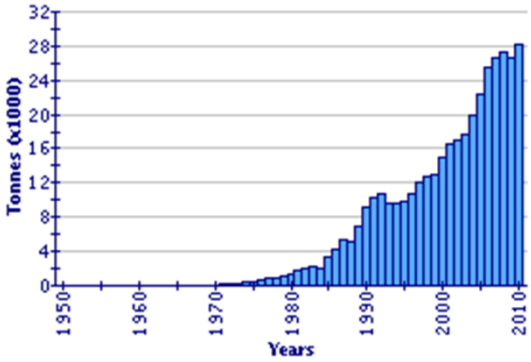

Figure 2 (FAO, 1989)

TABLE 2.6: DEVELOPMENT OF SMALL-SCALE FISH-FARMING IN THE LAKE BASIN AREA
COST-BENEFIT ANALYSIS - INDIVIDUAL FARMERS (K.Sh.)

Fish-farm identification number	1	2	3	4	5
Starting year	1986	1967	1985	1988	1989
Number of ponds	3	1	3	1	2
Total area (m2)	531	60	408	466	246
Initial investment (K.Sh.)	40687	2898	9476	25116	4598
Yield of latest harvest (t/ha/yr)	2.5	1.2	3.4	0.6	4
Length of cycle (months)	16	>60	14	28	19
Price of fish (K.Sh./kg)	8	--	2	62.5	50
INCOME (TABLE-SIZE FISH)	1062	0	277	1748	4920
INCOME (FINGERLINGS)	0	0	0	0	0
PURCHASES					
Fingerlings	0	0	0	0	0
DAP	0	0	0	0	0
Dairy meal	0	0	0	0	0
Growers marsh	0	0	0	0	0
Maize bran	8212	2430	1560	1800	2433
Rice bran	0	0	0	0	0
Maize meal	0	0	0	0	0
Blood meal	546	0	0	0	0
Omena	0	0	0	0	0
Cabbage	0	0	0	0	0
Kale	0	0	0	0	0
Other	0	0	0	0	0
Total purchases	8758	2430	1560	1800	2433
GROSS MARGIN	-7696	-2430	-1283	-52	2487
TOOLS	200	200	200	200	200
LABOR					
Feeding	23	20	46	62	11
Fertilizing	5	--	--	3	1
Maintenance	3	5	2	12	15
Stocking and harvesting	1	1	7	8	3
TOTAL NUMBER OF MAN/DAYS	32	26	55	85	30
Unit cost of Labor (per man/day)	25	25	43	30	50
TOTAL COST OF LABOR	400	325	1183	1275	750
COST OF OPERATIONS	9358	2955	2943	3275	3383
PROFIT ON OPERATIONS	-8296	-2955	-2666	-1527	1537
DEPRECIATION	2034	145	474	1256	230
NET PROFIT	-10330	-3100	-3140	-2783	1307
PROFIT OVER FIXED ASSETS (%)		-25.4	-107	-33.1	-11.1	28.4
PROFIT OVER TOTAL ASSETS (%)		-22.8	-70.8	-28.7	-10.4	20.8

Without poultry, the next most affordable meat is fish. There is also an increase in tourists, especially in areas of Nepal such as Kathmandu. This is leading to a huge demand for fish, illustrated in figure 2 above.

Cost Analysis

Sample Budget for two 5 acre ponds with no land costs

SYSTEM 10 Acres 2 Ponds			
Annual Cost $ 22919		Expected Production	35000 lbs
ANNUAL FIXED COSTS		NUMBER OF FINGERLINGS	36750
AQUATIC LICENSE FEE	10	FOOD (LBS)	63000
POND CONSTRUCTION COST	667	VARIABLE COSTS	
DIPNETS/WADERS, Etc.	20	FINGERLING COST	5145
WELL CONSTRUCTION	400	FOOD COSTS	11340
WATER PUMPING COST	550	HARVEST LABOR COST	50
OXYGEN TEST KIT	40	MISCELLANEOUS COST	450
HARVESTING EQUIPMENT	200	VARIABLE COST INTEREST	1274
BOAT AND MOTOR	50	TOTAL VARIABLE COSTS	18259
AERATOR	420		
FIXED COST INTEREST	2003		
TOTAL FIXED COSTS	4660	TOTAL ALL COSTS	22919

Figure 3 ([2]FAO, 1989)

AQUACULTURE PRODUCT MARKETING

	WHOLESALE FILLETED	WHOLESALE DRESSED	RETAIL LIVE	WHOLE SALE
DRESSED WEIGHT	14000.00	21000.00	N/A	N/A
PROCESSING COST	11200.00	9100.00	N/A	N/A
BREAK EVEN PRICE / LB	2.44	1.52	0.65	0.65
GROSS RETURN	37100.00	35700.00	43750.00	26250.00
TOTAL NET RETURN	14181.21	12781.21	20831.21	3331.21
RETURN TO MANAGEMENT	2981.21	3681.21	20831.21	3331.21
RETURN / ACRE	298.12	368.12	2083.12	333.12
RETURN / LB	0.41	0.37	0.60	0.10

Figure 4 (Gebhart G, and Williams K., 2000)

The cost to start a fish farm vary heavily on size. A full size commercial fish farm can cost an initial investment of $200,000 upwards to $1,000,000. Small fish farms with five ponds or less require an initial investment of $10,000 to $50,000. To maintain production on a small fish farm it costs around $10,000 Cana[illegible] recent s[illegible] includes feed (pellets) and facility requirements. Transport costs total to an estimated $6000 [Over sea charges: $5000(WFR, 2013) + Motor transport: $150/day x 10(Ryder, 2014)].

Benefits

Atlantic Cod would benefit Nepal by offering a nutritious, environmentally sustainable meat source, which could one day be available in the rapidly changing rural community of Nepal. For the current time however, Atlantic Cod is an inexpensive meat alternative for urban centers in Nepal [Such as Kathmandu]. “Everything is changing in Nepal” (Khanal R.K, 2014). As Nepal develops, so may consumer base in rural areas. They may move to meat in their diet. Fish is already popular in surrounding Asian countries and is affordable option for wealthier

rural farmers who may be adapting to a richer diet. Atlantic Cod can also be a luxury food item for wealthy urban citizens or restaurants located in city centers. By bringing Atlantic Cod in Nepal, there would be an increase in meat variety and availability for wealthier citizens. Finally this export would create jobs through transport as well as processing and handling in Nepal.

Bhat Bhateni Super Market

If Atlantic Cod did make it to market in large Nepalese cities such as Kathmandu, there would be a demand for it, it could be sold in grocery stores such as Bhat Bhateni a local grocery chain (Bhat Bhateni, 2013)**.** Bhat-Bhateni Supermarket and Departmental Store is a common urban supermarket located in many cities across Nepal. Locations include: Tangal, Maharajgunj, Koteshwor, Chuchepati, Balaju, Kalanki, Anamnagar, and Pokhara. The large variety of stores across Nepal, gives a great advantage of availability to most of Nepal's urban population (Bhat Bhateni, 2013). Bhat Bhateni can be contacted by phone at 977 1 4419181, 4413825, by email at panu@bbsm.com.np or by visiting their website at http://www.bbsm.com.np/new/index1.php?option=information&id=26.

Competition

The final challenge in competition. China and India have a major aquaculture sector in Nepal and can provide the same quality of fish for a cheaper price as they are much closer and transportation costs are minimized. Further research is required to determine price of shipping from India to Nepal, in order it to shipping from Canada. Most likely the cost will be much smaller, due to already set transport routes, and a much shorter travelling difference. India makes up 51.5% of Nepal's imports and China makes up 39.23% of Nepal's imports. In 2003/2004 0.7

million Nepalese Rupees worth of salmon, frozen fish and fish in brine were imported from India (FAO, 2012). “There are two groups of fish traders involved in fish marketing in Nepal: those from India and those from Nepal.” (FAO, 2012). India is second largest Fish Producer in world. Major fish exports to Nepal from India include: talapia milkfish, various carps, rohu, catla, mirgal and rock cods. Sold between 39 to 67 rupees per kilogram (Praduman K, et al., 2005). Most similar to Atlantic Cod is Rock cod, which is sold at 67 rupees per kilogram or 76 cents Canadian. In comparison, Atlantic Cod is Canada is sold for $7.12 Canadian per kg (FOC, 2014).

Evaluation

In conclusion there is a demand for Atlantic Cod in urban centers of Nepal, however near to none in rural areas. With that being said the price to transport, store and safely sell Atlantic Cod would greatly overcome the cost of profit. In addition the competition from neighbouring countries such as China or India would easily offer a replacement product for half the price simply due to a lower price of transport. Nepal’s lack of market, proper storage facilities, transport and commercial fish industry make it extremely difficult to make this export safe without spending profitless money on external industry responsibilities (i.e storage facilities). It is my recommendation that Canadian Atlantic Cod are not exported to Nepal.

Alternative Solution

Although it has been recommended that the exportation of Atlantic Cod to Nepal should not be considered, there are alternative products Canada could offer. The main problem with this export idea is cost. The cost for transport, storage and marketing is simply too high for the average Nepalese consumer. However if the cost of transport and market were gone, Atlantic Cod would have a much more affordable price. With this in mind, Canada could export just the

genetics or eggs of Atlantic Cod, as well with education on aquaculture systems. Nepal does contain a small fish industry and numerous ponds and rivers that are not strictly regulated by the government like in Canada (FAO, 1999). The exportation of genetics is not new to Canada (already in dairy industry) and would allow for jobs, and Nepal to produce their own sustainable Atlantic Cod (Robinson A, 2014).

Conclusion

Atlantic Cod are a recently developed cold water farmed fish. Atlantic Cod offer a bounty of nutrients, such as protein and omega 3 fatty acids, all at an affordable price. Atlantic cod are a sustainable product that are not only environmentally friendly, but also an industry that can be further developed to maximize output and use of fish waste. Although this industry is highly beneficial to Canada, its value is lost when exported to Nepal. A combination of global competition and lack of infrastructure in Nepal make this trade proposal un-realistic, as the price on the Atlantic Cod would be too high for a Nepalese market. An alternative option Canada can offer however is selling eggs, prime fish genetics, or education on aquaculture to Nepalese business men and women looking to produce an efficient, sustainable meat alternative system.

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