ECONOMIC IMPACTS
of the Newfoundland and Labrador Aquaculture Industry

Newfoundland Labrador

Fisheries and Aquaculture

Publication Prepared by:
Aquaculture Division
Department of Fisheries and Aquaculture
2014

Photo reference:
Front and back cover feature image: Salmonid site in Fortune Bay
Front and back cover inset image: Mussel growing lines
Table of Contents: Newfoundland and Labrador mussels on growing lines

Page 1	Salmonid site in Fortune Bay
Page 2	Pool's Cove
Page 3	Farmed mussels, salmon, and steelhead trout
Pages 5 - 6	Mussel farm located in Little Bay Arm, Green Bay
Page 7	Steamed farmed Newfoundland and Labrador mussels
Page 18	Students from the Fisheries and Marine Institute of Memorial University of Newfoundland examining smolts in the aquaculture lab

Table of Contents

Introduction 1

Industry Overview 2

Methodology 4

Economic Impacts of the Provincial Aquaculture Sector 5
- Gross Domestic Product 5
- Employment 8
- Labour Income 9

Salmonid Sector Impacts 10
- Gross Domestic Product 11
- Employment 12
- Labour Income 13

Shellfish Sector Impacts 14
- Gross Domestic Product 15
- Employment 16
- Labour Income 17

Summary 18

Annex 1 - Data Tables

Introduction

Aquaculture in Newfoundland and Labrador is an expanding industry that is becoming an increasingly important economic contributor to rural regions of the province. As expansion continues, there are both economic and social impacts for residents, businesses, and communities. There is an indication that for some areas, where an aquaculture industry is present, there have been impacts such as individuals moving into, or back to, rural communities, increased housing starts, and new business activity.

The Department of Fisheries and Aquaculture (DFA), in conjunction with the Department of Finance, has prepared a macroeconomic assessment of the provincial aquaculture industry to quantify impacts of the industry on the provincial economy. The following analysis provides the provincial economic impact of the aquaculture industry as a whole, as well as a breakdown of the contributions from the salmonid and shellfish sectors.

Industry Overview

Aquaculture has a long history in Newfoundland and Labrador. Beginning in the late 1800s, the first hatchery was constructed in the province to support Atlantic cod stocking activities. Modern aquaculture attempts began as early as the 1970s, when the first commercial mussel sites in the province were licensed. Initial attempts at salmonid aquaculture began in the 1980s, when the first Atlantic salmon and steelhead trout sites were licensed.

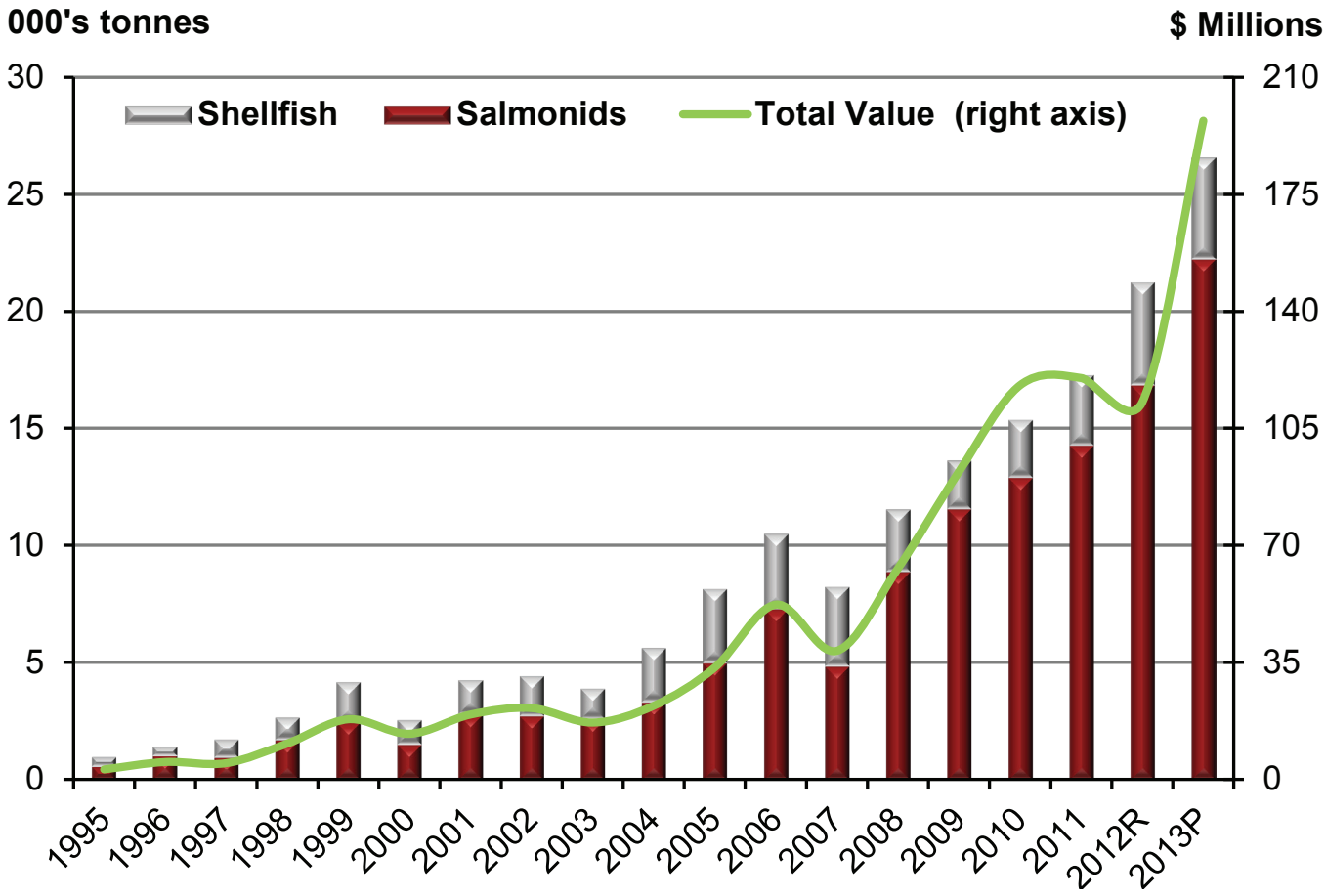
The 1980s and 1990s were a time of pre-commercial development for aquaculture in the province. Public agencies were engaged in research activities to address commercialization challenges. During this time, commercial aquaculture was attempted for a variety of species, including mussels, oysters, scallops, Atlantic salmon, steelhead trout, arctic char, and Atlantic cod. Early commercialization efforts were initiated by small, family-run businesses and resulted in limited success.

In 2000, a strategy for the development of the provincial aquaculture industry was released: http://www.fishaq.gov.nl.ca/publications/strategicplan/strategic_plan.pdf. The report recognized that there was a need to better coordinate limited resources for research and commercial development activities. It identified three commercial priority species (Atlantic salmon, steelhead trout, and blue mussels) and one focus species (Atlantic cod) for development.

Today, aquaculture is comprised of two main sectors, salmonid and shellfish, with operations located in the southern, northeastern, and western regions of the province. Aquaculture has grown from a pre-commercial industry worth approximately $3 million in 1995 to a commercial industry that was worth $197 million in 2013 (see page 3).

Aquaculture Production

Newfoundland and Labrador



Note: Salmonid production is reported as head-on gutted weight.
Source: Department of Fisheries and Aquaculture

R = Revised; P = Preliminary

Methodology

DFA partnered with the Economic Research and Analysis Division of the Department of Finance, to complete an economic impact analysis of the provincial aquaculture industry. The purpose was to quantify the economic impacts the aquaculture industry has on Newfoundland and Labrador. The analysis covers the period from 2003 to 2013 and provides impacts for the aquaculture industry as a whole, as well as for each sector (salmonid and shellfish).

The economic impact of the provincial aquaculture industry was assessed using three macroeconomic variables, Gross Domestic Product (GDP), employment, and labour income. GDP is defined as the value of unduplicated goods or services produced by an industry or geographic region. It represents the share of industry output that accrues as income to factors of production (labour income and return to capital). Labour income represents the value of wages, salaries, and benefits earned by workers in the industry. Employment is measured in person years and is the equivalent of one person working for 12 months of the year on a full-time basis. For example, one person year could be equal to one person working for 12 months of the year, or two people working for 6 months each during the year. Person year estimates do not indicate how many different people work within an industry/sector during a given year. The total number of individuals employed exceeds this figure because of seasonal peaks in activity.

The estimated impacts of the aquaculture industry on provincial GDP, labour income, and employment were separated into direct impacts and spin-off impacts. Direct impacts relate to activity directly associated with hatchery and grow-out activity. Spin-off impacts include both indirect and induced impacts. Indirect impacts estimate the activity generated by other industries that provide inputs (goods and services) into the aquaculture industry, such as net cleaning, equipment maintenance and repair, and transportation. Induced activities account for all spending that occurs in an economy generated from individuals employed in direct aquaculture operations and the indirect industries.

The economic analysis was completed with the Newfoundland and Labrador Econometric Model (NALEM) and the Newfoundland and Labrador Input-Output Model (NALIOM). An explanation of these models is provided in the box below.

NALEM is a detailed model of the relationships between key economic variables affecting the provincial economy, and is used by the Government of Newfoundland and Labrador for economic forecasting. It is also used to assess the economic impacts created by major development projects, as well as government policy changes.

NALIOM simulates the relationships between commodity outputs and commodity inputs at an industry level, under the assumption of constant returns to scale (i.e. the proportion of factor inputs used per dollar of output remains constant). NALIOM provides estimates of the GDP, employment, and labour income impacts for 727 commodity purchases distributed over 300 industries. The strength of the model lies in its ability to capture backward linkages (i.e. indirect impacts that arise from the production of intermediate inputs by other industries).

Most of the direct economic impacts of aquaculture presented come directly from Statistics Canada. NALIOM is used in this study to obtain the indirect aquaculture sector impacts. These indirect impacts are combined with the direct impacts to produce the induced impacts. The induced impacts are based on multipliers derived from NALEM. The direct, indirect, and induced impacts are then combined to determine the total economic impacts of the aquaculture sector on the provincial economy.

Economic Impacts of the Provincial Aquaculture Sector

The following analysis highlights the economic impacts the aquaculture industry has on provincial GDP, employment, and labour income.

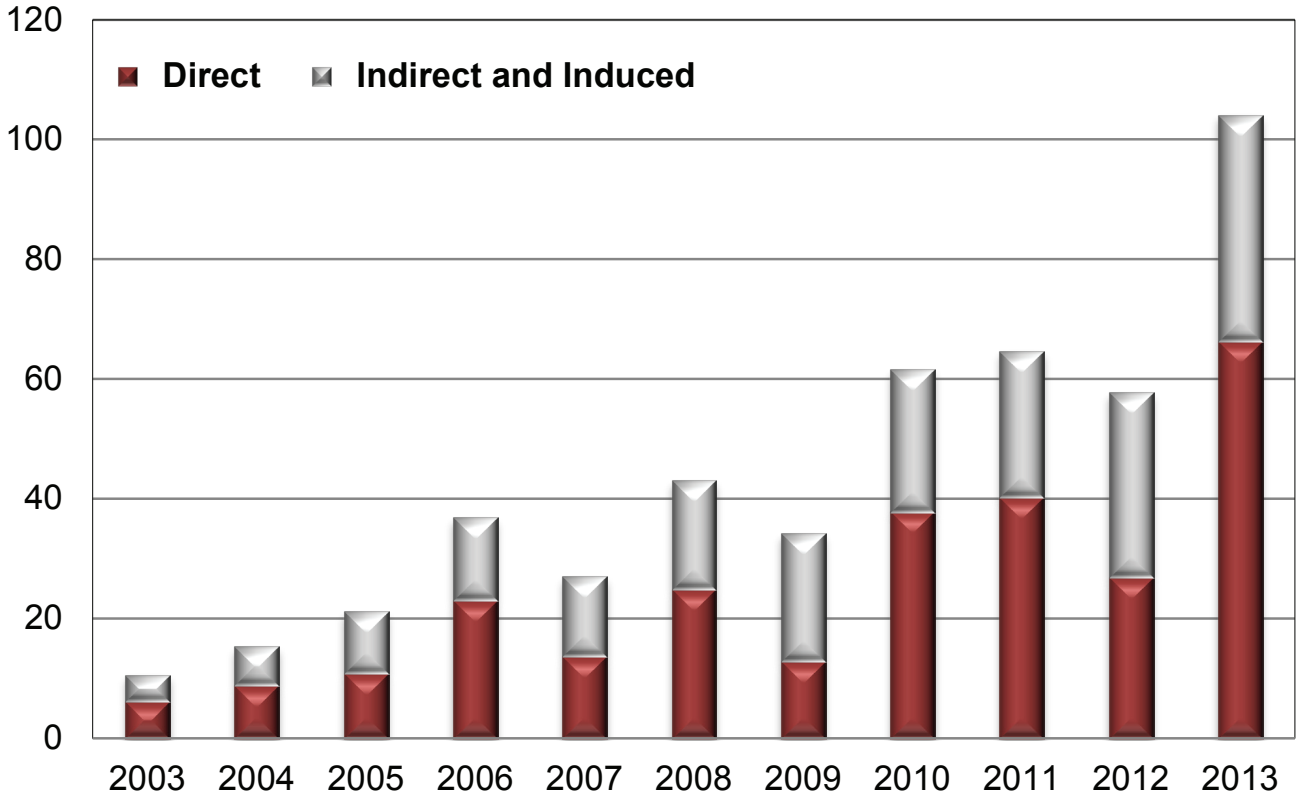
Gross Domestic Product

GDP impacts produced by the aquaculture industry have significantly increased over the past decade. In 2013, total GDP from aquaculture activity, including direct, indirect, and induced activities, was estimated to be approximately $104.1 million. In 2003, total impacts were estimated to be $10.5 million. Total GDP impacts from aquaculture activity over the last decade were $476.3 million, with a compound annual growth rate of 25.7 per cent. The graph on page 6 shows total aquaculture impacts on provincial GDP over the past ten years.

The direct GDP benefit generated by the aquaculture industry increased substantially between 2003 and 2013. In 2003, the direct impact was estimated to be $6.1 million. In 2013, that value increased to $66.2 million. The growth observed in direct GDP was mainly driven by annual increases in the volume of salmonid production, which grew by over 19,000 tonnes from 2003 to 2013. In 2012, direct aquaculture GDP dropped to about $26.9 million, as a significant decline in market prices for cultured salmon and large increases in feed costs reduced the return to capital. This decline in direct GDP occurred despite an increase in the volume of production from 17,264 tonnes in 2011 to 21,228 tonnes in 2012. Direct GDP in 2013 was boosted by a rebound in salmon prices and high mussel prices, which resulted in a significant increase in value.

Gross Domestic Product Impacts of Aquaculture Industry

$Millions



Source: Department of Finance

Both indirect and induced GDP impacts from aquaculture increased over the last decade. Indirect GDP, generated through Newfoundland and Labrador companies supplying goods and services to the aquaculture industry, was approximately $26.2 million in 2013, up from $2 million in 2003. In addition, an estimated $11.7 million in induced GDP was created in 2013. This compares to $2.4 million in induced GDP in 2003. Indirect and induced GDP growth is a reflection of expanded production volumes and increased non-wage operating expenditures for aquaculture companies. Among the main support and service industries were equipment maintenance and repair, equipment manufacturing, packaging supplies, and transportation services.

Why are market value of production and gross domestic product different?

The estimated final market value of aquaculture production in 2013 was $197 million, which resulted in $66 million in direct GDP and a total GDP impact (including indirect and induced) of $104 million. The market value of the aquaculture industry is determined by production volume and market prices. GDP, on the other hand, measures the "new income" created directly in Newfoundland and Labrador by the farming and processing of aquaculture products. It is the labour income and return on capital earned by employees and business owners working directly in the aquaculture sector. The remaining aquaculture spending flows to other supply industries and is either captured as indirect activity or flows out of the province to cover the cost of imported inputs. Inputs sourced from outside the province represent a leakage and are not counted in local GDP. This is illustrated in the case of imported feed in the salmonid sector which can represent up to 55 per cent of operating expenditures for that sector.

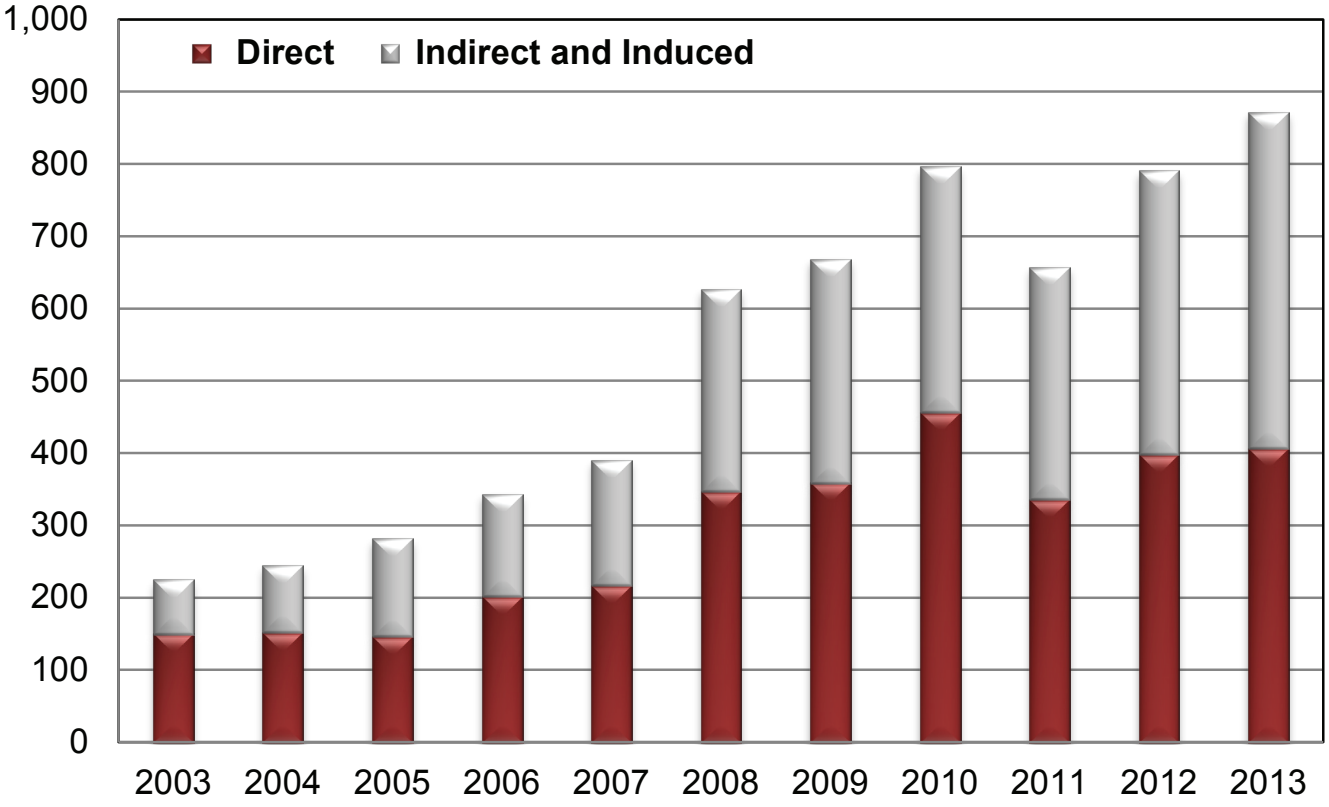
When direct and indirect employees and business owners spend their income in other areas of the economy on items such as cars, housing, and other retail goods, they are generating the induced economic impacts.

Employment

Employment in the aquaculture industry grew between 2003 and 2013. Total employment impacts were estimated to be 872 person years in 2013, compared to approximately 225 person years in 2003. Person year is a variable that estimates the equivalent number of full-time positions generated by an industry, but does not indicate the number of people employed in the industry. Employment impacts generated by the aquaculture industry for the period covering 2003 to 2013 are shown in the graph below.

Aquaculture Employment Impacts

Person Years



Source: Department of Finance

Direct employment in the aquaculture industry grew substantially over the past decade. Total direct impacts more than doubled, growing from 150 person years to 406 person years between 2003 and 2013. Increased employment resulted from year-over-year production volume increases.

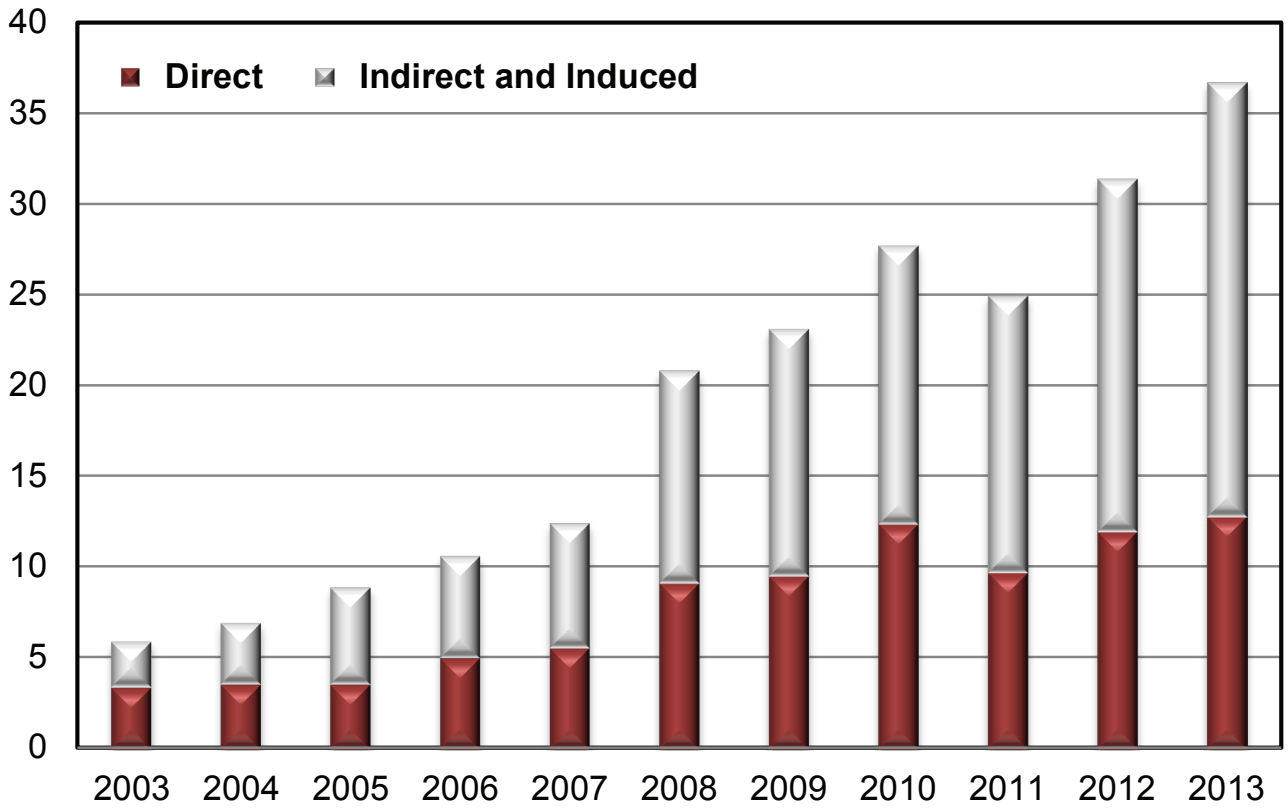
Spin-off industries also experienced employment gains between 2003 and 2013. An estimated 465 person years of employment was created by spin-off activities in 2013, up from 74 person years in 2003. The growth observed in indirect and induced employment is also the result of increased aquaculture production that in turn resulted in higher levels of non-wage operating expenditures within the province.

Labour Income

Labour income impacts produced by the provincial aquaculture industry have increased over the past ten years. In 2013, labour income impacts were estimated to be $36.7 million, representing a sixfold increase since 2003. Total impacts on labour income from aquaculture activity were estimated to be $209.5 million over the period covering 2003 to 2013, with a compound annual growth rate of 20 per cent. Labour income impacts for the industry are presented in the graph below.

Aquaculture Labour Income Impacts

$Millions



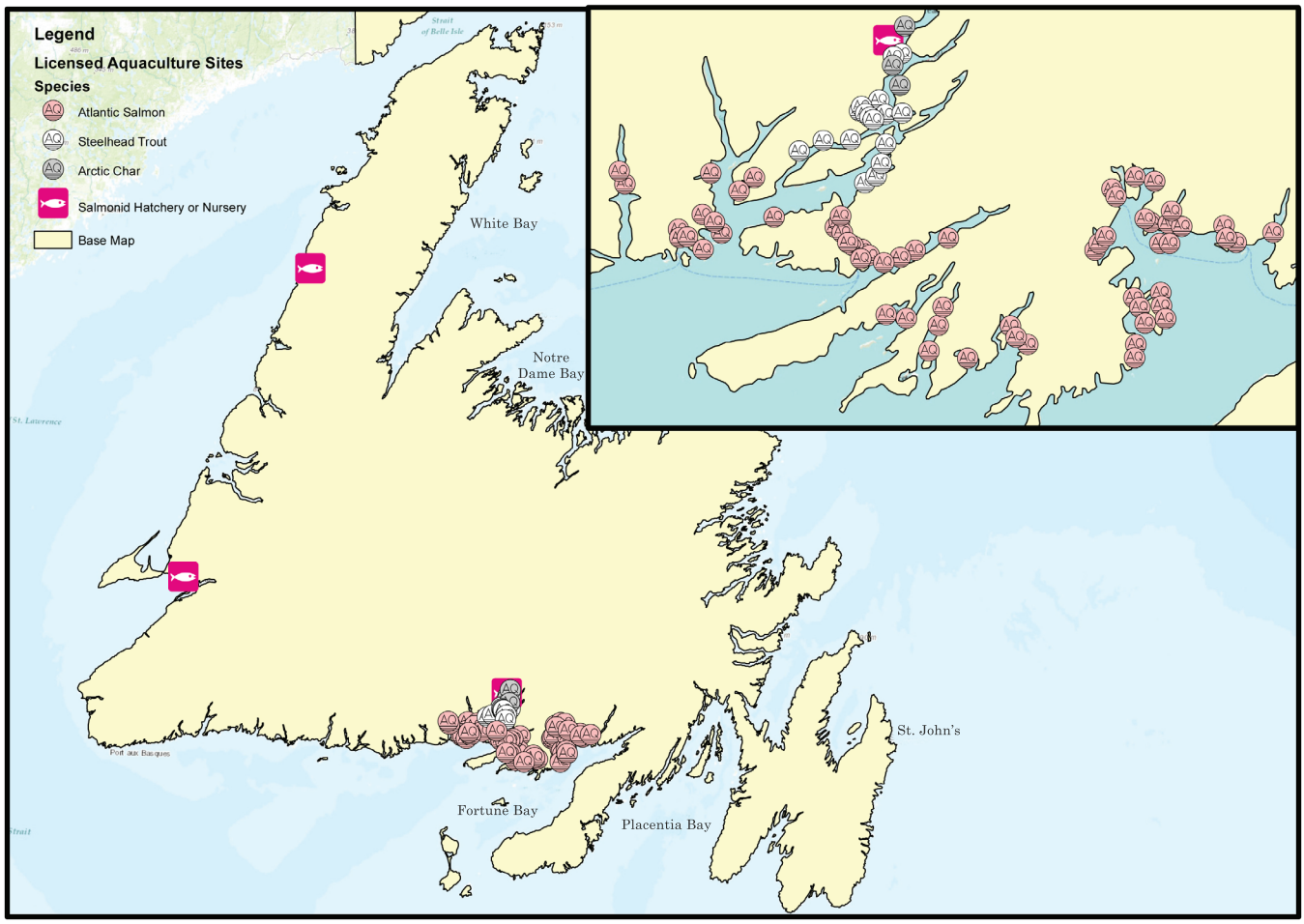
Source: Department of Finance

Direct labour income impact has grown since 2003. Estimates indicate the direct labour income impact from aquaculture was $12.8 million in 2013, up from $3.4 million in 2003. This increase is due to higher production volumes, resulting in a higher demand for labour, as well as increased wages for individuals employed in the industry. Average labour compensation per person year of direct aquaculture employment was estimated at approximately $31,400 in 2013.

Spin-off impacts also grew significantly during this time period. In 2003, indirect and induced labour income was $2.5 million. By 2013, spin-off labour income was estimated to be $23.9 million. Indirect income growth is largely due to increased spending by aquaculture companies within the province, in particular higher levels of non-wage operational spending. Induced labour income growth is mainly the result of higher levels of consumer spending by those employed directly or indirectly by the aquaculture industry. In 2013, average labour compensation per person year was approximately $49,700 for companies supplying the aquaculture industry.

Salmonid Sector Impacts

The salmonid sector in Newfoundland and Labrador is comprised of two commercial species, Atlantic salmon and steelhead trout. A limited amount of Arctic char is also produced. The vast majority of activity from this sector is located in the Coast of Bays region of the province. The map below shows the location of licensed aquaculture salmonid sites.



Salmonid Aquaculture Sites

Source: Department of Fisheries and Aquaculture

The salmonid sector accounts for the majority of aquaculture production in the province. In 2013, 83.6 per cent of total aquaculture production was attributable to the salmonid sector. Within the sector, Atlantic salmon production accounts for the majority of production. Atlantic salmon represented 88.3 per cent of the total salmonid produced in 2013. Therefore, fluctuations in the salmonid sector, particularly in Atlantic salmon production, have the largest impact on the aquaculture industry. Economic impact tables for the salmonid sector are presented in Table 2 in Annex 1.

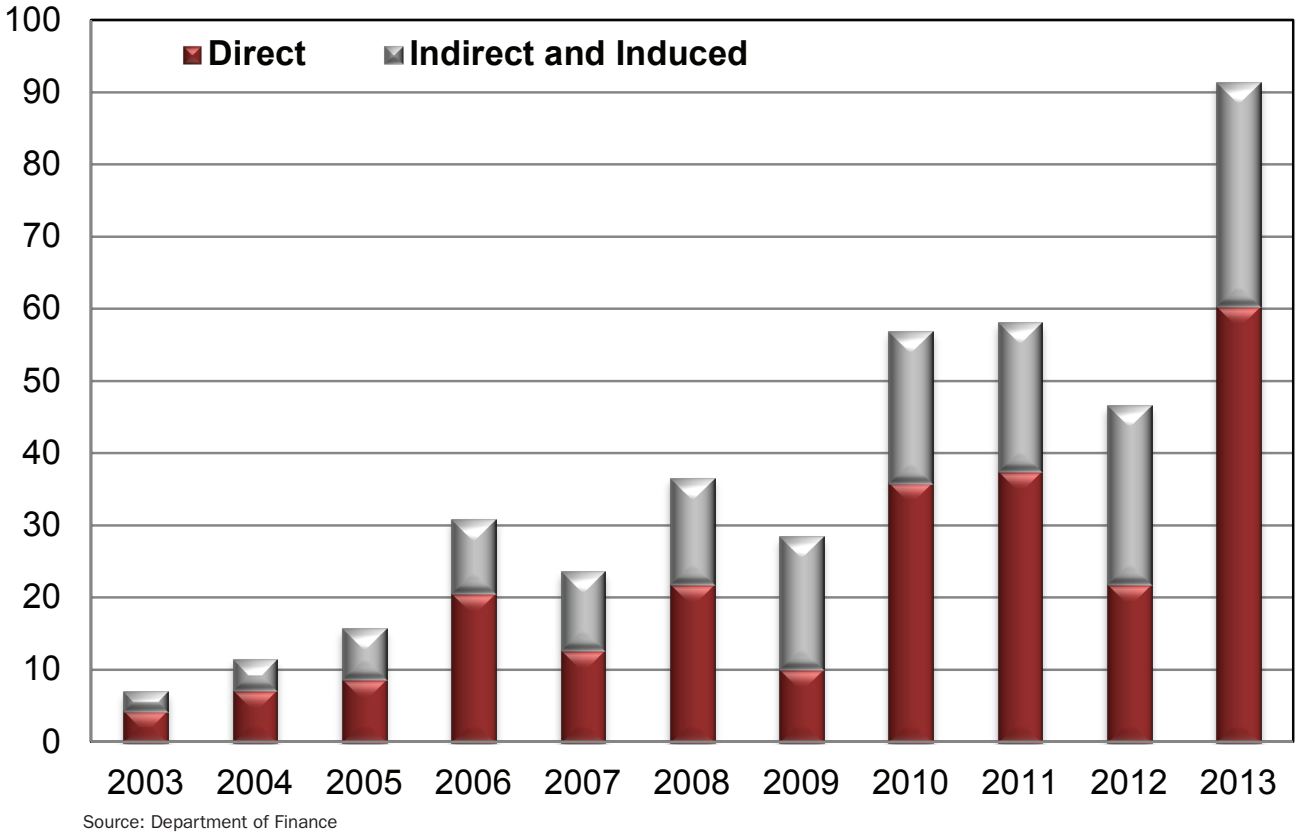
Gross Domestic Product

GDP impacts generated by the salmonid sector grew between 2003 and 2013. In 2013, GDP impacts from the salmonid sector were approximately $91.3 million, up from $7 million in 2003. Total GDP impacts over the past decade were estimated to be $406.4 million and grew at a compound annual growth rate of 29.3 per cent. In 2013, salmonid production accounted for an estimated 87.7 per cent of total aquaculture GDP. The graph below shows GDP impacts generated from the salmonid sector.

Direct GDP for the salmonid sector increased from $4.3 million in 2003 to approximately $60.3 million in 2013, largely as a result of expanding production volumes. Indirect and induced GDP also grew over the study period from $2.7 million in 2003 to $31 million in 2013. The significant increase is attributable to additional operational spending by aquaculture companies, spurred by attractive investment programs implemented by DFA in 2006. The Aquaculture Capital Equity Program (ACEP) and the Aquaculture Working Capital Loan Guarantee Program have been instrumental in providing aquaculture companies access to adequate levels of capital to invest in new operations, which in turn generates investment in rural Newfoundland and Labrador. Government investment through ACEP has generated significant private sector spending, mainly in rural areas.

Salmonid Sector Gross Domestic Product Impacts

$Millions



Source: Department of Finance

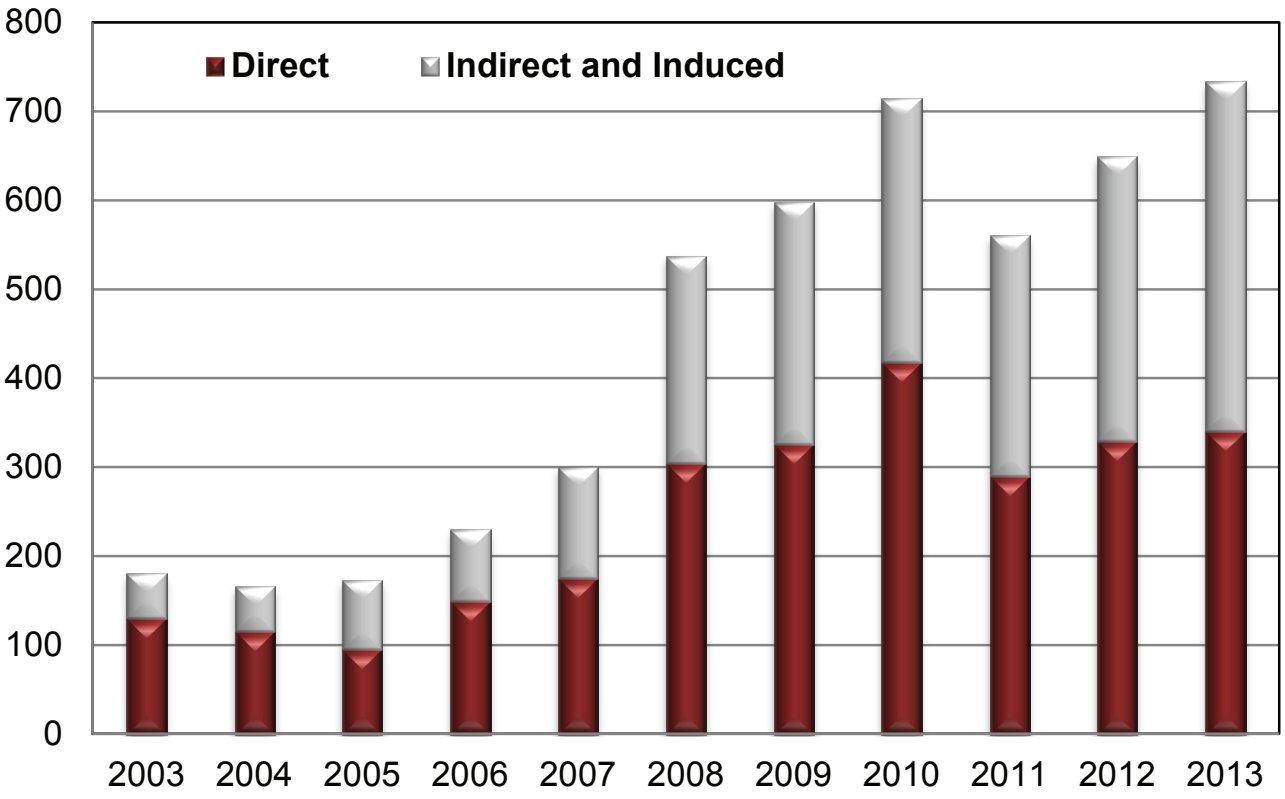
Employment

Total employment generated from the salmonid sector has increased since 2003. In 2013, the salmonid sector created 734 person years of employment through direct and spin-off activities. This represents an increase of approximately 553 person years over 2003. Salmonid aquaculture accounted for 84.1 per cent of total employment generated by the aquaculture sector in 2013. Employment impacts for the sector are shown below.

Direct employment in the salmonid sector also grew in the last decade. In 2013, there was an estimated 340 person years of employment, up from 130 person years in 2003. Spin-off employment impacts increased, from 51 person years in 2003 to 393 person years in 2013. The growth observed in direct employment is due to expanded production volumes, while spin-off employment growth is largely attributable to increased spending within the province on operational inputs.

Salmonid Sector Employment Impacts

Person Years



Source: Department of Finance

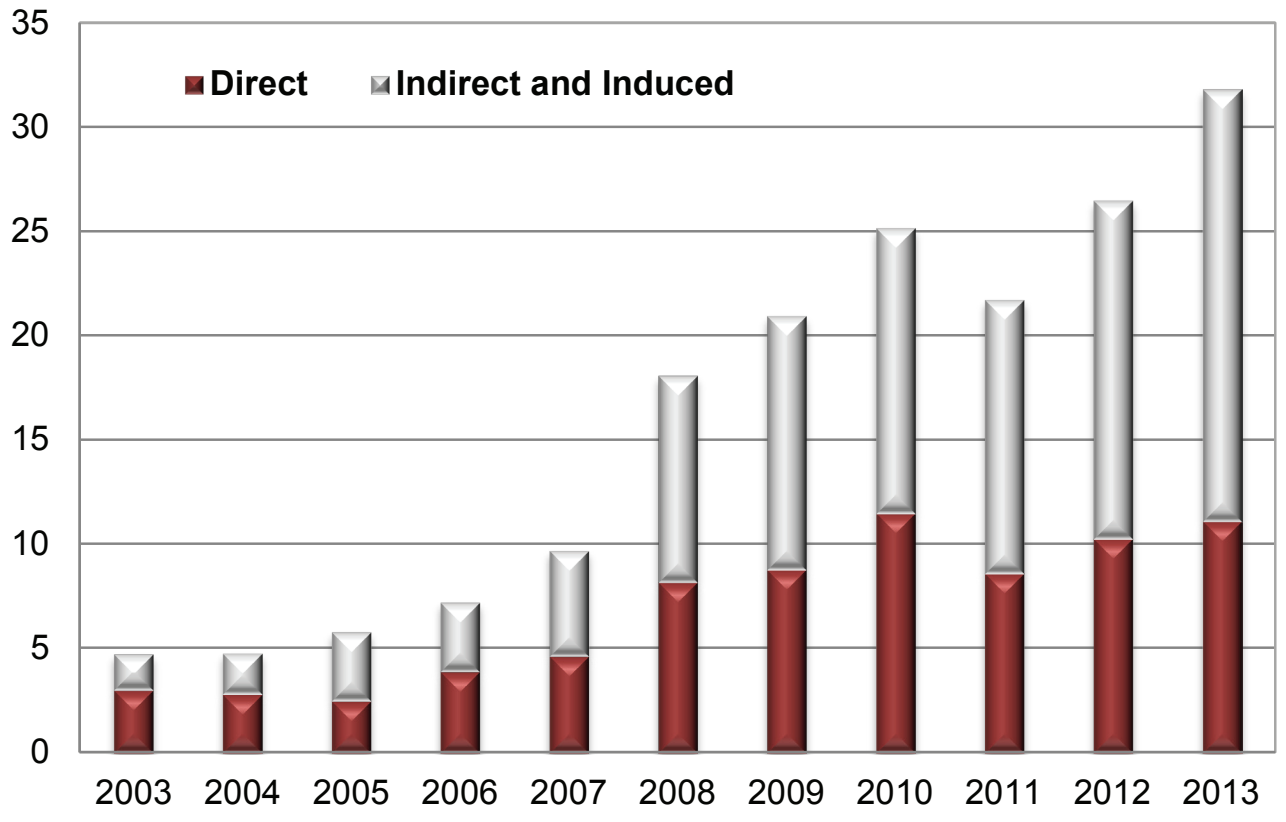
Labour Income

Labour income in the salmonid sector experienced substantial growth over the last ten years. In 2013, total labour income impacts were $31.8 million, representing an increase of $27.1 million over 2003. Total impacts over the study period were estimated at $176.5 million, with a compound annual growth rate of 20.9 per cent. Salmonid aquaculture accounts for the majority of aquaculture labour income and in 2013 accounted for 86.7 per cent of the labour income generated by the provincial aquaculture industry. Labour income impacts for the salmonid sector are shown in the graph below.

The direct labour income impact for the salmonid sector rose during the study period, from $3 million in 2003 to $11.1 million in 2013. Similarly, indirect and induced impacts increased by $19 million, from $1.7 million in 2003 to $20.7 million in 2013. The increase in labour income over the last ten years is attributable to expanded employment related to the sector as well as higher wage levels for workers.

Salmonid Sector Labour Income Impacts

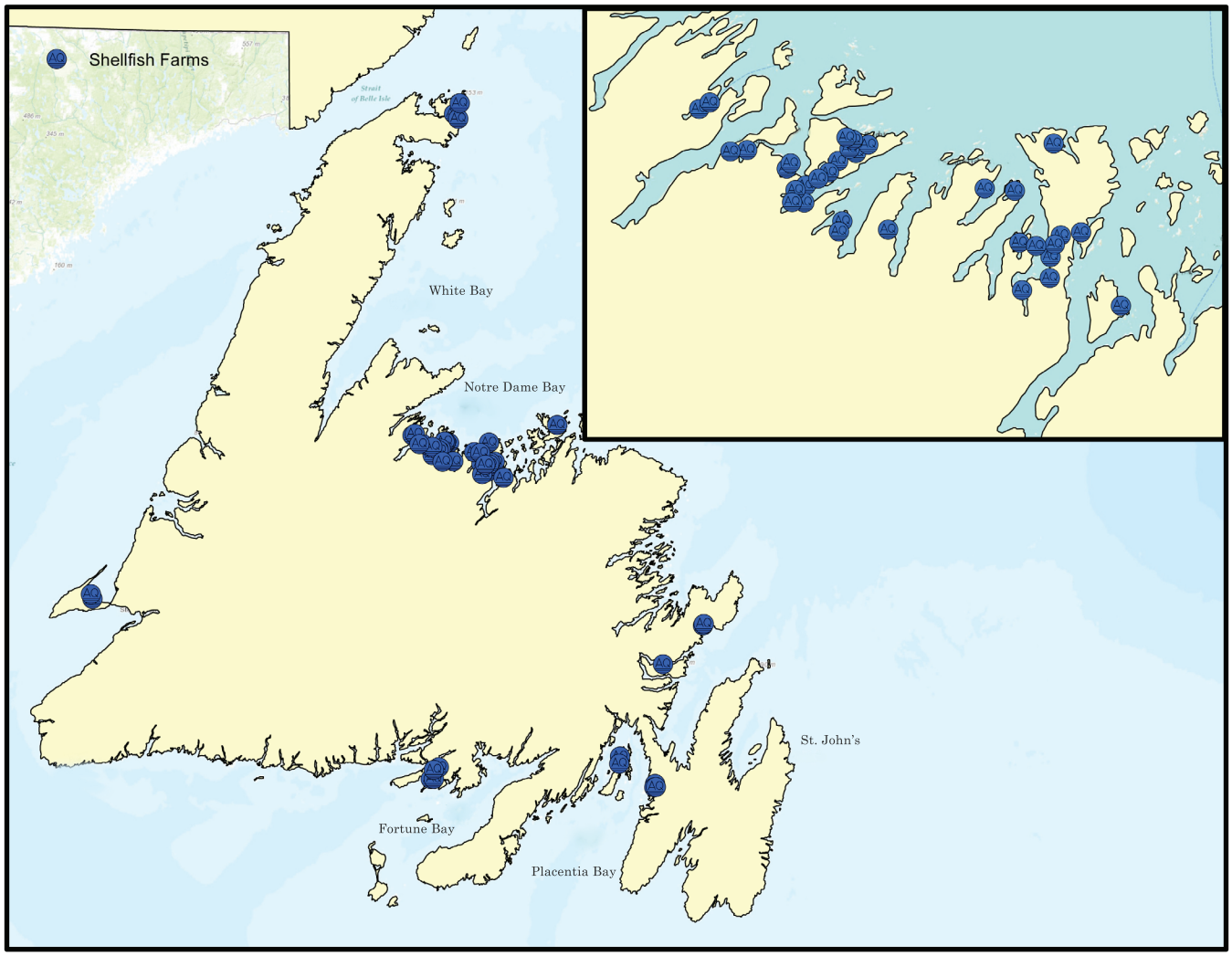
$Millions



Source: Department of Finance

Shellfish Sector Impacts

The shellfish sector produces one commercial species, the blue mussel. In addition, there is research and development work ongoing with oysters. The majority of grow-out activity is located in the Green Bay/Notre Dame Bay area, however, grow-out and processing operations are located throughout the province. The map below shows the location of licensed commercial shellfish sites in the province. Shellfish production accounted for 16.4 per cent of total aquaculture production in 2013. Economic impacts for the shellfish sector are presented in Table 3 in Annex 1.



Shellfish Aquaculture Sites

Source: Department of Fisheries and Aquaculture

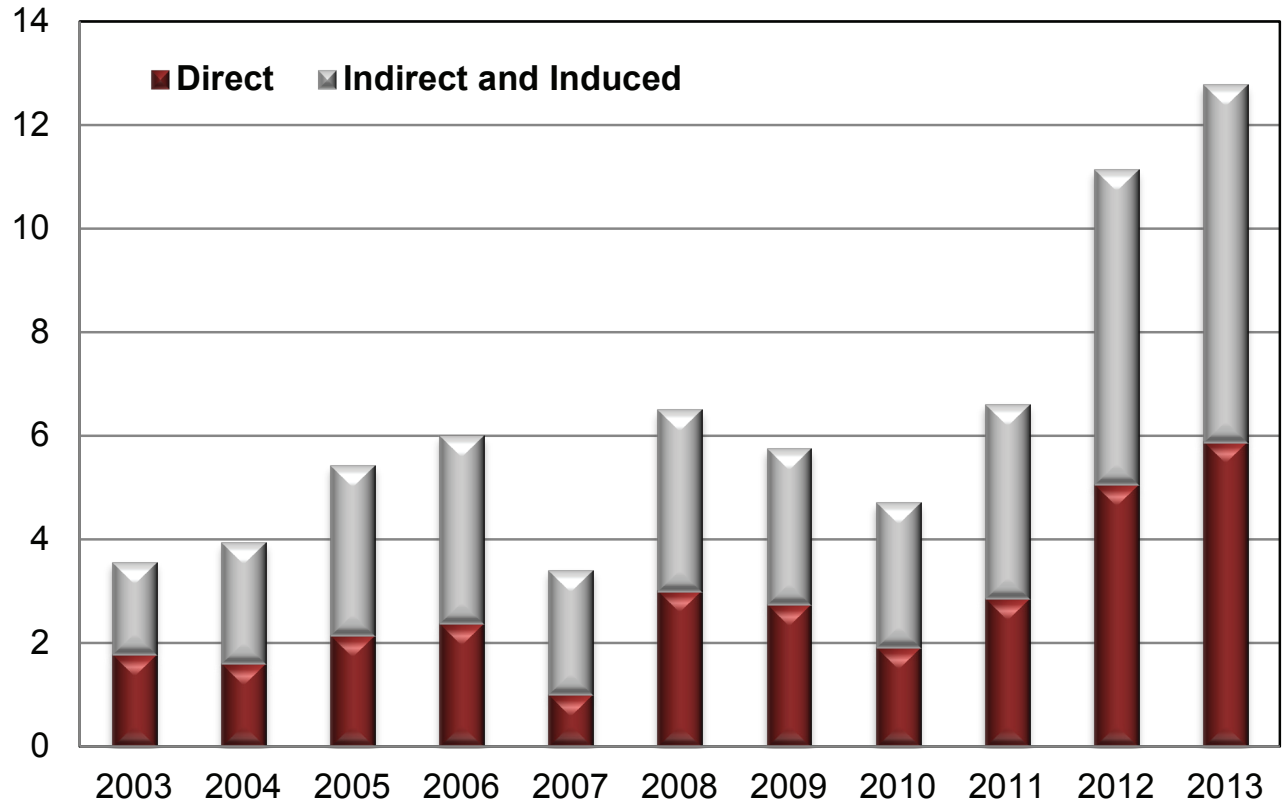
Gross Domestic Product

GDP impacts generated by the shellfish sector increased between 2003 and 2013. Total GDP impacts generated more than tripled over the past decade. Estimated total impacts increased from $3.6 million in 2003 to $12.8 million in 2013, with a compound annual growth rate of 13.6 per cent. GDP impacts for the shellfish sector are shown in the graph below.

Direct GDP for the sector more than tripled during the period, rising from $1.8 million in 2003 to $5.9 million in 2013, while indirect and induced impacts grew from $1.8 million to $6.9 million. The stagnation observed in the shellfish sector in the early 2000s was largely due to challenges with market development. In 2009, the Department of Fisheries and Aquaculture commissioned a report, *Newfoundland and Labrador Mussel Market Study,* that identified several recommendations, including a more coordinated marketing effort and sector certification. In 2013, eight mussel growers and three processors became the first shellfish operations in North America to receive organic certification. In addition, two shellfish processors became the first internationally to receive the Best Aquaculture Practices certification. Enhanced marketing efforts, along with new market development, have contributed to the significant increase in production volume and GDP experienced since 2010.

Shellfish Sector Gross Domestic Product Impacts

$Millions



Source: Department of Finance

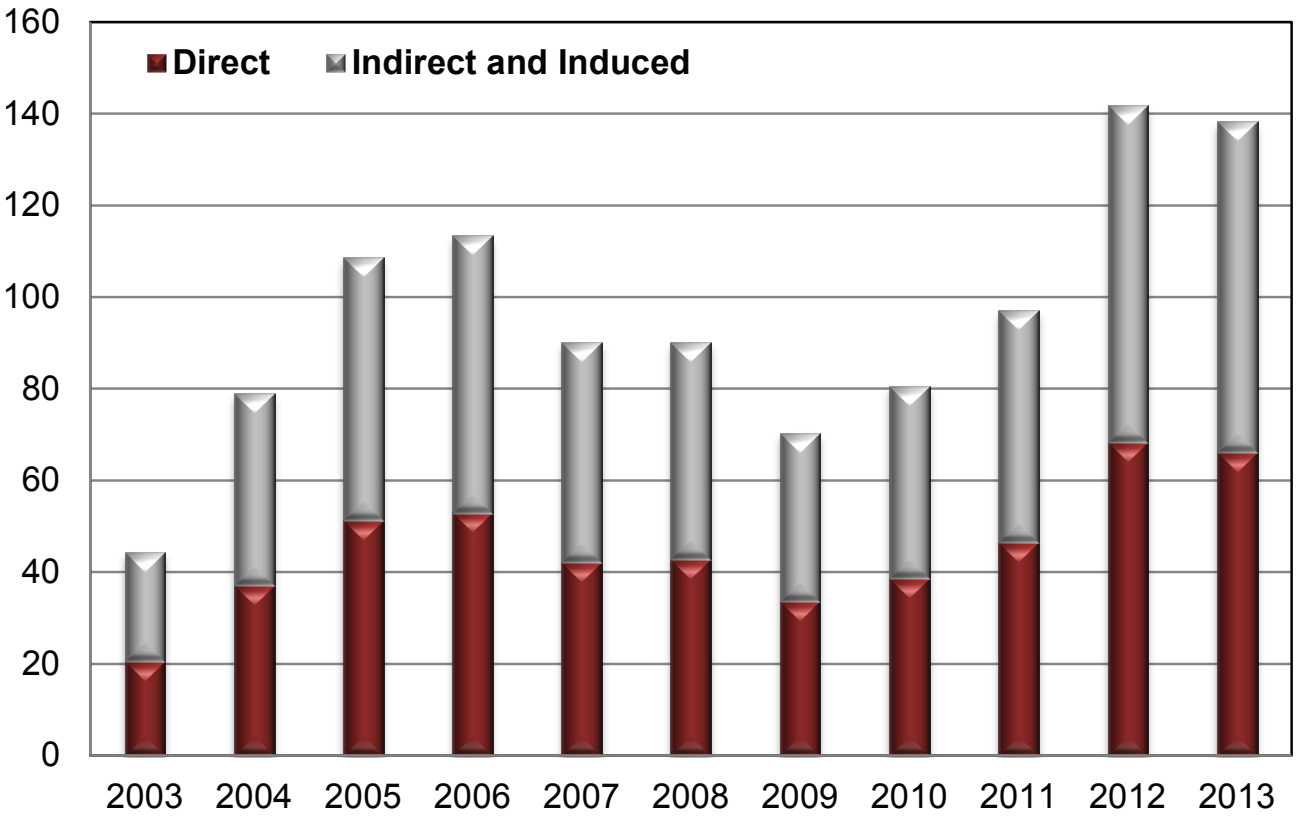
Employment

Shellfish sector employment grew significantly over the past decade. Between 2003 and 2013, employment within the sector tripled. In 2013, total employment generated was 138 person years of employment, up from 44 person years in 2003. Employment impacts for the shellfish sector are shown in the graph below.

Direct employment from grow-out activity rose from 21 person years in 2003, to 66 person years in 2013 as a result of higher production levels. Indirect and induced employment generated by the sector accounted for 72 person years in 2013, up from only 24 person years in 2003. The increase in spin-off employment is due to a higher demand for operational inputs from provincial suppliers as well as the economic activity generated from the spending of income.

Shellfish Sector Employment Impacts

Person Years



Source: Department of Finance

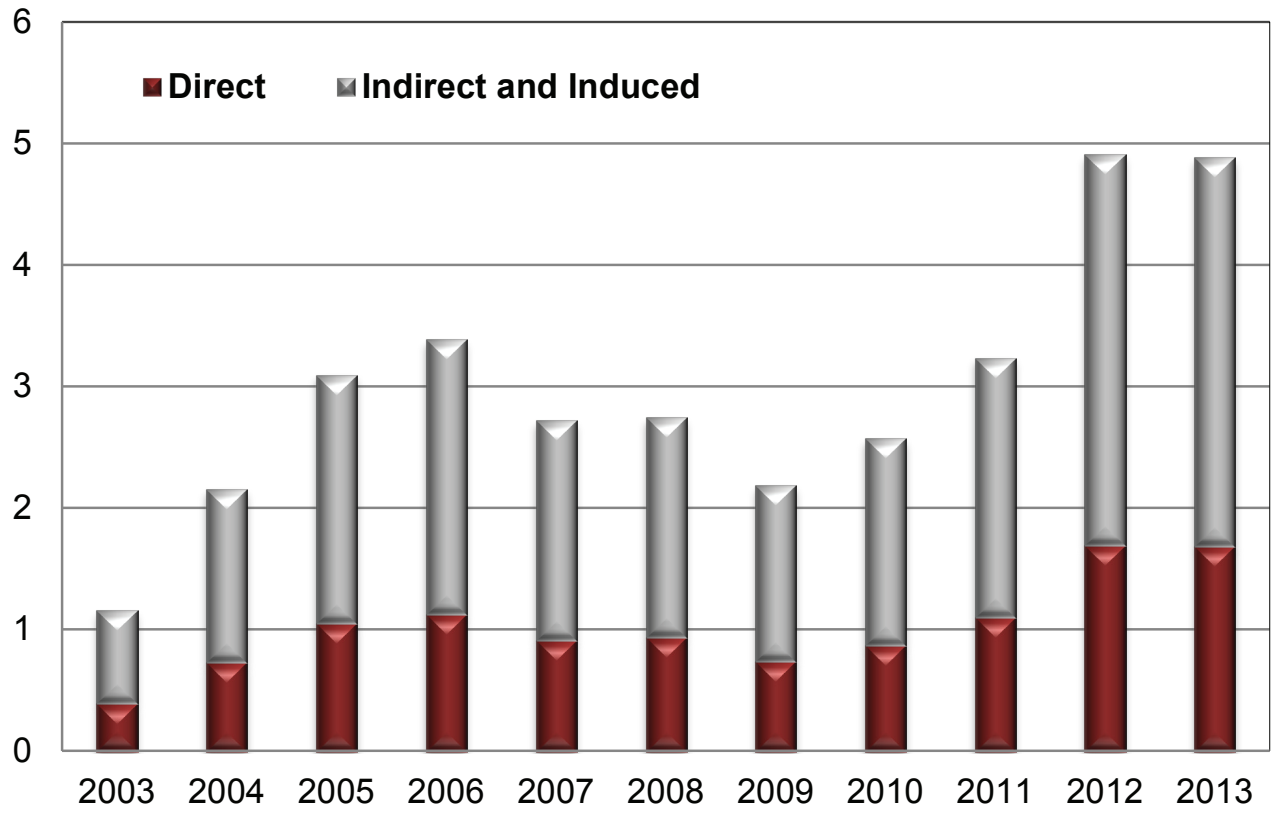
Labour Income

Labour income for the shellfish sector quadrupled over the past ten years. In 2013, labour income generated from the shellfish sector was $4.9 million, up from $1.2 million in 2003. Total labour income impacts over the study period was $33 million, representing a compound annual growth rate of 15.5 per cent. The graph below shows the labour income impacts for the shellfish sector.

Direct labour income increased from approximately $400,000 in 2003 to $1.7 million in 2013. Indirect and induced labour income increased during the same period, up from approximately $800,000 in 2003 to $3.2 million in 2013. The growth observed in labour income is largely attributable to higher production levels creating the need for additional employment in the sector.

Shellfish Sector Labour Income Impacts

$Millions



Source: Department of Finance

Summary

Over the past ten years, the aquaculture industry in Newfoundland and Labrador has experienced significant growth. Production volumes and values have risen, reaching all time highs in 2013. Along with that expansion, there have been economic benefits for the people of the province, from large-scale commercial investment to increased spending by industry participants, and additional employment in rural regions.

The outlook for the provincial aquaculture industry is positive as the demand for high quality fish protein increases to supply an increasing global population. In 2013, Newfoundland and Labrador became the second largest producer of aquaculture products nationally, and achieved the second highest production value in Canada. In order to maintain this status, sustainable management and development is crucial. A renewed strategic approach to aquaculture development will address sustainable management, support capacity, and research and development in the years ahead.

ANNEX 1

Data Tables

TABLE 1 – AQUACULTURE SECTOR IMPACTS	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
GDP $Millions											
Direct	6.1	8.8	10.8	23.0	13.7	24.9	12.8	37.8	40.3	26.9	66.2
Indirect and Induced	4.5	6.6	10.3	13.8	13.3	18.2	21.4	23.8	24.4	30.9	37.9
Total	10.5	15.4	21.1	36.8	27.0	43.0	34.2	61.6	64.7	57.7	104.1
Labour Income $Millions											
Direct	3.4	3.6	3.6	5.0	5.6	9.1	9.5	12.3	9.7	11.9	12.8
Indirect and Induced	2.5	3.4	5.3	5.6	6.9	11.7	13.6	15.4	15.3	19.5	23.9
Total	5.9	6.9	8.9	10.6	12.4	20.8	23.1	27.7	25.0	31.4	36.7
Employment (Person Years)											
Direct	150	152	146	202	217	347	359	456	336	398	406
Indirect and Induced	74	93	135	142	173	280	310	340	322	393	465
Total	225	245	282	343	390	627	669	796	658	791	872

TABLE 2 – SALMONID AQUACULTURE IMPACTS	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
GDP $Millions											
Direct	4.3	7.2	8.7	20.6	12.7	21.9	10.1	35.9	37.4	21.8	60.3
Indirect and Induced	2.7	4.2	7.1	10.2	10.9	14.7	18.4	21.0	20.7	24.8	31.0
Total	7.0	11.4	15.7	30.8	23.5	36.5	28.5	56.9	58.1	46.6	91.3
Labour Income $Millions											
Direct	3.0	2.8	2.5	3.9	4.6	8.2	8.8	11.5	8.6	10.2	11.1
Indirect and Induced	1.7	2.0	3.3	3.4	5.1	9.9	12.2	13.7	13.1	16.2	20.7
Total	4.8	4.8	5.8	7.2	9.7	18.1	20.9	25.2	21.7	26.5	31.8
Employment (Person Years)											
Direct	130	115	95	149	175	304	325	418	289	329	340
Indirect and Induced	51	51	78	81	125	233	273	298	271	320	393
Total	180	166	173	230	300	537	598	715	561	649	734

TABLE 3 – SHELLFISH AQUACULTURE IMPACTS	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
GDP $Millions											
Direct	1.8	1.6	2.2	2.4	1.0	3.0	2.7	1.9	2.8	5.1	5.9
Indirect and Induced	1.8	2.3	3.3	3.6	2.4	3.5	3.0	2.8	3.8	6.1	6.9
Total	3.6	3.9	5.4	6.0	3.4	6.5	5.8	4.7	6.6	11.1	12.8
Labour Income $Millions											
Direct	0.4	0.7	1.1	1.1	0.9	0.9	0.7	0.9	1.1	1.7	1.7
Indirect and Induced	0.8	1.4	2.0	2.3	1.8	1.8	1.5	1.7	2.1	3.2	3.2
Total	1.2	2.2	3.1	3.4	2.7	2.7	2.2	2.6	3.2	4.9	4.9
Employment (Person Years)											
Direct	21	37	51	53	42	43	34	39	46	68	66
Indirect and Induced	24	42	57	60	48	47	37	42	51	73	72
Total	44	79	109	113	90	90	70	81	97	142	138

**Numbers may not add due to rounding*

Newfoundland Labrador

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