Economic Impact of the Cage Culture Industry in Ontario

March 2007

Funded by:

Canada FedNor

Northern Ontario Aquaculture Association

Prepared by:

HCA

Harry Cummings & Associates Inc.

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Harry Cummings and Associates Inc.
96 Kathleen Street, Guelph Ontario. N1H 4Y3
Phone: (519) 823-1647 / Fax: (519) 821-0202
URL: www.hcaconsulting.ca
Email: hca@web.ca

Executive Summary

In October 2006, the Northern Ontario Aquaculture Association (NOAA) initiated a study to examine the economic impacts of the cage culture industry in Ontario. A key objective of the study was to measure the economic impact of the cage culture industry through an analysis of direct and indirect economic benefits to the local and provincial economy.

The direct economic impacts (sales and jobs) associated with the Ontario cage culture industry were identified through a review of secondary data and key informant interviews with cage culture operators while the indirect economic impacts (sales and jobs) were identified through a survey of 'aqua-related' businesses that provide goods and services to the cage culture operators.

Unlike forestry, mining and agriculture, the aquaculture industry is a relatively new economic sector in Ontario. Lake based cage culture operations were established in the in the mid-late 1980s and have since come to represent the dominant production system in Ontario in terms of total fish production. Rainbow trout is the main fish species produced by the 7-8 cage culture operators in Ontario with most of these operations located in northern Lake Huron.

The cage culture industry makes an important contribution to community and regional economies in Ontario. In terms of direct benefits, Ontario cage culture operators produced a total of 3,275 tonnes of rainbow trout in 2005 which had a total farm gate value of $12.5 million. The total employment associated with this production activity amounted to 50 full-time equivalent jobs.

With respect to the indirect impacts, cage culture industry linkages with local and regional suppliers of goods and services generate significant economic benefits across a range of industry sectors including manufacturing, retail and wholesale trade, construction, transportation, and business services. The results from this study indicate that these businesses generated an estimated $38.2 million in cage culture related sales and sustained a total of 179 full-time equivalent jobs. Collectively, cage culture operators and the businesses they deal with generated a total of almost $51 million in sales and supported 229 full-time jobs. This includes a substantial number of jobs in the value added sector with two major processing facilities located in Ontario.

The study determined that the cage culture industry sustains employment in numerous Northern Ontario communities including Little Current, Espanola, Manitowaning, Kagawong, Gore Bay, Mindemoya, Evansville, Val Caron, Parry Sound, Sudbury and North Bay. The bulk of this employment activity is linked to cage culture production and businesses that provide marina supplies and service, cage fabrication and maintenance supplies and service, construction/building materials, and processing. All of the cage

culture production jobs and at least 30% of the indirect jobs related to cage culture production are located in Northern Ontario.

The cage culture industry is also providing employment in a number of communities in Southern Ontario including Hanover, Fergus, Guelph, Kitchener, New Hamburg, St. Thomas, Woodstock, Holland Centre, Dunnville, Embro, Elmira, New Dundee, Shelbourne, Coburg and Toronto. The bulk of this employment activity is linked to businesses that are providing fish feed supplies, fingerlings, and processing.

The Ontario cage culture industry also sustains a small number of jobs in the Atlantic provinces where several fish feed suppliers and netting and rigging suppliers are based.

The economic multipliers associated with the Ontario cage culture industry are substantial. The study determined that the cage culture industry has an employment multiplier of 4.5 and a sales expenditure multiplier of 4. These multipliers suggest that every job in cage culture production sustains an additional 3.5 jobs in the wider economy while every dollar in farm gate sales generates an additional 3 dollars in the wider economy.

Using slightly more conservative multipliers and assuming a 10% annual increase in production it is estimated that the Ontario cage culture industry could be producing as much as 8,400 tonnes of rainbow trout in 10 years. The direct on-farm employment associated with this production would amount to approximately 130 full-time equivalent jobs with a further 389 full-time indirect jobs sustained in the wider economy. In terms of sales, the total annual farm gate receipts at the end of the 10^{th} year of production would amount to almost $34 million with a further $84 million in indirect sales related to businesses that deal with cage culture operations.

Cage culture operators and the businesses they deal with identified a number of industry strengths. A key strength relates to the experience and resourcefulness of the cage culture operators and industry stakeholders who helped build the industry from the ground up over a short span of 20 years. The commitment of operators to engage and take the lead in science based research and development initiatives was also cited as an important feature of the industry. Operators are passionate about seeing the industry succeed and believe the industry has considerable potential for future expansion. Aqua-related businesses strongly support the expansion of the cage culture industry and believe Ontario has substantial bodies of fresh water to accommodate further growth. Industry stakeholders also recognize the importance of the industry in supporting small businesses in Northern Ontario and providing stable employment in rural communities.

In terms of challenges, the key issue as identified by cage culture operators and the businesses they deal with is the lack of functional government regulations and guidelines which is preventing cage culture operations from expanding existing sites and accessing new sites. With the Ontario cage culture industry being “held back”

operators believe that competitors from other regions of Canada and international producers are gaining a competitive advantage.

There is also concern that regulatory bodies are being misinformed and influenced by special interest groups such as environmental activists. Industry stakeholders would like to see objective science based regulations as the only standard used for determining policy and guidelines. Cage culture production represents a first generation industry in Ontario and operators feel they have not been adequately recognized for the substantial work and research they have undertaken to establish the industry over the last 20 years while complying with all of the regulations.

This study has found that the cage culture industry in Ontario produces important economic benefits for rural communities across Ontario including many communities in Northern Ontario. The industry is productive and entrepreneurial. It has also demonstrated its ability to diversify local economies and provide stable employment. The industry has even greater future economic potential for Ontario and the province possesses considerable freshwater resources for supporting the expansion of the industry. For the cage culture industry to thrive and maintain its economic viability, regulatory agencies will need to make a strategic commitment to address institutional barriers and enable its future growth.

Acknowledgements

The Northern Ontario Aquaculture Association (NOAA) is pleased to present the findings of this study and wish to thank the various supporters of the project. Without their input and support, this project would not have been possible.

Harry Cummings and Associates (HCA) was chosen to undertake the study. We thank them for their understanding, and expertise in carrying out this study and in preparing a comprehensive report. Especially noteworthy is the base-line data acquired through the aqua-related business survey. This represents an entirely new source of data which was used in determining the indirect economic impact of the Ontario cage culture industry. Furthermore, the study has the necessary framework to be updated when data from the 2006 Census is made available from Statistics Canada.

An integral part of the research process involved the development of a comprehensive list of aqua-related businesses. The compilation of this list was made possible through the support of Karen Tracey and Natasha Pelletier at NOAA and several cage culture operators including Gord Cole (Aqua-Cage Fisheries Ltd.), Dan Glofcheskie (North Wind Fisheries Ltd.), Mike Meeker (Meeker's Aquaculture) and Dale Jordison (Cold Water Fisheries Inc.)

Special gratitude goes to the staff at NOAA who acted as an exceptional liaison between HCA and the NOAA Board of Directors and coordinated two important information events over the course of the study: the Aquaculture Farm Tour which was conducted in October 2006 and the Freshwater Aquaculture Research and Development Workshop which was conducted in December 2006.

Important contributions also came from Richard Moccia and David Bevan with the Aquaculture Centre, University of Guelph and Eric Gilbert with Fisheries and Oceans Canada

A great many other individuals need to be thanked including all of the cage culture operators and aqua-related businesses who gave their time to participate in the key informant interviews.

Funding was a crucial element in implementing a project of this scope. The project would not have been possible without the funding provided by FedNor and the NOAA membership.

Sincerely,

NOAA Board of Directors

March 2007

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1.0 Introduction

In October 2006, the Northern Ontario Aquaculture Association (NOAA) initiated a study to examine the economic impacts of the cage culture industry in Ontario.[1] A key objective of the study was to measure the economic impact of the cage culture industry in Northern Ontario through an analysis of direct and indirect economic benefits to the local and provincial economy. A further objective of the study was to compare the current and future potential impact of the cage culture industry if the industry was allowed to grow in a sustainable manner of 10% per year.

The funding for this study was provided by FedNor and NOAA and the research was undertaken by Harry Cummings and Associates.

The first section of this report provides an overview of the background to the study and the study methodology. It also provides a brief socio-economic profile of the Study Area where the majority of cage culture production is concentrated in Ontario.

Section 2 of the report provides a brief overview of global and Canadian aquaculture production and its industry growth potential while Section 3 provides production information on aquaculture production in Ontario using data collected by the Aquaculture Centre, University of Guelph and information collected through key informant interviews with cage culture operators. This section also describes the direct economic impact of the cage culture industry on the local and provincial economy. Farm receipts and on farm jobs represent the first step in understanding the economic impact of the cage culture industry. Section 3 also documents the strengths of the cage culture industry in Ontario as well as the challenges faced by the industry from the perspective of producers.

Section 4 reviews the methodology that was used to estimate the indirect economic impact of the cage culture industry. A major source of information was a survey of aqua-related businesses that deal with cage culture producers. This section provides a summary of the results from the aqua-related business survey including the indirect economic impact of the cage culture industry. Section 4 also presents the strengths and challenges of the cage culture industry in Ontario from the perspective of aqua-related businesses.

Section 5 presents the summary results of the direct and indirect economic impacts of the cage culture industry in Ontario as well as estimates for the future potential growth.

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[1] NOAA serves as an industry association with representation from approximately 30 industry stakeholders including cage culture operators, fingerling producers, feed manufacturers, equipment suppliers, research institutions, etc. Because of the various government agencies involved in regulating the industry, a key role played by NOAA is to facilitate communication between the agencies and industry stakeholders. NOAA also explores research opportunities on behalf of its membership and provides a meeting place for different agencies to meet and share information and stay informed about industry related activities.

1.1 Background to the Ontario Cage Culture Industry Economic Impact Study

Economic development in Northern Ontario is strongly linked to the growth of traditional natural resource sectors such as forestry and mining. Nearly one-third of the communities in Northern Ontario are dependent on forestry and 84% of the 17,000 people employed in Ontario's mining industry work in Northern Ontario (Economic Developers Council, 2004).

In recent years, a number of research initiatives have demonstrated that agriculture is also generating a significant economic impact in Northern Ontario. In 2001, agriculture in Northeastern Ontario generated close to $120 million in farm gate receipts and an additional $185 million in indirect sales through businesses that support agriculture. In terms of employment, agriculture in northeastern Ontario provided 2,800 full-time on farm jobs and a further 1,200 full-time indirect jobs (Cummings et al., 2004).[2] The agri-impact studies demonstrated the extensive linkages that agriculture has with other sectors of the economy and its ability to generate a significant number of jobs in the local and regional economy beyond the primary production stage.

Unlike forestry, mining and terrestrial based agriculture, the aquaculture industry is a relatively new economic sector in Ontario. The industry was largely established within the last 20 years and the bulk of aquaculture production comes from lake based cage culture operations located in the northern Lake Huron area.

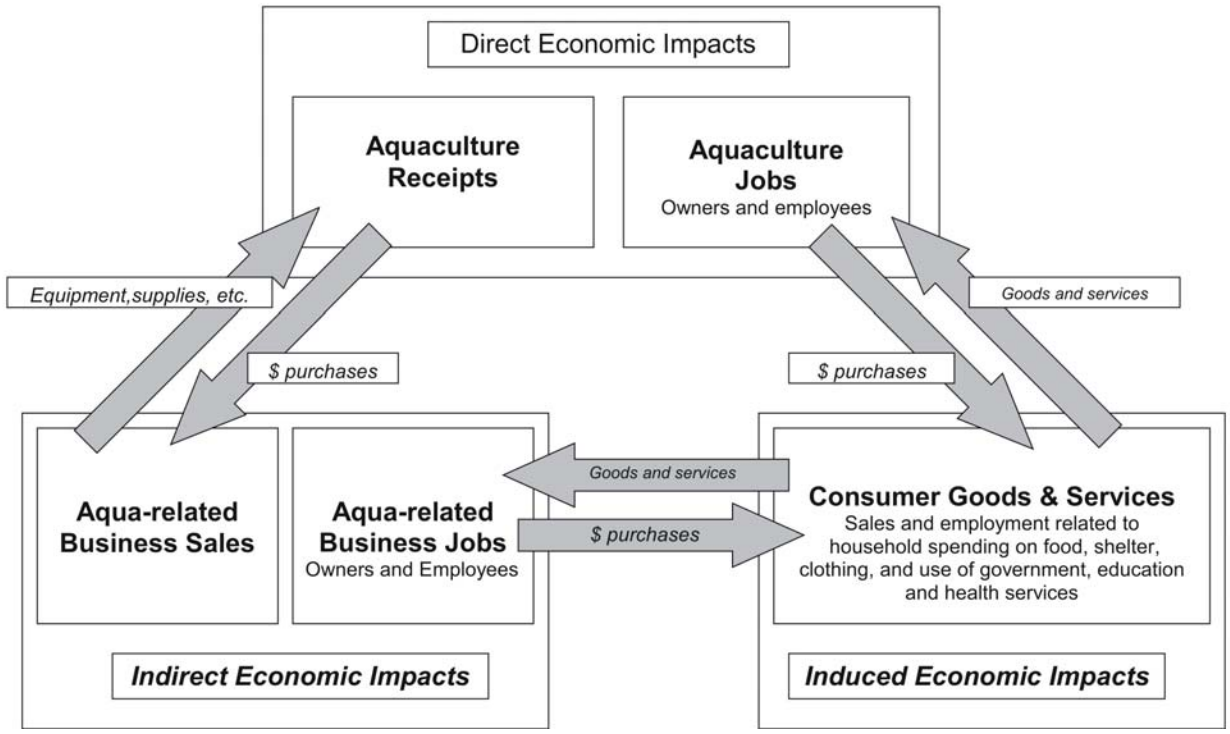
Production data associated with the Ontario aquaculture industry has been collected by the Aquaculture Centre at the University of Guelph since 1988 through an annual survey of producers. The survey provides important information on the major and minor fish species produced, the total volume of production and farm gate value of production, and production related employment. The Aquaculture Centre also provides estimates of the total economic contribution of the aquaculture using standard economic multipliers as provided by the Ontario Ministry of Agriculture, Food and Rural Affairs.

However, this report represents the first study of its kind to examine and document the economic impact of the Ontario cage culture industry beyond the farm gate using a survey of aqua-related businesses and an input-output like model to derive industry based multipliers. This approach depicts the economy as a series of sectors that buy and sell goods to each other until they reach the point of consumption. The focus of this study is on the dollars and jobs created by the cage culture industry in Ontario.

The following figure illustrates the relationship between the direct, indirect and induced economic linkages associated with the aquaculture industry.[3]

[2] Northeastern Ontario includes the following Districts: Parry Sound, Manitoulin, Nipissing, Temiskaming, Sudbury, and Algoma.
[3] The induced economic impacts were not calculated as part of this study.

Figure 1.1 Tracking the Economic Impacts of the Aquaculture Sector



The **direct economic impact** refers to farm gate receipts and employment associated with on-farm activities (i.e. fish production).

The **indirect economic impact** refers to the sales and employment associated with the re-spending of the farm gate receipts on goods and services provided by aquaculture related businesses. An aqua-related business is defined as a business that either sells products/services to cage culture operators or buys products/services from cage culture operators. Aqua-related businesses include companies that provide feed supplies, trout fingerlings, nets/pens/cages/tanks, floatation systems and buildings, engines and mechanical supplies and services, refrigeration and cooling, processing and packaging, electrical/plumbing products and services, construction services, safety devices, fuel, transportation services, insurance/finance/accounting services, legal services, consulting and research services, etc.

Finally, the jobholders in both the fish farms and the aqua-related businesses contribute to an **induced economic impact** through the spending of their wages on personal / consumer items including housing, clothing, food, and transportation. They also support jobs in an array of government service sectors including health and education.

While Figure 1.1 is useful in understanding key linkages in the cage culture industry, it does not reflect the overall complexity of the system. The system is actually a multitude of interconnected loops between various sectors with each sector impacted by a host of inputs and outputs which in turn change the inputs and outputs of the other sectors in the system. In addition to changes experienced within the Study Area the system is also impacted by change occurring elsewhere in the province, country and the world.

Other economic impact studies related to aquaculture production have identified a number of socio-economic benefits associated the industry.

In New Brunswick where the industry is centered around salmon production, the industry provides 1,600 direct jobs and a further 3,000 indirect jobs while the value of wages associated with the direct and indirect aquaculture activity is estimated at over $90 million. In the case of New Brunswick it was also determined that the large majority of jobs related to production are held by individuals under the age of 40 thus enabling young people to stay in their home communities. Additionally, the growth of the aquaculture industry in New Brunswick has supported an increase in the number of full-time jobs which has provided additional security to for local families to commit their personal resources to the area and further enhance economic spin-offs (Aquaculture Strategies Inc. December 2001).

In the State of Maine, the aquaculture industry is mostly focused on salmon production but also some trout production. The total direct, indirect and induced economic impact of the aquaculture industry in Maine is estimated at $130 million annually and employs about 1,400. The aquaculture industry has the added benefit of sustaining many of the businesses that serve Maine's traditional fishing industry while stimulating the growth of support businesses that are now considered to be part of the aquaculture business cluster (Planning Decisions. October 2003).

A 2004 study in the State of South Australia also shows the significant contribution that aquaculture can make to the local and regional economy in terms of business activity, household income and contribution to the state's growth and employment levels. The bulk of aquaculture production in South Australia in 2002-03 was related to tuna farming which generated approximately $260 million in farm gate receipts and provided just over 700 on farm jobs (EconSearch Pty. Ltd. 2004). Tuna farming in South Australia generated an additional $241 million in indirect sales and provided just over 1,000 jobs in businesses that supported tuna farming. The study also pointed out the importance of aquaculture in helping small regional towns in South Australia reduce their reliance on one or a small number of major industries. It was noted that the relatively large labour requirements and material inputs associated with aquaculture production have shown the potential for the industry to increase the complexity and diversity of local economies. It was also noted that the demand for local labour, goods and services assists in offsetting the contraction of other local industry and may help to avoid or limit the range of other economic and social pressures associated with declining regional economies (EconSearch Pty. Ltd. 2004).

With respect to the growth potential of the industry, both the New Brunswick study (Aquaculture Strategies Inc. December 2001) and the Maine study (Planning Decisions. October 2003) identified significant industry growth potential as wild fish resources decline and aquaculture continues to develop as a sustainable and cost-effective solution to world fish supplies. The strength of local expertise in aquaculture research and production and the proximity of these regions to large consumer markets were also noted as important enabling factors that will help these regions capture the economic potential of the industry.

While the current aquaculture industry in Ontario is not on the same production scale as the examples cited above, this report will demonstrate that the industry is substantial and is well positioned with many of the enabling factors for future growth. The report will illustrate the success of the Ontario cage culture industry in establishing itself as an important local and regional industry sector within a span of just 20 years. The report will also identify the issues and factors that are constraining the ability of the industry to reach its economic potential.

1.2 Study Methodology

The direct economic impacts associated with the Ontario cage culture industry were identified through a review of secondary data from the Aquaculture Centre – University of Guelph and Statistics Canada. Key informant interviews and site visits were also conducted with cage culture operators. As part of the interview process operators were asked to provide information on the size and scale of their farm in terms of production characteristics (e.g. quantity of production and value of farm gate sales) and employment characteristics. Operators were also asked to describe any aquaculture research and development activities that they participated in. Additionally, operators provided commentary on the current strengths of the cage culture industry in Ontario as well as some of the barriers and obstacles that are limiting/restricting expansion of the industry.

The indirect economic impacts associated with the Ontario cage culture industry were identified through a survey of aqua-related businesses. As noted above, an aqua-related business is defined as a business that either sells products/services to cage culture operators or buys products/services from cage culture operators. The list of businesses was prepared with the assistance of the Northern Ontario Aquaculture Association and cage culture operators. As part of the interview process aqua-related businesses were asked to provide information on the types of goods and services they provide to cage culture operators along with the gross annual sales associated with this activity. Aqua-related businesses were also asked to provide their opinion on the importance of the aquaculture industry to the local and regional economy. Additionally, aqua-related businesses were asked to indicate what they viewed as the strengths and challenges of the aquaculture industry.

1.3 Socio-Economic Profile of the Study Area

This section of the report provides a socio-economic profile of the region of Ontario where the majority of the cage culture production is concentrated. Specifically, this relates to Manitoulin District and Parry Sound District. The combined production of the six cage culture operations in these Districts accounts for approximately 80% of the total cage culture production in Ontario.

Data for the socio-economic profile was drawn from Statistics Canada's Population Census, which is conducted at five-year intervals. The most recent population census data is from 2006. Data for the Study Area is compared to data at the Provincial and Northern Ontario level to provide more detailed insight into the relative importance of the contribution of the Study Area to these economies.

1.3.1 Population and Population Change

The population is increasing in the region where cage culture production is concentrated in Ontario. Between 1996 and 2006, the population of Manitoulin District increased by almost 15% from 11,413 to 13,090 while the population of Parry Sound District increased by 2.5% from 39,906 to 40,918. In comparison, the population of Northern Ontario as a whole declined by almost 4% while the population of Ontario increased by 13% during the same period.

It is also important to note that the population figures as presented in Table 1.1 do not reflect seasonal variations in population which occur as a result of significant in-migration of summer cottagers/tourists in Manitoulin and Parry Sound Districts.

Table 1.1 Population in Manitoulin and Parry Sound Districts, 1996, 2001 and 2006.

Region	1996	2001	2006	% Change 1996 to 2001	% Change 2001 to 2006	% Change 1996 to 2006
Manitoulin	11,413	12,679	13,090	11.1%	3.2%	14.7%
Parry Sound	39,906	39,665	40,918	-0.6%	3.2%	2.5%
Study Area	51,319	52,344	54,008	2.0%	3.2%	5.2%
Northern Ontario [a]	876,739	839,549	843,853	-4.2%	0.5%	-3.8%
Ontario	10,753,573	11,410,046	12,160,282	6.1%	6.6%	13.1%

Source: Statistics Canada Population Census, 1996, 2001 and 2006.
[a] Northern Ontario includes the following Districts: Muskoka, Nipissing, Sudbury, Manitoulin, Parry Sound, Temiskaming, Cochrane, Algoma, Thunder Bay, Rainy River, Kenora, and the City of Greater Sudbury.

1.3.2 Economic Profile of the Study Area

The North American Industry Classification System (NAICS) is an industry classification system developed by the Statistical agencies of Canada, Mexico and the United States. The classification system was created against the background of the North American Free Trade Agreement and was designed to provide common definitions of the industrial structure of the three countries and a common statistical framework to facilitate analysis of the three economies. The NAICS classification system replaces the Standard Industrial Classification system which was used by Statistics Canada prior to the 2001 Census. NAICS organizes Canadian industries into distinguishable categories, or classifications. At the greatest level of aggregation in published census data, these industries are divided into 20 separate categories, and are presented in Table 1.2.

In 2001, the top five industrial sectors in Manitoulin District by employment included health and social services (15%), retail (13%), public administration (10%), accommodation and food services (9%), and construction (8%). In 2001, the top five industrial sectors in Parry Sound District by employment included retail (14%), health and social services (12%), accommodation and food services (11%), construction (11%), and manufacturing (10%). In contrast, the top five sectors by employment for the province of Ontario in 2001 included manufacturing (16%), retail (11%), health and social services (9%), professional services (7%), and accommodation and food services (6%).

The agriculture sector (which includes aquaculture) accounts for almost 5% of the jobs in Manitoulin District and just over 2% of the jobs in Parry Sound District. In comparison, the agriculture sector accounts for about 1% of the jobs across Northern Ontario and just under 2% of the jobs across Ontario.

Total employment in Manitoulin District increased by 540 jobs (10.5%) from 4,865 jobs in 1996 to 5,665 jobs in 2001 (Table 1.3). Industrial sectors that experienced the most job growth included public administration (190 jobs), health and social services (160), and retail (120) while job losses were experienced in agriculture (90) and manufacturing (85).

Total employment in Parry Sound District increased by 815 jobs (4.5%) from 17,945 jobs in 1996 to 18,760 jobs in 2001 (Table 1.4). Industrial sectors that experienced the most job growth included construction (310 jobs), manufacturing (145), and retail (80) while job losses were experienced in public administration (165), accommodation and food services (150), and educational services (130).

Table 1.2 Employment by Industrial Sector in Manitoulin and Parry Sound Districts, 2001. [a]

	Manitoulin District		Parry Sound District		Study Area		Northern [d] Ontario		Ontario	
	#	%	#	%	#	%	#	%	#	%
All industries	5,665	100%	18,760	100%	24,425	100%	402,590	100%	5,992,765	100%
Agriculture [b]	265	4.7%	450	2.4%	715	2.9%	4,430	1.1%	110,475	1.8%
Forestry, fishing and hunting [c]	110	1.9%	200	1.1%	310	1.3%	8,045	2.0%	13,200	0.2%
Mining and oil and gas extraction	130	2.3%	90	0.5%	220	0.9%	12,380	3.1%	21,110	0.4%
Utilities	40	0.7%	150	0.8%	190	0.8%	3,820	0.9%	46,230	0.8%
Construction	465	8.2%	2,130	11.4%	2,595	10.6%	27,300	6.8%	332,255	5.5%
Manufacturing	200	3.5%	1,900	10.1%	2,100	8.6%	43,130	10.7%	984,330	16.4%
Wholesale trade	120	2.1%	420	2.2%	540	2.2%	9,915	2.5%	278,865	4.7%
Retail trade	735	13.0%	2,710	14.4%	3,445	14.1%	51,785	12.9%	671,865	11.2%
Transportation and warehousing	385	6.8%	1,065	5.7%	1,450	5.9%	23,510	5.8%	280,150	4.7%
Information and cultural industries	55	1.0%	215	1.1%	270	1.1%	6,640	1.6%	171,750	2.9%
Finance and insurance	145	2.6%	290	1.5%	435	1.8%	9,500	2.4%	292,555	4.9%
Real estate and rental and leasing	30	0.5%	315	1.7%	345	1.4%	5,545	1.4%	108,890	1.8%
Professional, scientific & tech services	145	2.6%	515	2.7%	660	2.7%	12,820	3.2%	429,095	7.2%
Management of companies	0	0.0%	0	0.0%	0	0.0%	150	0.0%	7,895	0.1%
Administrative and support services	120	2.1%	585	3.1%	705	2.9%	15,720	3.9%	257,025	4.3%
Educational services	370	6.5%	1,140	6.1%	1,510	6.2%	29,750	7.4%	371,200	6.2%
Health care and social services	875	15.4%	2,215	11.8%	3,090	12.7%	47,015	11.7%	531,795	8.9%
Arts, entertainment and recreation	140	2.5%	460	2.5%	600	2.5%	8,060	2.0%	121,950	2.0%
Accommodation and food services	515	9.1%	2,020	10.8%	2,535	10.4%	34,645	8.6%	380,060	6.3%
Other services (except public admin)	245	4.3%	905	4.8%	1,150	4.7%	19,175	4.8%	273,125	4.6%
Public administration	575	10.2%	985	5.3%	1,560	6.4%	29,255	7.3%	308,955	5.2%

Source: Statistics Canada, 2001.

[a] Employment is linked to place of residence not place of work and refers to a period of at least three months' work in the last year.

[b] The Agriculture sector includes aquaculture.

[c] The Fishing sector does not include aquaculture.

[d] Northern Ontario includes the following Districts: Muskoka, Nipissing, Sudbury, Manitoulin, Parry Sound, Temiskaming, Cochrane, Algoma, Thunder Bay, Rainy River, Kenora, and the City of Greater Sudbury.

Table 1.3 Employment by Select Industrial Sector for Manitoulin District, 1991-2001. [a]

Industry	1991		1996		2001		Change 1991 to 2001		Change 1996 to 2001	
	Total number of jobs	% of total jobs	Total number of jobs	% of total jobs	Total number of jobs	% of total jobs	Total change in number of jobs	% change in jobs	Total change in number of jobs	% change in jobs
All industries	4,865	100%	5,125	100%	5,665	100%	800	16.4%	540	10.5%
Agriculture [b]	360	7.4%	355	6.9%	265	4.7%	-95	-26.4%	-90	-25.4%
Forestry and logging	95	2.0%	85	1.7%	110	1.9%	15	15.8%	25	29.4%
Mining and oil and gas extraction	125	2.6%	80	1.6%	130	2.3%	5	4.0%	50	62.5%
Manufacturing	265	5.4%	285	5.6%	200	3.5%	-65	-24.5%	-85	-29.8%
Construction	370	7.6%	470	9.2%	465	8.2%	95	25.7%	-5	-1.1%
Transportation and warehousing	170	3.5%	335	6.5%	385	6.8%	215	126.5%	50	14.9%
Retail trade	515	10.6%	615	12.0%	735	13.0%	220	42.7%	120	19.5%
Accommodation and food services	565	11.6%	475	9.3%	515	9.1%	-50	-8.8%	40	8.4%
Educational services	430	8.8%	350	6.8%	370	6.5%	-60	-14.0%	20	5.7%
Health care and social services	590	12.1%	715	14.0%	875	15.4%	285	48.3%	160	22.4%
Public administration	665	13.7%	385	7.5%	575	10.2%	-90	-13.5%	190	49.4%

Source: Statistics Canada, 1991, 1996, 2001.
[a] While NAICS and SIC industry sectors are not directly comparable, selected sectors have been presented to illustrate general trends.
[b] The Agriculture sector includes aquaculture.

Table 1.4 Employment by Select Industrial Sector for Parry Sound District, 1991-2001. [a]

Industry	1991		1996		2001		Change 1991 to 2001		Change 1996 to 2001	
	Total number of jobs	% of total jobs	Total number of jobs	% of total jobs	Total number of jobs	% of total jobs	Total change in number of jobs	% change in jobs	Total change in number of jobs	% change in jobs
All industries	17,690	100%	17,945	100%	18,760	100%	1,070	6.0%	815	4.5%
Agriculture [b]	460	2.6%	380	2.1%	450	2.4%	-10	-2.2%	70	18.4%
Forestry and logging	105	0.6%	140	0.8%	200	1.1%	95	90.5%	60	42.9%
Mining and oil and gas extraction	100	0.6%	130	0.7%	90	0.5%	-10	-10.0%	-40	-30.8%
Manufacturing	1,705	9.6%	1,755	9.8%	1,900	10.1%	195	11.4%	145	8.3%
Construction	2,105	11.9%	1,820	10.1%	2,130	11.4%	25	1.2%	310	17.0%
Transportation and warehousing	1,165	6.6%	1,100	6.1%	1,065	5.7%	-100	-8.6%	-35	-3.2%
Retail trade	2,450	13.8%	2,630	14.7%	2,710	14.4%	260	10.6%	80	3.0%
Accommodation and food services	2,005	11.3%	2,170	12.1%	2,020	10.8%	15	0.7%	-150	-6.9%
Educational services	1,090	6.2%	1,270	7.1%	1,140	6.1%	50	4.6%	-130	-10.2%
Health care and social services	1,565	8.8%	2,170	12.1%	2,215	11.8%	650	41.5%	45	2.1%
Public administration	1,560	8.8%	1,150	6.4%	985	5.3%	-575	-36.9%	-165	-14.3%

[a] While NAICS and SIC industry sectors are not directly comparable, selected sectors have been presented to illustrate general trends.
[b] The Agriculture sector includes aquaculture.
Source: Statistics Canada, 1991, 1996, 2001.

A further assessment of industrial specialization in the Study Area can be obtained using the Location Quotient. Economic analysts have found the Location Quotient (LQ) to be a useful tool in determining which sectors of the economy are more specialized than others (Bendavid-Val, 1991, p.73). The term 'specialized' in this instance refers to the relative size or presence of an industrial activity. The LQ is essentially a ratio of ratios. In assessing industrial sector specialization, the regional share of a particular industrial sector is compared to the provincial share in the sector. Using the Agriculture sector as an example, the LQ for 2001 is calculated as follows:

$$LQ = \frac{\text{Number of agriculture jobs in the Study Area}}{\text{Total number of jobs in the Study Area}} \div \frac{\text{Number of agriculture jobs in Ontario}}{\text{Total number of jobs in Ontario}}$$

$$LQ = (715 \div 24{,}425) \div (110{,}475 \div 5{,}992{,}765) = 1.6$$

For the purpose of interpreting the LQ, the LQ has a base value of one. An LQ of one suggests that the Study Area and Ontario are specialized to an equal degree in the chosen industry sector. If the LQ for the Study Area is greater than one, it indicates that the Study Area has a higher degree of specialization in the industrial sector than the province. An LQ of less than one indicates that the industrial sector is less specialized in the Study Area than it is for the province.

Table 1.5 presents the LQs for the Study Area (Manitoulin and Parry Sound Districts) relative to Northern Ontario and Ontario.

Compared to the Ontario economy the economy of the Study Area is specialized in Forestry/Hunting (5.8)[4], Mining (2.6), Construction (1.9), Agriculture – which includes aquaculture (1.6), and Accommodation/Food Services (1.6).

Compared to the economy of Northern Ontario the economy of the Study Area is specialized in Agriculture – which includes aquaculture (2.7) and Construction (1.6).

[4] As defined by the North American Industrial Classification System, the Fishing industry is comprised of establishments primarily engaged in the commercial catching or taking of finfish, shellfish, and other marine animals from their natural habitats. It excludes establishments engaged in farm-raised finfish, shellfish or other marine animals within a confined space and under controlled feeding and harvesting conditions – these types of establishments are included with the Agriculture industry (Animal Aquaculture).

Table 1.5 Location Quotient for Study Area Industrial Sectors Relative to Northern Ontario and Ontario, 2001

NAICS Industrial Sector	Study Area Relative to Northern Ontario	Study Area Relative to Ontario
Agriculture	2.7	1.6
Forestry, fishing and hunting	0.6	5.8
Mining and oil and gas extraction	0.3	2.6
Utilities	0.8	1.0
Construction	1.6	1.9
Manufacturing	0.8	0.5
Wholesale trade	0.9	0.5
Retail trade	1.1	1.3
Transportation and warehousing	1.0	1.3
Information and cultural industries	0.7	0.4
Finance and insurance	0.8	0.4
Real estate and rental and leasing	1.0	0.8
Professional, scientific & tech services	0.8	0.4
Management of companies	0.0	0.0
Administrative and support services	0.7	0.7
Educational services	0.8	1.0
Health care and social services	1.1	1.4
Arts, entertainment and recreation	1.2	1.2
Accommodation and food services	1.2	1.6
Other services (except public admin)	1.0	1.0
Public administration	0.9	1.2

2.0 Overview of Global and Canadian Aquaculture Production

2.1 Introduction

Aquaculture is defined as the propagation, cultivation or rearing of aquatic organisms including fish, molluscs, crustaceans, and aquatic plants (Moccia et al., January 1997). As described by the Food and Agricultural Organization of the United Nations (FAO. April 2006), farming of aquatic organisms can occur in inland and coastal areas. Simply put, aquaculture is the farming of plants or animals in marine or fresh water. It represents the aquatic form of agriculture, and is often referred to as 'fish farming' (Statistics Canada. October 2005).

2.2 Global Aquaculture Production

Global aquaculture production has grown substantially in the last 50 years, both in terms of quantity and its relative contribution to the world's supply of fish for human consumption. Research conducted by FAO has shown that since the early 1950s production increased from less than a million tonnes to just over 59 million tonnes in 2004, with a value of US$ 70 billion (Subasinghe. 2006. p.7). According to FAO statistics, the contribution of aquaculture to global supplies of fish, crustaceans, and molluscs increased from 4% of the total production by weight in 1970 to 30% in 2002 (FAO. 2004. p.14). FAO statistics also show that aquaculture is growing more rapidly than all other animal food producing sectors. Globally, the sector has grown at an average rate of 9% per year since 1970 compared with only 1% for marine capture fisheries and 3% for terrestrial farmed meat production systems over the same period (FAO. 2004. p14).

The research conducted by FAO points to the continuation of the increasing trend in aquaculture production in forthcoming decades in light of stagnant marine capture fisheries production and growing consumption patterns and consumer preference for fish products (Subasinghe. 2006. p7). The FAO study conducted in 2001 indicates that world demand for fish and fishery products is projected to expand by approximately 50 million tonnes, from 133 million tonnes in 1999/2001 to 183 million tonnes by 2015 (Ibid. 2002. p.7).

As shown in Table 2.1, China dominates global aquaculture production accounting for approximately 70% of the total production in 2002. Although aquaculture production in Canada represents less than 0.5% of total global production, Canada ranks within the top ten countries in terms of the average annual growth of the industry (Table 2.2).

Table 2.1 Top Ten Aquaculture Producers in Terms of Quantity, 2000-2002

Top ten producers in terms of quantity [a]	2000	2002	Average Annual Growth (percentage rate)
	(thousand tonnes)		
China	24,580.7	27,767.3	6.3
India	1,942.2	2,191.7	6.2
Indonesia	788.5	914.1	7.7
Japan	762.8	828.4	4.2
Bangladesh	657.1	786.6	9.4
Thailand	738.2	644.9	-6.5
Norway	491.2	553.9	6.2
Chile	391.6	545.7	18.0
Viet Nam	510.6	518.5	0.8
United States	456.0	497.3	4.4
Top ten subtotal	31,318.8	35,248.4	6.1
Canada	127.6	172.3	16.2
Rest of the world	4,049.9	4,377.9	4.0
Total	35,496.3	39,798.6	5.9

Source: FAO World Review of Fisheries and Aquaculture, 2004.
[a] Data exclude aquatic plants.

Table 2.2 Top Ten Aquaculture Producers in Terms of Growth, 2000-2002

Top ten producers in terms of growth	2000	2002	Average Annual Growth (percentage rate)
	(thousand tonnes)		
Iran (Islamic Rep. of)	40.6	76.8	37.6
Faeroe Islands	32.6	50.9	25.0
Lao People's Dem. Rep.	42.1	59.7	19.1
Brazil	176.5	246.2	18.1
Chile	391.6	545.7	18.0
Russian Federation	74.1	101.3	16.9
Mexico	53.9	73.7	16.9
Taiwan Province of China	243.9	330.2	16.4
Canada	127.6	172.3	16.2
Myanmar	98.9	121.3	10.7

Source: FAO World Review of Fisheries and Aquaculture, 2004.
[a] Data exclude aquatic plants.

2.3 Canadian Aquaculture Production

The first detailed records of planned aquaculture activity in Canada extend back to 1857 when the first Superintendent of Fisheries in Lower Canada (Quebec) studied the incubation and hatching of Atlantic salmon and brook trout eggs. By 1950, federal and provincial hatcheries were producing about 750 million freshwater fish annually which were primarily used for re-stocking wild populations. As a commercial activity, aquaculture represents a relatively new sector of the economy with the first commercial operations starting up in the 1970s (Herbert. 2002).

Under the North American Industry Classification System (NAICS), aquaculture production in Canada is formally classified as 'Animal Aquaculture'. It is grouped under the Agriculture, Forestry, Fishing and Hunting industrial sector and belongs to the animal production subsector which includes beef and dairy farming, hog farming, poultry and egg production, and other animal production (Statistics Canada. 2003. p.19-20).

As noted in the NAICS catalogue, animal aquaculture in Canada comprises establishments primarily engaged in farm-raising finfish, shellfish, or any kind of aquatic animal. These establishments use some form of intervention in the rearing process to enhance production, such as keeping animals in captivity, regular stocking and feeding of animals, and protecting them from predators (Ibid. 2003. p.87-88).

As described in the National Occupational Classification System (NOCS), aquaculture operators and managers manage operations of facilities which cultivate and harvest fish, shellfish or marine plants for replenishment of wildlife stocks or for commercial sale. They are employed by public or private fish hatcheries and commercial aquatic farms, or they may be self-employed (Human Resources and Skills Development Canada. 2006).

As detailed by NOCS, aquaculture operators and managers require a wide range of skill sets and ability levels. Related duties include some or all of the following:

- Manage the overall operation of a fish hatchery, fish farm or other aquatic farm
- Identify requirements of the species and select and oversee preparation of site for species cultivation
- Co-ordinate selection and maintenance of brood stock
- Determine food requirements and structure feeding regimes
- Monitor environment and maintain optimum conditions
- Conduct and supervise stock examination to identify disease or parasites, and apply prescribed medicinal substances to control and prevent infection
- Operate and maintain cultivating and harvesting equipment
- Collect and record growth and production data
- Supervise and train aquaculture and fish hatchery support workers and supervise technicians and technologists
- Maintain financial records and establish market strategies, inventory and quality control methods

- Scuba dive to inspect farm operations
- Design and construct pens, floating stations and collector strings or fences for farms.

Aquaculture is a growth industry in Canada and has expanded significantly in the last 10 years. As shown in Table 2.3, Canada's fish farmers produced a total of 154,993 tonnes of finfish and shellfish in 2005, more than twice the level of 66,269 tonnes reported in 1995 (Statistics Canada. Aquaculture Statistics 2005).

Total aquaculture production in Canada represents about 15% of the total quantity harvested by Canada's traditional fishery. However, over the last 10 years production in traditional fisheries has steadily declined on a year-over-year basis. During the same period aquaculture production has increased at times as much as 25%+ in a year (Statistics Canada. October 2005. p.3).

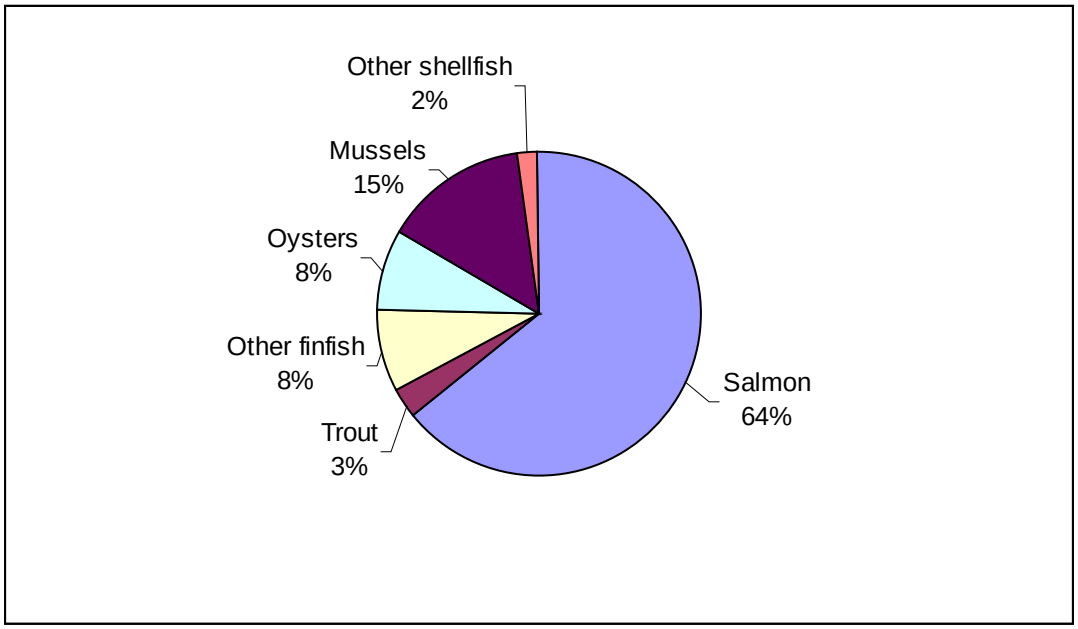
Table 2.3 Aquaculture Production by Province and Canada, 2005

	NFLD	PEI	NS	NB	QC	ON	MB	SK	AB	BC	CAN
Production [a]	tonnes										
Salmon [b]	x	x	x	35,000	0	0	0	0	0	63,441	98,441
Trout [b]	0	x	0	300	300	4,000	11	x	x	112	4,723
Other finfish [c]	x	x	x	x	x	x	x	x	x	x	12,636
Total finfish [d]	**5,006**	**10**	**5,704**	**35,300**	**300**	**4,000**	**11**	**x**	**x**	**63,553**	**115,800**
Total shellfish	**3,157**	**18,911**	**3,213**	**2,357**	**915**	**0**	**0**	**x**	**x**	**9,730**	**38,283**
Total aquaculture	**8,163**	**18,921**	**8,917**	**37,657**	**1,215**	**4,000**	**11**	**x**	**x**	**73,283**	**154,083**
Re-stocking [e]	**.**	**.**	**.**	**.**	**910**	**.**	**.**	**.**	**.**	**.**	**910**
Total aquaculture (including re-stocking)	**8,163**	**18,921**	**8,917**	**37,657**	**2,125**	**4,000**	**11**	**x**	**x**	**73,283**	**154,993**

Source: Statistics Canada. Aquaculture Statistics 2005.
[a] The production of aquaculture includes the amount produced on sites and excludes hatcheries or processing. Shellfish also includes some wild production. The data, collected from each of the provincial departments responsible for aquaculture, are considered accurate and reliable.
[b] Excludes confidential data at Canada level.
[c] Other finfish data is only available at the Canada level and includes confidential data from the provinces.
d Excludes other finfish for all provinces.
[e] To outfitters: operations offering lodging and services for hunting, fishing and trapping.

Most of the Canadian aquaculture production is finfish with salmon production dominating the industry. As shown in Figure 2.1, salmon production accounts for 64% of the total aquaculture production in Canada. There is considerable regional variation across Canada with respect to the type of aquaculture production activity. The majority of aquaculture production is situated in New Brunswick and British Columbia where salmon production is concentrated. Mussel production is largely concentrated in Prince Edward Island, Newfoundland and Nova Scotia while oyster production is largely concentrated in British Columbia with substantial production in Prince Edward Island and New Brunswick as well. In central Canada, in-land water based trout operations are the most common form of aquaculture. Trout production is largely concentrated in Ontario. Additional details on Ontario aquaculture production are provided in section 3.0 of this report.

Figure 2.1 Aquaculture Production in Canada by Type of Fish/Shellfish. 2005



Source: Statistics Canada. Aquaculture Statistics 2005.

In terms of value, Canadian aquaculture products were worth just over $715 million in 2005 (Table 2.4), up 36% from 2004 and slightly more than double the level of $342 million in 1995 (Statistics Canada. Aquaculture Statistics 2005).

While aquaculture only represents about 24% of the value derived from Canada's traditional fishery, it is growing at a faster pace. In 1994 for example, aquaculture accounted for less than 18% of the value of the fishery (Statistics Canada. October 2005. p.3).

Table 2.4 Aquaculture Value by Province and Canada, 2005

	NFLD	PEI	NS	NB	QC	ON	MB	SK	AB	BC	CAN
Value [a]	thousands of dollars										
Salmon [b]	x	x	x	$225,000	$0	$0	$0	$0	$0	$318,634	$543,634
Trout [b]	$0	x	$0	$3,000	$1,854	$15,500	$43	x	x	$673	$21,070
Other finfish [c]	x	x	x	x	x	x	x	x	x	x	$74,937
Total finfish [d]	**$26,600**	**$1,900**	**$29,551**	**$228,000**	**$1,854**	**$15,500**	**$43**	**x**	**x**	**$319,307**	**$639,641**
Total shellfish	**$6,900**	**$26,900**	**$10,867**	**$2,500**	**$2,170**	**$0**	**$0**	**$0**	**$0**	**$17,603**	**$66,940**
Total aquaculture	**$33,500**	**$28,800**	**$40,418**	**$230,500**	**$4,024**	**$15,500**	**$43**	**x**	**x**	**$336,910**	**$706,581**
Re-stocking [e]	**.**	**.**	**.**	**.**	**$8,526**	**.**	**.**	**.**	**.**	**.**	**$8,526**
Total aquaculture (including re-stocking)	**$33,500**	**$28,800**	**$40,418**	**$230,500**	**$12,550**	**$15,500**	**$43**	**x**	**x**	**$336,910**	**$715,107**

Source: Statistics Canada. Aquaculture Statistics 2005.
[a] The value of aquaculture includes the value produced on sites and excludes hatcheries or processing. Shellfish also includes some wild production. The data, collected from each of the provincial departments responsible for aquaculture, are considered accurate and reliable.
[b] Excludes confidential data at Canada level.
[c] Other finfish data is only available at the Canada level and includes confidential data from the provinces.
d Excludes other finfish for all provinces.
[e] To outfitters: operations offering lodging and services for hunting, fishing and trapping.

Increasing demand for fish and fish products along with the drop-off in the fish catch of the traditional fisheries indicate an increasing role for aquaculture in addressing the needs of the marketplace. Canada continues to be one of the world's top fish and seafood exporters with related export commodities accounting for almost 18% of national agri-food exports in 2000, generating earnings of just over $4 billion (Lanteigne. December 2002. p.12). Aquaculture exports increased substantially during the 1990s, more than doubling between 1992 and 2000 with the United States being Canada's largest market for aquaculture exports (Ibid. p.13). Within Canada's fish and seafood industry aquaculture production continues to show the strongest growth of any sector.

Domestic consumption of fish is also on the rise. Canadian consumption patterns reveal that while per capita consumption of red meat declined from 27.9kg to 26.9kg between 1991 and 2003, consumption of fish increased from 6.3kg to 6.9kg. (Statistics Canada. October 2005. p.5). The increase in demand for fish products can be linked to changes in consumer tastes and demographics as well as increased consumer awareness of the benefits of Omega-3 fatty acids, particularly Docosohexaenoic acid (DHA). Fish is naturally rich in DHA, especially cold-water species such as salmon, trout, halibut and tuna (Aquaculture Centre. October 2002). The healthy benefits associated with consuming fish are reflected in Canada's new Food Guide where the recommended number of servings of fish has increased to two servings per week (Health Canada. 2007; Globe and Mail. February 10, 2007).

Canada is particularly well suited to aquaculture due to its enormous coastline and abundance of bodies of fresh water. With the availability of clean water inland and in the marine environment, the biophysical potential for aquaculture is tremendous. Additionally, the diversity of geography and environments facilitates raising a range of different species (Lanteigne. December 2002. p.34).

Canada also has a skilled and educated workforce that can respond to the needs of the industry. Demand for farmed fish has also resulted in an increased demand for a variety of specialties in biology and in techniques related to the fishing industry (e.g. fish biologists, specialized veterinarians, aquaculture technicians) and the demand for these types of skilled professionals is expected to continue to increase (Human Resources and Skills Development Canada. 1999).

Fish farming has become an important component of many communities and local and regional economies across Canada. While specific data on employment are not available, a 2004 study completed on behalf of the Canadian Aquaculture Industry Alliance estimated that 454 aquaculture firms employed 5,000 to 6,000 people, most of them full-time (as reported by Statistics Canada. October 2005. p.3).

In terms of public perception, the fish farming industry in Canada is largely viewed in a positive way. A recent national public opinion survey conducted by Fisheries and Oceans Canada determined that 72% of respondents supported the practice of fish farming in Canada (Fisheries and Oceans Canada. June 2006). Furthermore, the survey determined that for respondents living within 10km of a lake or river the support level was 77%. The survey also determined that 75% of respondents viewed fish farming as a good way to reduce harvesting pressure on wild fish stocks and just over 80% of the respondents living within 10km of a lake or river were in agreement with this position. A further finding of the Fisheries and Oceans survey is that fish farms are perceived as operating in a sustainable way. Close to 60% of respondents in general as well as respondents living within 10km of a lake or river reported that they were confident that fish farming was currently operating in a sustainable way. The survey also revealed that about 20% of the respondents did not know enough about fish farming to provide an opinion about its current sustainability.

3.0 Overview of Ontario Aquaculture Production

3.1 Ontario Aquaculture Production

In Ontario, the provincial government has practiced aquaculture to stock lakes and streams since the early 1900s. Aquaculture remained an exclusive government activity up until 1962 when changes to the Game and Fish Act allowed private sector interests to culture and sell rainbow and brook trout for human consumption or stocking and smallmouth and largemouth bass for stocking only (Moccia, Naylor and Reid. January 1997).

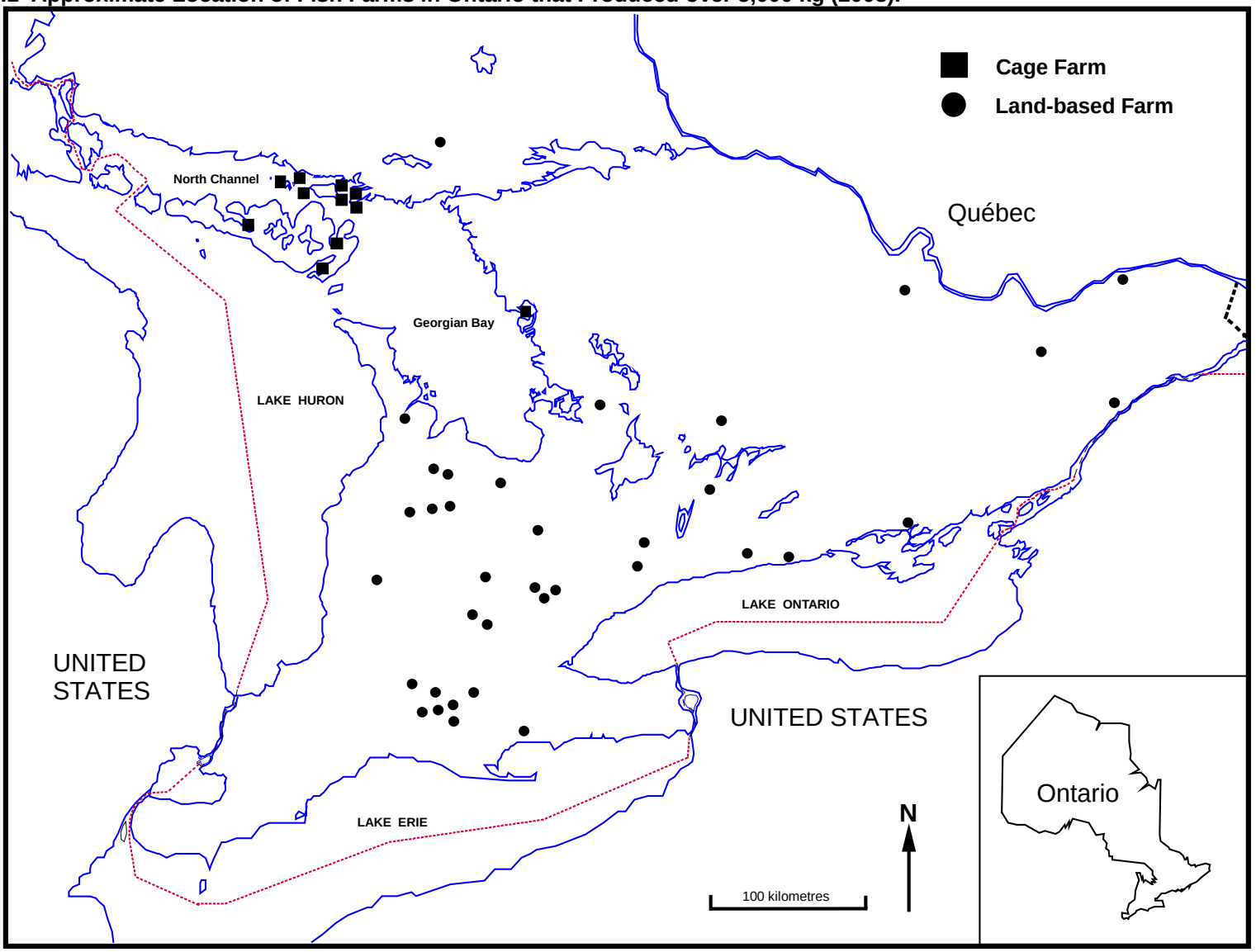
Commercial aquaculture ventures in Ontario initially involved the production of rainbow trout in pond structures which were specifically designed for fish production and facilitated stock management and harvesting. As described by Moccia et al. (January 1997), this type of production is typically favoured by the hobby farmer and is characterized by low stocking densities, high labour costs with resulting high variable costs of production.

More intensive land based production facilities emerged since the mid 1970s with the construction of long rectangular concrete raceways or circular tanks. These types of facilities allowed for higher fish stocking densities with the application of more rigorous animal husbandry practices and maximal water usage. The benefits associated with this form of production included improved feed conversions and enhanced labour efficiency (Moccia et al. January 1997).

Lake based cage culture operations were established in the in the mid-late 1980s and have since come to represent the dominant production system in Ontario in terms of total fish production. In this type of system, fish are reared from fingerling to market-size in net-pens moored in open water (Moccia et al. January 1997).

Most aquaculture operations are located in Central or Southern Ontario. A number of factors have resulted in the clustering of aquacultural operations in this part of the province including the availability of high quality water (ground and surface water supplies), suitable climate conditions, proximity to a large population/market base, and a well developed infrastructure for goods and services (Moccia and Bevan. August 1996). As shown in Figure 3.1, the cage culture industry is mainly located in northern Lake Huron (with most operations centered in the North Channel area near Manitoulin Island and one operation near Parry Sound) while land based aquaculture operations are primarily located in Southern Ontario.

Figure 3.1 Approximate Location of Fish Farms in Ontario that Produced over 5,000 kg (2003).



Source: R.D. Moccia and D.J. Bevan, 2006, Aquaculture Centre, University of Guelph, Guelph, Ontario, Canada, 2003.

Rainbow trout dominates aquaculture production in Ontario. In 2005, fish farms produced 4,075 tonnes of rainbow trout (primarily for human consumption) which is slightly above the 4,030 tonnes produced in 2004. In contrast, the annual combined production of Arctic charr and tilapia amounts to approximately 100 tonnes while the production of brook trout and bass (primarily for pond stocking and recreational purposes) is less than 25 tonnes annually (Moccia and Bevan. January 2007). The majority of rainbow trout production in Ontario comes from 7-8 farms located in the Georgian Bay area while more than 60 facilities across Southern Ontario are involved with pond stocking, typically rainbow trout, brook trout, and bass (Ibid. January 2007).[5]

Table 3.1 and Figure 3.2 show Ontario trout production trends associated with land-based and cage aquaculture facilities between 1988 and 2005. In 1988, production of rainbow trout amounted to 1,830 tonnes with 90% of the production coming from land-based operations. By 1997 the production of rainbow trout had more than doubled to 3,725 tonnes with production being evenly split between land-based and cage operations. In each of the years from 2000 and 2005, total rainbow trout production in Ontario amounted to 4,000 tonnes or more and cage production facilities accounted for 76%-81% of the total production. Approximately half of the total farmed rainbow trout production in Ontario comes from two large cage culture operations while the remaining cage culture production is split between 5-6 producers.

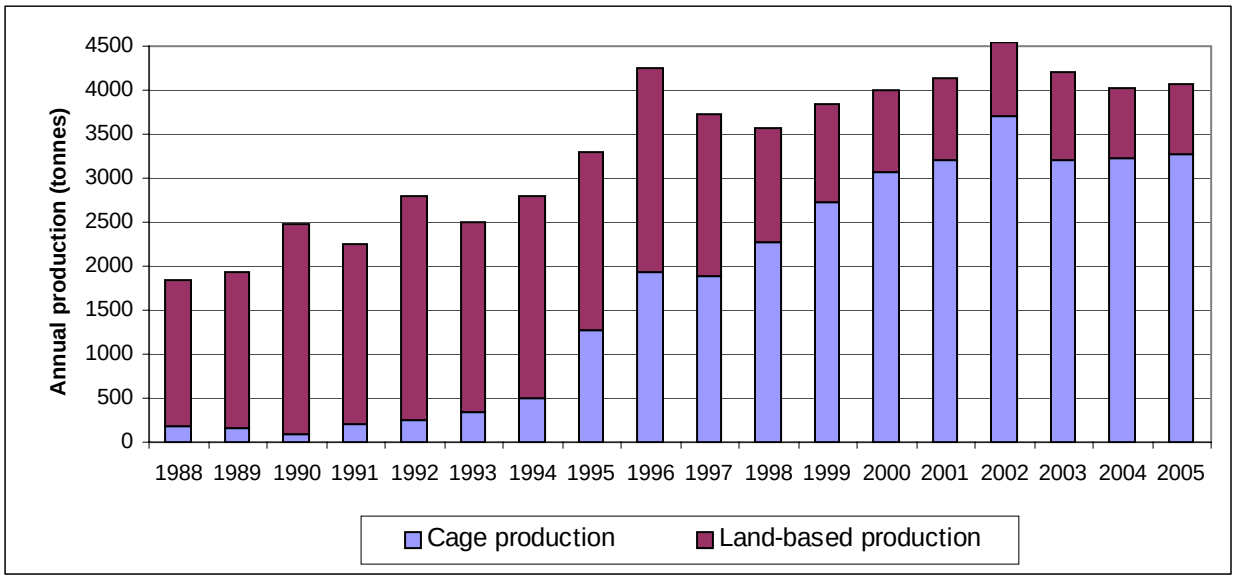
Table 3.1 Comparison of Ontario Land-based and Cage Aquaculture Trout Production (tonnes)

Year	Cage Production		Land-based Production		Total
	tonnes	%	tonnes	%	tonnes
1988	190	10.4%	1,640	89.6%	1,830
1989	167	8.7%	1,758	91.3%	1,925
1990	95	3.8%	2,375	96.2%	2,470
1991	197	8.7%	2,058	91.3%	2,255
1992	250	8.9%	2,550	91.1%	2,800
1993	339	13.6%	2,161	86.4%	2,500
1994	500	17.9%	2,300	82.1%	2,800
1995	1,263	38.3%	2,037	61.7%	3,300
1996	1,931	45.5%	2,309	54.5%	4,240
1997	1,894	50.8%	1,831	49.2%	3,725
1998	2,274	63.6%	1,302	36.4%	3,576
1999	2,730	70.9%	1,120	29.1%	3,850
2000	3,074	76.9%	926	23.2%	4,000
2001	3,200	77.4%	935	22.6%	4,135
2002	3,700	81.3%	850	18.7%	4,550
2003	3,200	76.2%	1,000	23.8%	4,200
2004	3,230	80.1%	800	19.9%	4,030
2005	3,275	80.4%	800	19.6%	4,075

Source: R.D. Moccia and D.J. Bevan, 2007, Aquaculture Centre, University of Guelph, Guelph, Ontario, Canada.

[5] Another aspect of the aquaculture industry in Ontario is the production of ornamental and tropical fish species (mostly by hobbyists) as well as gamefish species in government fish culture facilities. The economic importance of this production activity is not covered by this report but merits further study.

Figure 3.2 Comparison of Ontario Land-based and Cage Aquaculture Trout Production (tonnes)



Source: R.D. Moccia and D.J. Bevan, 2007, Aquaculture Centre, University of Guelph, Guelph, Ontario, Canada.

3.2 Ontario Cage Culture Farm Gate Receipts

The total farm gate value associated with land-based and cage aquaculture production in 2005 was approximately $18 million. Rainbow trout production accounted for $15.5 million or 86% of the total farm gate value while the sales of tilapia, Arctic charr, bass and other fish species was estimated at about $1 million and production associated with pond stocking facilities was conservatively estimated at an additional $1.5 million (Moccia and Bevan. January 2007). With cage culture production accounting for just over 80% of the total trout production, the farm gate value of cage culture production in Ontario is estimated at $12.5 million.

As shown in Table 3.2, total production of rainbow trout increased by about 21% between 1995 and 2000 and subsequently leveled off at approximately 4,000 tonnes by 2005. While the average farm gate price for rainbow trout was generally over $4/kg for the period 1995 to 2000, the average price for 2001 to 2005 has generally been under $4/kg.

Table 3.2 Ontario Aquaculture Trout Production and Farm Gate Value, 1995-2005

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
						Tonnes					
Production	3,300	4,240	3,725	3,580	3,850	4,000	4,135	4,650	4,200	4,000	4,000
						Millions of dollars					
Value	$13.3	$19.6	$15.9	$14.2	$15.5	$16.5	$16.1	$17.9	$17.0	$15.5	$15.5
						Average price per kilogram					
$ / kg	$4.02	$4.62	$4.27	$3.97	$4.03	$4.13	$3.89	$3.85	$4.05	$3.88	$3.88

Source: Statistics Canada. Aquaculture Statistics 2005.

3.3 Ontario Cage Culture Farm Employment

Survey data collected by the Aquaculture Centre - University of Guelph indicates that the Ontario aquaculture industry (cage production, pond production, etc. combined) generated approximately 180 person-years of direct on-farm employment in 2005. This consisted of 115 person-years of full-time employment and 65 person-years of part-time employment. Indirect employment was conservatively estimated at 200 person-years (Moccia and Bevan. January 2007).

Cage culture operators were invited to participate in key informant interviews to discuss their production and employment related details. A total of four operators were interviewed representing different sized operations (from 200 tonnes of annual production up to 900 tonnes or more of annual production). Collectively these four operators have over 70 years of industry experience and account for over 75% of the total cage culture production in Ontario. While the operators have experimented with growing various fish species in the past (e.g. rainbow trout, Arctic charr, Atlantic salmon, sturgeon, etc.) production is now focused exclusively on rainbow trout.

Operators were asked to identify the total number of full and part-time employees in their operation. Given the small number of cage culture operations in Ontario and the high degree of communication between operators it was possible to derive an estimate of the total number of jobs involved in Ontario cage culture production. The resulting figure of 50 full-time equivalent jobs was verified by operators, NOAA, and the Aquaculture Centre – University of Guelph.

Operators were asked to indicate the extent to which they are able to find skilled labour locally (Northern Ontario). Currently, all of the operators reported that they are able to meet their labour requirements at the local or provincial level and they are willing to provide on the job training. Operators noted that employees in the cage culture industry need to have a strong work ethic (e.g. reliable, hard-working, professional, care about

their work and the people they work with, etc.) and must be able to work outdoors in different weather conditions.

The operators reported on some labour related challenges. One operator noted that the quality of resumes has declined in recent years as more people are moving west to take advantage of employment opportunities in Alberta. It was also suggested that a more experienced labour pool is associated with New Brunswick and British Columbia where people tend to have a better attitude toward the fish farming work environment. It was noted that aquaculture technicians in Ontario have fewer opportunities for promotion into middle or senior management positions due to the relatively small number of producers in Ontario.

3.4 Ontario Cage Culture Industry Strengths and Challenges from the Perspective of Producers

As noted above, the four operators who were interviewed for this study have over 70 years of collective industry experience and account for over 75% of the total cage culture production in Ontario.

All four of these operators have participated in various research activities, independently and with other industry stakeholders and research groups. Some of the research activities include:

- fish feed trials and improving feed conversions to improve efficiency – independently and with feed supply companies and the Aquaculture Centre - University of Guelph
- research on fish manure collectors (using a tarp system placed beneath the cages) and application of manure as a soil nutrient to pasture lands with Ministry of Natural Resources
- ongoing water monitoring research and model development with the Aquaculture Centre - University of Guelph.
- examining cage site water quality and sediment data compared to lab conditions with a University Guelph PhD student and support students
- ongoing rehabilitation / regeneration research at decommissioned cage sites
- bottom sediment studies with Laurentian University
- ongoing fallowing project and bottom sediment study with Environment Canada
- design and implementation of Ontario's first submersible cage system
- research on fines removable feed delivery system
- research on harvesting techniques

Additional research activities related to cage culture production are presented in the following section on industry strengths.

3.4.1 Industry Strengths

A key strength that was identified relates to the experience and multi-skill set of the cage culture operators. As noted by one operator, the production industry as it exits today was built from the ground up over the last twenty years by a group of dedicated and resourceful entrepreneurs. Over the years operators have developed and adopted innovative production practices. The commitment of operators to engage and take the lead in research and development initiatives was also cited as an important feature of the industry. Operators are passionate about seeing the industry succeed and believe the industry has considerable potential for future expansion. A related strength and advantage of the industry is the significant freshwater resources in Ontario that can accommodate further expansion of trout production. It was also noted that operators can easily respond to consumer demand in Ontario and other markets if allowed to grow. As for the state of consumer demand for trout, one operator noted that demand in 2006 exceeded supply by 20%.

Operators also recognize that the cage culture industry plays an important role in providing stable employment in small communities and rural areas of Northern Ontario. They also recognize that their operations have a positive impact on employment in other sectors of the economy as a result of their expenditures with various types of businesses that provide production inputs. Another important aspect of the industry is that the processing facilities are located in Ontario and capture the value-added benefits (i.e. sales and jobs) for small communities in Northern and Southern Ontario.[6]

A further strength of the industry is that it provides consumers with a healthy and high quality food option. As indicated by one operator, consumers are increasingly looking for ‘local’ and ‘fresh’ food product options on the store shelf and the Ontario cage culture industry can respond to this interest. A further advantage is that the industry is close to major markets in Canada and the USA. Operators also note that cage culture production represents an excellent alternative source for table market fish in response to declining ocean fish stocks.

Operators indicated that the industry is well supported by the University of Guelph and the Ontario Ministry of Agriculture, Food and Rural Affairs, as well as Fisheries and Oceans Canada and FedNor.

As noted above, research and development is an important aspect of the Ontario cage culture industry and producers have been very proactive in undertaking and promoting science based research initiatives over the years. Two recent examples include a multi-year project at the Experimental Lakes Area and a two year demonstration project to examine the potential for producing and marketing a fish waste compost product.

[6] The two major processing facilities in Ontario are: Cold Water Fisheries Inc. in Little Current and Cole-Munro Food Groups Inc. in St. Thomas.

Experimental Lakes Area Research

The Northern Ontario Aquaculture Association has invested in research through the Experimental Lake Area (ELA) program.[7] The current research is examining the environmental effects of organic wastes/sediments from cage fish farms on the bottom layer. A test site has been operating for a few years and the plan is to run for one more year and then decommission the site and examine the impact for 2 years post decommission as the site returns to it natural state.

Fish Waste Composting Pilot Project

Another important research initiative is the fish waste composting demonstration/pilot project which is now entering its second year. Cage culture operators have been interested in finding a value-added and environmentally sound application for fish waste (mortalities, processing plant waste, etc.) rather than sending wastes to a land fill. Some small scale experimentation was conducted with fish waste materials leading up to the pilot study. The demonstration project is now in its second year and is using a blend of fish mortalities, processing plant waste and wood shavings to produce a value added compost product which can be marketed to consumers. Considerable time was devoted to researching and developing a compost material that met the composting quality criteria (e.g. maturity, foreign matter, trace elements limits, pathogenic organisms standards, organic contaminants) as promoted by the Canadian Council of Ministers of the Environment, the Ministry of the Environment, Agriculture and Agri-Food Canada and the Standards Council of Canada.

Recycling is a key theme of the demonstration project not only in the use of base ingredients for the compost (fish mortalities, processing plant waste, wood shavings) but also in the use and modification of the production equipment including reconditioned cement mixers and drive units. The project also recycles 1 tonne fish feed bags for bulk packaging the compost. Field and crop tests have been conducted as part of the initial phase of the project and will continue in 2007.

The next phase of the project will examine marketing and promotion issues. Potential markets for bulk distribution include commercial farming operations, market garden centres, and golf courses. INCO has also expressed an interest in using the product for regreening initiatives and the project is looking at incorporating zebra mussels (a harmful invasive species in Ontario‘s waterways) in the compost to address the soil acidity issues faced by INCO.

Based on current levels of fish waste produced in the region and factoring in the required amount of wood shavings to produce the proper compost blend, it is estimated

[7] The ELA program is operated by Fisheries and Oceans Canada with facilities located in northwestern Ontario (midway between Kenora and Dryden). The facilities include 58 small lakes and their watersheds which serve as a natural laboratory for studying the effects of various research initiatives. A broad range of government agencies, universities and private organizations participate in the research.

that just over 2,200 tonnes of finished compost product could be produced annually as a value added product. Similar types of compost product currently retail for about $5 per 20kg bag and if this value were applied to the projected volume of fish based compost it would have an estimated retail market value of $550,000. As well, if formally established as a business venture the production and distribution of the compost product would create a number of new full-time and part-time jobs in the local economy.

The project is being supported by NOAA with additional funding and support from FedNor, Fisheries and Oceans Canada, and the Ontario Ministry of Agriculture, Food and Rural Affairs.

3.4.2 Industry Challenges

Cage culture operators were asked to comment on the challenges facing the industry.

The key issue as identified by all four operators is the lack of functional government regulations and guidelines which prevent the cage culture industry from expanding existing sites and accessing new sites.[8] As described by one operator the lack of clearly defined policies and regulations is counterproductive to the growth of the industry and results in considerable frustration for operators who are trying to expand the industry.

There is also concern among operators that regulatory bodies are being misinformed and influenced by special interest activists such as environmental groups. Operators would like to see objective science based regulations as the only standard used to determine policy and guidelines.

Cage culture production represents a first generation industry in Ontario and operators feel they have not been adequately recognized for the substantial work and research they have engaged in to establish the industry over the last 20 years while complying with all of the regulations.

Operators expressed further concern that the Ontario cage culture industry is being held back and is missing an opportunity to solidify its position in the marketplace while competitors from other regions of Canada and international producers are gaining a competitive advantage. It was also suggested that there is some risk associated with having a few operators account for the bulk of the production as the loss of one of the major producers could have implications for two Ontario processing facilities that depend on Ontario suppliers.

Operators noted that they are facing challenges in maintaining a reasonable level of profitability (and optimism) in light of rising production costs, competition from producers

[8] At the federal level aquaculture falls under the jurisdiction of the Department of Fisheries and Oceans. In Ontario the industry falls under the jurisdiction of the Ministry of Natural Resources and the Ministry of the Environment.

in other provinces/countries, and increasing costs associated with regulatory requirements.

When asked to comment on the types of supports that are needed in the industry, the key action item noted by operators is to address the regulatory barriers that are constraining the industry. Operators would like to see the development of a more supportive regulatory body to guide the growth of the industry. Operators believe that they have worked hard to meet the “tight” regulatory guidelines and feel that the public needs to be made more aware of the historical and ongoing efforts that operators have made to ensure that the industry meets all of the regulatory requirements.

As described by one operator, “government agencies need to tell aquaculture critics that they are satisfied and confident with the regulations being used to monitor and protect the environment and that producers are doing a good job. The regulatory agencies also need to take the middle road on enforcing regulations and give producers credit for the good work they are doing in complying with regulations. Policies and guidelines shouldn’t be directed or influenced by knee jerk responses to critics if producers are following guidelines that are science based.”

4.0 Indirect Economic Impact of Cage Culture Production in Ontario

4.1 Introduction

Indirect economic impacts refer to the jobs and sales generated off the cage culture farm by aquaculture related businesses which interact directly with farm operations through buying and selling products and services. It should be noted that for the purpose of this study the term 'aqua-related businesses' includes only those businesses that buy from or sell to cage culture operators; sales to farm families for personal consumption are excluded from the indirect impact assessment, but are included later as induced impacts. The focus was placed on estimating the level of indirect economic activity associated with the cage culture industry given its dominance in the aquaculture sector in Ontario.

A survey-based 'input-output-like' approach was used to measure the indirect impacts of the cage culture industry. This was completed through a telephone survey conducted between December 2006 and March 2007. The method and survey format was originally developed by HCA for use in the agriculture sector but can be easily applied to any sector of the economy.[9] The methodology identifies the value of gross sales and the jobs produced by a sample of businesses that provide goods and services to a particular industry (e.g. agriculture or aquaculture). From this sample, an estimate is produced for the total population of industry related businesses in the Study Area. This in turn is used to estimate the total indirect economic impact (sales and employment) associated with all industry related businesses in the Study Area.

4.2 Development of the Aqua-Related Business Inventory

A list of aqua-related businesses was developed by collecting business names and contact information from a number of sources including the Northern Ontario Aquaculture Association and individual cage culture operators. Businesses were also identified through the NOAA website and in some cases the actual aqua-related businesses that were contacted during the survey provided additional referrals to other businesses.

The business list was shared with NOAA to confirm that all of the major aqua-related businesses were included such as feed suppliers, fingerling suppliers, processors, cage manufacturers, net suppliers, transportation services, water testing services, etc. Three of the cage culture operators were also helpful in identifying businesses with 'smaller' linkages to the industry including accountants, banks, legal services, insurance services, building/electrical/plumbing contractors, building supplies, equipment supplies, research consultants, etc. The final number of aqua-related businesses identified through this process amounted to 131. Recognizing that the major businesses were included in this list, a further 30 'small' aqua-related businesses (e.g. accountants,

[9] Additional details on the methodology are provided in Appendix A.

banks, legal services, insurance services, building/electrical/plumbing contractors, etc.) were factored into the inventory to account for all of the cage culture operators and the final estimate of aqua-related-businesses was estimated at 161.

An attempt was made to interview all of the businesses where the business contact information had been validated. This amounted to 118 businesses. Generally, it was a faster process to reach businesses that had more direct and significant linkages with the cage culture industry (e.g. feed companies, fingerling suppliers, processors, cage manufacturers, etc.) than to reach businesses that had small accounts or limited business activity with cage culture operators (legal services, banks, contractors, hardware/building supplies, office supplies, etc.).

A total of 60 businesses ultimately completed the telephone survey (51%) while a total of four businesses declined to participate in the survey. During the course of the survey, respondents were asked to provide information regarding the total value of sales and employment figures for their business for the 2005 fiscal year. They were also asked to estimate the percentage of sales related to the aquaculture sector through sales to, or purchases from, cage culture operations. Data was entered directly into an electronic spreadsheet.

4.3 Total Gross Sales for the Aqua-Related Businesses Surveyed

Aqua-related businesses were asked to identify their total gross sales in 2006. This includes sales related and unrelated to the cage culture industry. For example, an electrical contractor may have a client/customer base of 100 regular customers of which 1 or 2 are cage operators. Aqua-related sales include only the portion of those sales to farmers for the purpose of operating the farm while sales unrelated to aquaculture include the portion of sales to farmers for household use as well as sales to non-farmers.

Survey results and business expenditure data from other sources indicate that a total of $206.8 million in sales were generated by the 53 businesses that provided sales data.[10]

4.3.1 Aqua-related Sales for the Businesses Surveyed

Aqua-related businesses were also asked to estimate the percentage of their total sales in 2006 that were related to aquaculture production in Ontario. This included sales related to cage culture and pond culture operations. The survey determined that $33.2 million or almost 16% of total gross sales from the businesses surveyed were related to aquaculture through purchases made from, or sales made to, farm operations. About 97% or $32.2 million of this sales activity was tied to cage culture operations while about 3% was tied to pond based operations or other aquaculture operations.

[10] Information on the value of fish feed inputs was also provided by cage culture operators and Statistics Canada, Aquaculture Statistics, 2005.

4.3.2 Location of Indirect Aqua-related Sales

Just over 41% of the aqua-related business sales activity was based in Northern Ontario communities including Little Current, Espanola, Manitowaning, Kagawong, Gore Bay, Mindemoya, Evansville, Val Caron, Parry Sound, Sudbury and North Bay. The bulk of the sales activity in Northern Ontario was linked to marina supplies and service, cage fabrication and maintenance supplies and service, construction/building materials, and processing.

Close to 44% of the aqua-related business sales activity was based in Southern Ontario communities including Hanover, Fergus, Guelph, Kitchener, New Hamburg, St. Thomas, Woodstock, Holland Centre, Dunnville, Embro, Elmira, New Dundee, Shelbourne, Coburg and Toronto. The bulk of the sales activity in Southern Ontario was linked to fish feed supplies, fingerlings, and processing.

Aqua-related business sales activity in other provinces accounted for 14% of total sales activity. This was largely linked to Nova Scotia and New Brunswick businesses providing netting/rigging supplies and fish feed supplies.

The small amount of international sales activity was linked to fingerling supplies from the United States.

Table 4.1 Location of Indirect Aqua-Related Business Sales Activity for the Businesses Surveyed

	Sales in Southern Ontario	Sales in Northern Ontario	Sales in Other Provinces	International Sales	Total Sales
Sales (million)	$14.3	$13.3	$4.5	$0.1	$32.2
Percentage	44.4%	41.3%	14.0%	0.3%	100%

4.3.3 Total Indirect Aqua-related Sales

A substantial amount of the aqua-related sales data that was collected is linked to about 12 businesses that are providing key production and processing inputs such as feed supplies, processing services, packaging materials, nets, and cages. Sales associated with these businesses account for approximately $29.9 million of the $32.2 million in sales tied to cage culture operations. Thus, the remaining 41 businesses that provided sales data generated a total of $2.3 million in aqua-related sales.

Excluding the 12 key businesses noted above a sampling multiplier of 3.6 (149 divided by 41) can be obtained for the remaining 149 aqua-related businesses and the total aqua-related sales for the 149 businesses can be estimated at $8.3 million (3.6 x $2.3

million). The above calculations result in a total indirect economic impact of approximately $38.2 million in aqua-related sales ($29.9 million + $8.3 million).

4.4 Total Employment for the Aqua-Related Businesses Surveyed

Aqua-related businesses were asked to identify the total number of people that they employed in 2006. Survey results indicate that a total of 891 full-time equivalent jobs were provided by the 52 businesses that provided employment data.

4.4.1 Aqua-related Employment for the Businesses Surveyed

In order to determine the number of aqua-related jobs, the percentage of aqua-related sales for each business was applied to the respective total number of jobs in each business. The survey results indicate that aquaculture supports a total of 112 full-time equivalent jobs in the businesses surveyed. A total of 102 jobs are tied to the cage culture industry while 10 jobs are linked to pond based or other aquaculture operations.

4.4.2 Location of Indirect Aqua-related Jobs

Approximately 30% of the aqua-related business employment was based in Northern Ontario communities while 56% were based in Southern Ontario communities and close to 14% were based in communities in other provinces (Nova Scotia and New Brunswick). The higher employment level in Southern Ontario is linked to labour activities associated with manufacturing based businesses (fish feed, processing, packaging, etc.).

Table 4.2 Location of Indirect Aqua-Related Business Job Activity for the Businesses Surveyed

	Jobs in Southern Ontario	Jobs in Northern Ontario	Jobs in Other Provinces	International Jobs	Total Jobs
Number of Jobs (full-time equivalents)	57.2	30.5	14.0	0.3	102
Percentage	56.1%	29.9%	13.7%	0.3%	100%

4.4.3 Total Indirect Aqua-related Employment

A substantial amount of the aqua-related employment data that was collected is linked to about 7 businesses that are providing key production and processing inputs such as processing services, packaging materials, nets, and cages. Jobs associated with these businesses account for approximately 70 of the 102 full-time equivalent jobs tied to cage culture operations. Thus, the remaining 45 businesses that provided sales data sustained a total of 32 full-time equivalent aqua-related jobs.

Excluding the 7 key businesses noted above a sampling multiplier of 3.4 (154 divided by 45) can be obtained for the remaining 154 aqua-related businesses and the total aqua-related jobs sustained by the 154 businesses can be estimated at 109 (3.4 x 32 jobs). The above calculations result in a total indirect economic impact of approximately 179 full-time equivalent aqua-related jobs (70 + 109).

The cage culture industry also directly supports a number of jobs in the different government agencies that regulate the industry. Based on figures provided by NOAA and the Ontario Ministry of Agriculture, Food and Rural Affairs, it is estimated that the cage culture industry sustains a total of approximately 8-9 full-time equivalent jobs in the Ministry of Natural Resources (MNR), the Ministry of the Environment (MOE), the Ministry of Agriculture, Food and Rural Affairs (OMAFRA), and the Department of Fisheries and Oceans Canada (DFO).

4.5 Ontario Cage Culture Industry Strengths and Challenges from the Perspective of Aqua-related Businesses

4.5.1 Industry Strengths

Aqua-related businesses were asked to identify what they considered to be some of the key strengths of the Ontario cage culture industry (Table 4.3). Of the 50 aqua-related businesses that responded to this question, 44% noted that the industry plays an important role in providing stable, local employment while 6% reported that the industry supports small businesses in Northern Ontario. Just over 22% of the businesses noted that the industry represents a sustainable approach to fish production and 14% indicated that Ontario has a sufficient natural resource base to allow for further expansion of the industry. Fourteen percent of the businesses recognized the importance of the aquaculture industry in reducing the demand on ocean stocks while 10% suggested that public demand for aquaculture fish will continue to increase as consumers become more aware of the health benefits of consuming fish.

Other strong points of the industry as identified by aqua-related businesses include:

- highly knowledgeable and dedicated cage culture operators who are using scientific methods and ongoing monitoring to ensure that their operating procedures are sustainable and limit environmental impacts
- cage culture operators frequently communicate with each other and stay informed of industry issues and trends
- the cage culture industry adds another sector to the local economy and provides more security if other sectors experience a downturn
- the industry has opportunities for producing more value added products if allowed to grow

Approximately 14% of the businesses did not know enough about the industry to comment on its strengths.

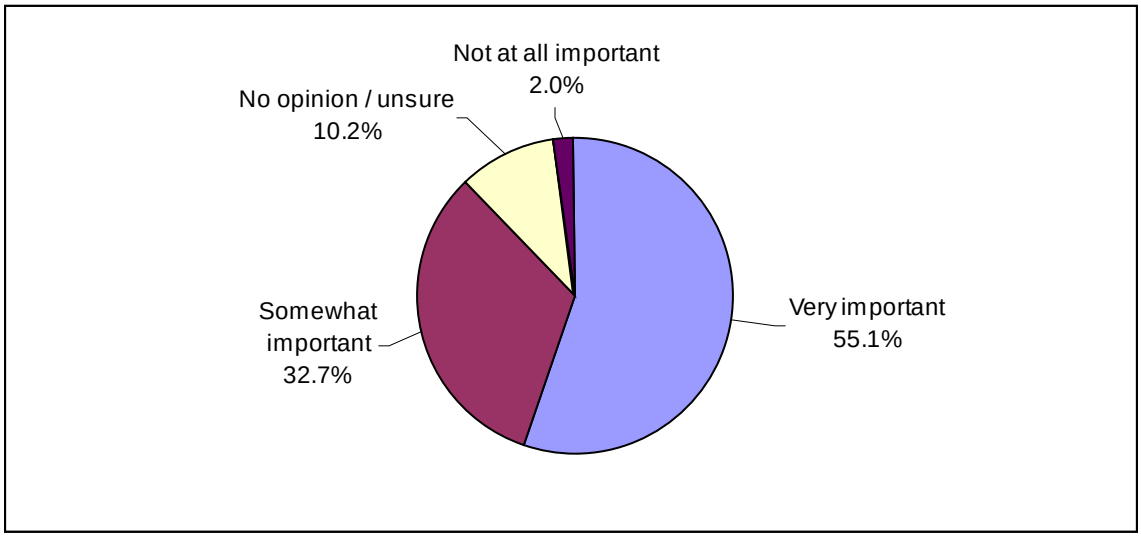
Table 4.3 Key Strengths of the Ontario Cage Culture Industry as Identified by Aqua-related Businesses [a]

44%	Provides stable, local employment
40%	Provides a healthy, quality food item for consumers
22%	Represents a sustainable approach to fish production
14%	Ontario has sufficient natural resource base to allow for industry expansion
14%	Reduces the demand on already depleted ocean fish stocks
14%	Not sure
10%	Public demand will continue to increase as consumers become more aware of the health benefits of fish
6%	Supports small businesses in Northern Ontario

[a] Respondents were allowed to identify more than one strength.

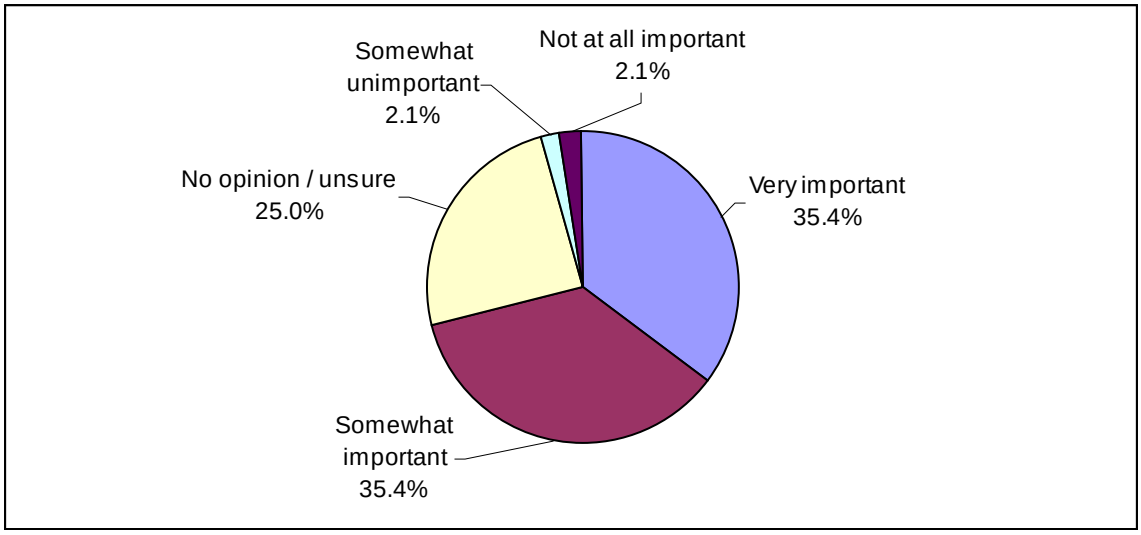
Aqua-related businesses were asked to identify how important they considered the cage culture industry to be to the local, regional and provincial economy. As shown in Figure 4.1, over 80% of the businesses reported that the cage culture industry is somewhat or very important to the local/community economy while 10% are unsure. Only 2% of the businesses indicated that the industry is not important to the local economy.

Figure 4.1 Aqua-related Business Perception of Importance of Cage Culture Industry to the Local Economy (n=49)



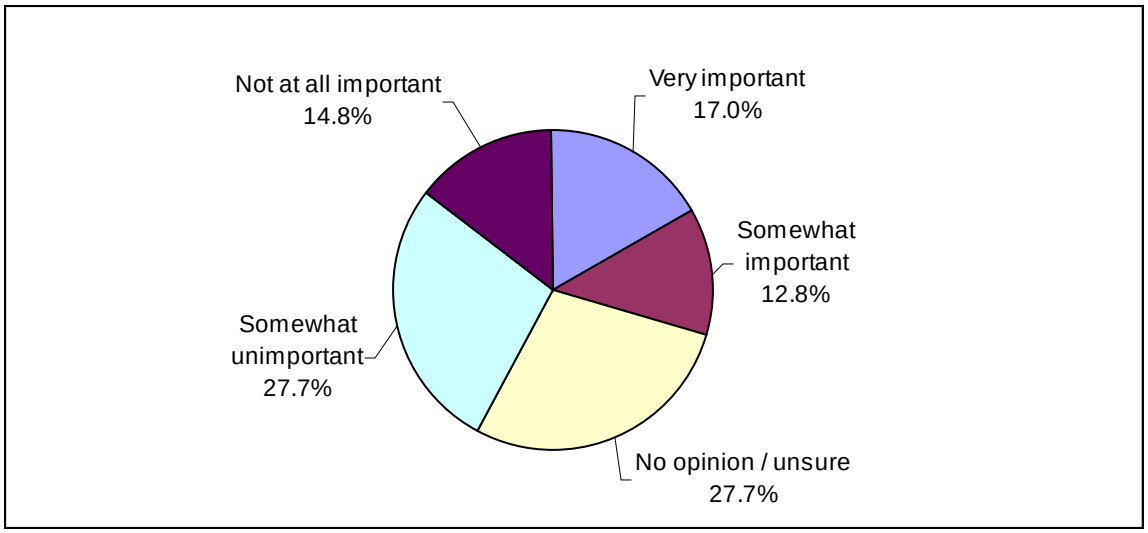
Close to 71% of the aqua-related businesses surveyed reported that the cage culture industry is somewhat or very important to the Northern Ontario economy while 25% are unsure. Only 4% of the businesses consider the industry to be unimportant to the economy of Northern Ontario (Figure 4.2).

Figure 4.2 Aqua-related Business Perception of Importance of Cage Culture Industry to the Northern Ontario Economy (n=48)



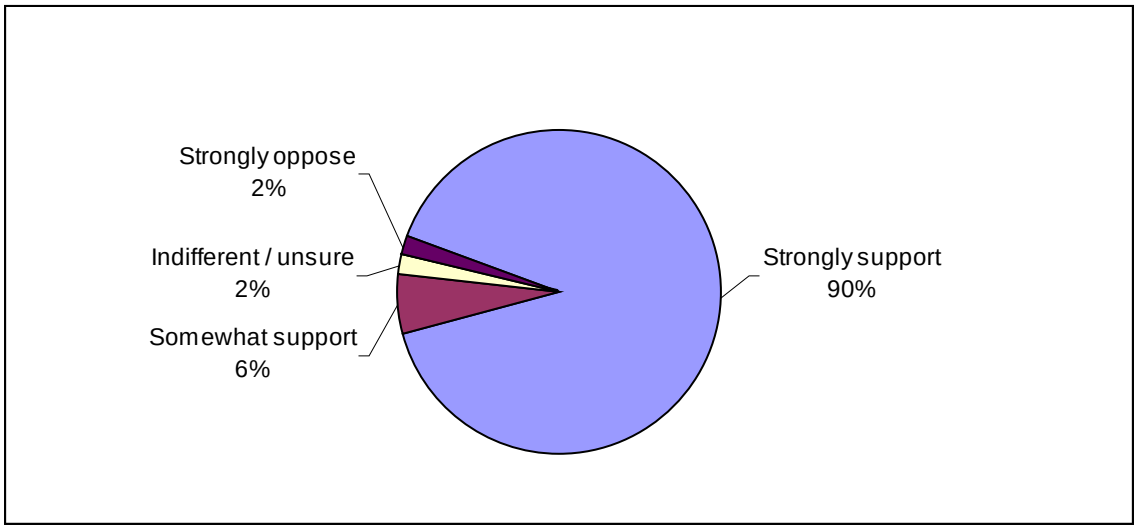
Close to 30% of the aqua-related businesses surveyed reported that the cage culture industry is somewhat or very important to the economy of Ontario as a whole while almost 28% are unsure. About 42% of the businesses consider the industry to be unimportant to the economy of Ontario (Figure 4.3).

Figure 4.3 Aqua-related Business Perception of Importance of Cage Culture Industry to the Ontario Economy (n=47)



Aqua-related businesses were asked to identify their level of support for further growth of the Ontario cage culture industry. As shown in Figure 4.4, 90% of the businesses strongly support the expansion of the cage culture industry while a further 6% are somewhat supportive of industry expansion. Only 2% of the businesses strongly oppose industry expansion while a further 2% are unsure.

Figure 4.4 Aqua-related Business Attitude Toward Expansion/Growth of the Ontario Cage Culture Industry (n=52)



4.5.2 Industry Challenges

Aqua-related businesses were asked to identify what they considered to be some of the key challenges of the Ontario cage culture industry (Table 4.4). Of the 49 aqua-related businesses that responded to this question, 43% identified provincial government regulations and regulations as a major inhibitor to industry expansion and growth. As noted by one aqua-related business representative the growth potential of the industry is being lost as cage culture operations are not being recognized and supported in the same way that government supports other types of agriculture

The influence of special interest groups such as cottagers associations, tourism and recreation associations, and environmental groups was viewed by 35% of the businesses as a significant challenge to the industry. As described by one aqua-related business “it is easy to manage the usual business risks but political risks are hard to plan for and leave the industry vulnerable. Despite the uncertainty created by provincial government regulatory constraints and challenges from special interest groups, the cage culture industry has achieved considerable success. The industry is where it is today because of the interest and commitment of industry stakeholders.”

Another respondent reported that “many of the concerns related to the environment are related to salmon production and are being unfairly carried over to the trout industry and influencing public opinion.”

Table 4.4 Key Challenges of the Ontario Cage Culture Industry as Identified by Aqua-related Businesses [a]

43%	Provincial government regulations and restrictions and lack of support for the industry
35%	Special interest groups (e.g. cottagers, tourism and recreation, environmental) advocating against the industry
22%	Not sure

[a] Respondents were allowed to identify more than one challenge.

A number of other industry challenges were identified by the respondents including:

- competition from salmon which is being produced in vast quantities and priced at levels that now compete with trout
- the significant cost for producers in meeting government regulatory requirements/testing, etc. and the costs are not being passed onto the consumer
- many fingerling operators are entering their senior years and could be exiting the industry soon. There is no sense of who will fill these positions to supply the cage culture operators and it could result in Ontario producers increasingly relying on out of province fingerling supplies
- 15 years ago the industry was an ‘energy trust’ as producers were enthusiastic and eager to see the new industry grow. Now there are too many disincentives to enter or stay in the industry and there is a risk that ‘new’ sector could contract or collapse and never reach its potential
- given that a small number of cage culture producers (2-3) account for over half of the total cage culture production in Ontario, the loss of a major producer could undermine the stability of one of the two major processing facilities in the province
- educational services related to aquaculture have become more limited in Ontario with the loss of some technician programs
- fish health management issues will continue to drive research and there is a need to ensure that Ontario specific diseases are given attention
- the number of veterinarians in the industry is limited as the industry is small and few vets move into this sector

Approximately 22% of the businesses did not know enough about the cage culture industry to comment on related challenges.

The aqua-related businesses provided a variety of responses when asked to comment on the types of industry supports that are needed. Of the 49 businesses that responded to this question, 31% indicted that the provincial rules and regulations need to be adapted to support the growth and maintenance of the industry. Related to this was a

desire to see aquaculture treated and supported in the same way as agriculture with the development of aquaculture guidelines/regulations based on scientific research results.

Approximately 16% of the businesses indicated that more work needed to be done in the area of education and awareness to inform the public about the health benefits of fish and the effort and commitment of producers to produce a quality product using sustainable practices.

Other types of supports or actions identified by the aqua-related businesses include:

- continue to research and monitoring to assess the environmental impact of the industry
- continue to try and bring industry stakeholders and interest groups together to work through differences
- develop additional promotional efforts to stimulate domestic consumption of rainbow trout
- examine further potential for selling rainbow trout in export markets
- regulate the level of fish imports

Approximately 38% of the businesses did not know enough about the cage culture industry to comment on possible industry supports/actions.

5.0 Summary of Economic Impact of Ontario Cage Culture Production

In terms of employment, cage culture operations in Ontario provide 50 direct and an estimated 179 indirect jobs. Thus, cage culture operations and the aqua-related businesses they deal with sustain an estimated total of 229 full-time equivalent jobs.

In terms of sales, cage culture operations in Ontario generate $12.5 million in direct sales and an estimated $38.2 million in indirect sales. Thus, cage culture operations and the aqua-related businesses they deal with generate an estimated total of $50.7 million in sales.

Table 5.1 Total Direct and Indirect Impact of Ontario Cage Culture Production

	Sales (million)	Jobs (full-time equivalent)
Direct	$12.5	50
Indirect	$38.2	179
Total	$50.7	229

When we take the total aqua-related employment figure and divide it by the total number of direct cage culture jobs, we get an employment multiplier of 4.5. This calculation suggests that for every job in cage culture production, an additional 3½ jobs are sustained in the wider economy.

When we take the total aqua-related sales figure and divide it by the total direct cage culture sales figure, we get a sales expenditure multiplier of 4.0. This calculation suggests that for every dollar generated on the farm, an additional 3 dollars are generated in the wider economy.

Economic impact studies on the aquaculture industry in other regions of North America are not directly comparable to the results presented here as the focus of this study is on cage culture production in Ontario which accounts for the large majority of Ontario aquaculture production (almost exclusively centered on rainbow trout production). Economic impact studies completed in other regions have used different methodologies and have typically examined aquaculture industries that feature a mix of finfish and shellfish production.

However, an input-output like model similar to the one used in this study has been used to determine the economic impact of the agriculture sector in over 20 different Counties and Districts of Ontario. While sales and job figures are not directly comparable because of differences in size and characteristics of the study areas, the multipliers

associated with each of the studies provide some insights into the importance of the linkages between primary production-related business and farm enterprises.

Employment multipliers associated with the agriculture sector ranged from 2 in the combined Counties of Elgin/Middlesex/Oxford to 4.5 in Huron County and 5.2 in Waterloo Region. The employment multiplier associated with the cage culture industry (4.5) suggests that the industry is performing as well as some of the top ranking agricultural regions in the province.

Sales expenditure multipliers associated with the agriculture sector ranged from 2 in the combined Districts of Parry Sound/Nipissing/Eastern Sudbury to 3.4 in Waterloo Region and 3.9 in Huron County. The sales expenditure multiplier associated with the cage culture industry (4.0) indicate that the industry is performing as well as some of the top ranking agricultural regions in the province.

5.1 Ontario Cage Culture Industry Potential Impact

The future potential economic impact of the Ontario cage culture industry was estimated by assuming a 10% annual increase in production and applying conservative sales and employments multipliers. A simple 10 year model has been used which assumes:

- a 10% annual increase in rainbow trout production based on 3,250 tonnes of production in the base year
- 1 direct on-farm job is required for the production of 65 tonnes of rainbow trout
- a conservative employment multiplier of 4
- an average price of $4 per kg for farm raised rainbow trout[11]
- a conservative sales multiplier of $3.5

Assuming a 10% annual increase in production, by the end of the 10th year of production the Ontario cage culture industry would be producing a total of 8,400 tonnes of rainbow trout. The direct on-farm employment associated with this production would amount to approximately 130 jobs with a further 389 indirect jobs sustained in the wider economy. In terms of sales, the total farm gate receipts at the end of the 10th year of production would amount to almost $34 million with a further $84 million in indirect sales related to businesses that deal with cage culture operations. Additional details are provided in Table 5.2.

[11] An average figure of $4/kg was determined based on a review of trend analysis data: from 1995 to 2000 the price tended to be slightly over $4/kg while it tended to be slightly under $4/kg between 2001 and 2005. Industry representatives also agreed with using an average price of $4/kg.

Table 5.2 Ontario Cage Culture Industry Future Potential Impact Assuming 10% Annual Increase in Production

	Year 2	Year 4	Year 6	Year 8	Year 10
PRODUCTION (tonnes)	**3,933**	**4,758**	**5,758**	**6,967**	**8,430**
EMPLOYMENT (full-time equivalent)					
Direct Jobs	61	73	89	107	130
Indirect Jobs	182	220	266	322	389
Total direct and indirect employment	**242**	**293**	**354**	**429**	**519**
SALES (million)					
Direct Sales	$15.7	$19.0	$23.0	$27.9	$33.7
Indirect Sales	$39.3	$47.6	$57.6	$69.7	$84.3
Total direct and indirect sales	**$55.1**	**$66.6**	**$80.6**	**$97.5**	**$118.0**

6.0 Conclusions

Cage culture production of rainbow trout has become the dominant aquaculture activity in Ontario over the last 10 years. Cage culture rainbow trout production currently accounts for over 80% of the total farmed rainbow trout production in Ontario as well over 80% of the total farm gate receipts.

The cage culture industry in Ontario makes an important economic contribution to community and regional economies. In 2005, a total of 3,275 tonnes of rainbow trout were produced by Ontario's seven cage culture operators with a total farm gate value of $12.5 million. A total of 50 full-time equivalent on-farm jobs were sustained with this production.

Economic benefits were also realized in the wider economy through industry linkages with local and regional suppliers of goods and services. These 'aquaculture-related' businesses represent a range of industry sectors including manufacturing, retail and wholesale trade, construction, transportation, and business services. The sales generated and the jobs sustained through these linkages represent the indirect economic impact of the cage culture industry. The research conducted in the this study indicates that these aqua-related businesses generated an estimated $38.2 million in cage culture related sales and sustained a total of 179 full-time equivalent jobs. Collectively, cage culture operators and the aqua-related businesses they deal with generated a total of almost $51 million in sales and supported 229 full-time jobs.

The study determined that the cage culture industry sustains employment in numerous Northern Ontario communities. The bulk of this employment activity is linked to cage culture production and businesses that provide marina supplies and services, cage fabrication and maintenance supplies and services, construction/building materials, and processing. All of the cage culture production jobs and at least 30% of the indirect jobs related to cage culture production are located in Northern Ontario.

The cage culture industry is also providing employment in a number of communities in Southern Ontario where the employment activity is largely linked to businesses that are providing fish feed supplies, fingerlings, and processing. The Ontario cage culture industry also sustains a small number of jobs in the Atlantic provinces where several fish feed suppliers and netting and rigging suppliers are based.

The economic multipliers associated with the Ontario cage culture industry are substantial. The study determined that the cage culture industry has an employment multiplier of 4.5 and a sales expenditure multiplier of 4. These multipliers suggest that every job in cage culture production sustains an additional 3.5 jobs in the wider economy while every dollar in farm gate sales generates an additional 3 dollars in the wider economy.

Using slightly more conservative multipliers and assuming a 10% annual increase in production it is estimated that the Ontario cage culture industry could be producing as much as 8,400 tonnes of rainbow trout in 10 years. The direct on-farm employment associated with this production would amount to approximately 130 full-time equivalent jobs with a further 389 full-time indirect jobs sustained in the wider economy. In terms of sales, the total farm gate receipts at the end of the 10th year of production would amount to almost $34 million with a further $84 million in indirect sales related to businesses that deal with cage culture operations.

This study has found that the cage culture industry in Ontario produces important economic benefits for rural communities across Ontario including many communities in Northern Ontario. The industry is productive and entrepreneurial. It has also demonstrated its ability to diversify local economies and provide stable employment. The industry has even greater future economic potential for Ontario and the province possesses considerable freshwater resources for supporting the expansion of the industry. For the cage culture industry to thrive and maintain its economic viability, regulatory agencies will need to make a strategic commitment to address institutional barriers and enable its future growth.

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Appendix A: Economic Impact Analysis - An Overview

Economic impact is generally a measure of the impact of a sector or a project on all sectors of the economy. Economic Impact Analysis studies are aimed at identifying "...changes in a local economy resulting from a stimulus (positive or negative) to a particular segment of the economy" (Davis, 1990, p 5). These studies are often based on one of the several standard methodologies of regional analysis: the economic base analysis and input-output analysis (Faas, 1980, p. 4).

Economic Base Approach

Economic Base Theory maintains that economic growth is only possible if the economy's exports grow (Bradfield, 1988, p.38). The theory is based on the belief that as exporting industries expand their sales, there will be an increasing demand for inputs locally which will consequently drive local economic growth (Bradfield, 1988, p.39). In economic base theory, the economy is classified into two sectors of basic and non-basic. The basic sector includes industries that ultimately export their product out of the region. The non-basic sector is the economic activity with final sales remaining inside the region (Davis, 1990, p. 10). These are support industries that provide everything from industrial inputs to houses for basic sector employees (Higgins and Savoie, 1995, p. 66). The exporting industries are identified as basic sectors while all other industries are classified as non-basic.

According to economic base theory, exports are the engine of the local economy. It follows then that the export of goods supports all other needs of the economy (Bendavid-Val, 1991, p. 77). Economic base theory and its supporters carry the separation of basic and non-basic sectors to the point where they attempt to predict the relative impact of the basic sector on the non-basic sector. The prediction of economic impact is assessed through two economic indicators known as the economic base ratio and economic base multiplier. Economic base theory has been refined to the point where it can be questioned: "What is the overall gain in employment or income in the region associated with each gain in export sales?" (Bendavid-Val, 1991, p. 78).

This question is answered through the economic base ratio indicator and the base multiplier indicator (Bendavid-Val, 1991, p. 780). The economic base ratio calculates jobs that are theoretically created from one additional job in the basic sector. The economic base ratio is the ratio between employment in the basic and non-basic sectors and is supported by the idea of basic and non-basic employment combined equaling total employment (Bendavid-Val, 1991, p. 78). The economic base multiplier is the ratio of total employment to basic employment and indicates how many jobs in total are provided for each basic job. Thus, the economic base multiplier is the total sum of the jobs created in both sectors from one job in the basic sector (Bendavid-Val, 1991, p. 78). The economic base method is used in this study to estimate jobs in the service sector related to the basic sector of aquaculture.

Input-Output Analysis

Input-Output (IO) analysis is used to measure the inter-relationships between economic activities at the sectoral, national and regional levels. Linkages are expressed by estimating the sales (outputs) from a given sector to all other sectors in the economy, and by estimating inputs from all other sectors to a specific sector. What makes the IO model so useful is its comprehensiveness, which disaggregates the economy into individual sectors (Josling, 1996, p. 5). Disaggregation permits analysis at the sectoral level, providing researchers with a close-up view of the economy. This analysis allows the researcher to assess where each sector purchases its inputs and where it sells its outputs. Such analysis is invaluable in identifying what investment will provide the greatest impact on an economy (Poole et al., 1994, p. 30).

The IO model estimates the movement of expenditures through the economy. This is traced through four different levels of expenditure: intermediate and primary suppliers, and intermediate and primary purchasers (Bendavid-Val, 1991, p. 88). Suppliers - intermediate and primary - purchase inputs for processing into inputs. Purchasers - intermediate and primary - buy outputs from suppliers and either use them to manufacture a product, or sell them as a final product (Bendavid-Val, 1991, p.88).

Input-output analysis has two main approaches. The Open Model allows the estimation of only the direct and indirect effects of a sector. The Closed Model estimates these, as well as the induced effects of a sector. The open model is used to trace the flow of variables between sectors of the economy (i.e. direct and indirect expenditures). The open model does not measure induced spending in the economy; expenditures on food, services and other household expenses would not be included (Davis, 1990, p. 59). The closed model is used to measure all aspects of the economy, including the direct, indirect and induced effects. Treating the household sector as a producer that sells labour to other purchasing sectors assesses induced effects (Davis, 1990, p. 59). As this study aims to measure all of the effects of the cage culture industry on the Study Area economy, it is based on the Closed Model approach.

There are several problems associated with the IO model. The first is that it is time-specific; it takes a snapshot of the economy at a specific point in time. This model cannot account for changes in product demand or input costs, or for the introduction of new technology into the industrial sector (Davis, 1990, p. 62). Thus, the IO model does not adjust for the changing nature of the economy. A second problem of the IO model is the cost and time needed for the construction of the tables associated with this analysis. For this reason, the analysis for this study has been carried out using a survey-based "input-output-like" approach.

Multipliers

Given the previous discussion of economic base analysis and input-output analysis, the reader may question where the application of the two models leads. One of the best

uses is that they allow the analyst to identify the impacts of economic changes or shocks to a system. Essentially, what these models do is measure the multiplier effects that result from a change in the economic system. In basic terms, multiplier effects are the relationship between direct jobs produced by a project or sector and indirect and/or induced jobs caused by the direct jobs, presented in a single number (Lewis et al., 1979, p. 1). Therefore, an economic multiplier can be used to estimate the impact of change in one variable (for example, the value of agricultural production) on another variable (for example, the value of non-agricultural production). Direct employment and production in the agriculture sector will affect the rest of the economy by supporting employment in related industries as well as in the retail sector. In this way, "...a multiplication of transactions occurs in the economy by people re-spending money" (Van Hoeve, 1995, p. 66). The multipliers calculated for this research include a sales expenditure multiplier and an employment multiplier.