Economic Contribution of the Oceans Sector in British Columbia

Prepared for:

Canada/British Columbia
Oceans Coordinating Committee

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Preface

This report was prepared under contract for the Canada/British Columbia Oceans Coordinating Committee (OCC). The OCC consists of the following federal and provincial agencies:

- federal
  - Fisheries & Oceans Canada
  - Environment Canada
  - Natural Resources Canada
  - Parks Canada
- provincial
  - BC Ministry of Environment (Oceans & Marine Fisheries Branch)
  - BC Ministry of Energy, Mines & Petroleum Resources
  - BC Agriculture & Lands (Integrated Land Management Bureau)
  - BC Attorney General

The consultants have benefited from discussions with government officials, industry associations and others. Notwithstanding this assistance, the authors have final responsibility for the analyses and conclusions of the study. The report should not be considered a reflection of the policies or positions of the individual member agencies of the Oceans Coordinating Committee.

Summary

1. Introduction

- the rising interest in the ocean has not been matched by supporting economic information and analysis in British Columbia – the oceans sector is not well represented by conventional statistics
- this study is a first step in filling the data gaps to help all levels of government, First Nations, key stakeholders, and the public at large to better comprehend the ocean's economic significance
- this study has two main objectives
  - define and describe the BC oceans sector
  - estimate the direct industry, indirect supplier and induced consumer spending impacts of the BC oceans sector to the province
- the study also reviews the economic potential of some other ocean sectors, in particular offshore oil & gas and offshore wind energy
- the study does not encompass some key areas of valuation, specifically ecosystem values and other non-market values. It is recognized that an assessment of these other non-commercial values is essential to appreciate fully the economic, social, and environmental value of the ocean to British Columbia
- the Project Team reviewed ocean sector economic studies in other jurisdictions within and outside Canada, reviewed a variety of documents, conducted interviews with government and industry officials including Statistics Canada and BC Stats personnel, and conducted special surveys of public and non-government agencies

2. Approach and Methodology

- the ocean sector is comprised of the private industries, research and education organizations, and various levels of government that depend on the ocean for transportation, operation, innovation or recreation or as a source of extractable resources
- the study adopted five principles:
  - use the North American Industry Classification System (NAICS), to the extent possible
  - use BC Stats/Statistics Canada data and concepts to the extent possible
  - identify an ocean share of total sector activity where possible
  - avoid double counting
  - include land-based processing of ocean resources
- the study identified seven (7) private sectors, two (2) public sectors and two (2) non-government sectors for analysis
- the study addressed four (4) main economic indicators: Gross Output, Gross Domestic Product (GDP), Labour Income, and Employment (measured in person-years)

3. Results for Existing Industries

- there are many business activities that are dependent on the ocean environment, including: 1) resource extraction, processing and distribution, 2) goods construction and manufacturing, and 3) services. In addition, many public (government) and non-government sector activities are tied to the promotion and regulation of ocean-based business activities, ocean-related education and research, and ocean environmental stewardship

- the ocean sector makes a very important contribution to the economy of British Columbia (Table A). The total economic impact of ocean-based business activities are summarized in Table A-1. Table A-2 provides subsector details, and Table A-3 summarizes the ocean sector's share of the BC economy in 2005

- ocean-related economic activity is concentrated in the four private sectors –ocean recreation, ocean transport, seafood, and ocean high tech - and in the federal government public sector. These five sectors comprise over 90% of the ocean sector total. Nevertheless, all ocean-related sectors are important as they contribute to a diversified economy throughout Coastal BC

- total ocean sector revenues/expenditures in 2005 were $11.6 billion:
  - $3,791 million ocean recreation
  - $3,330 million ocean transport
  - $1,380 million seafood
  - $1,125 million ocean high tech
  - $854 million federal government
  - $398 million ship & boat building
  - $283 million forestry
  - $216 million marine construction
  - $153 million provincial government
  - $60 million universities & research institutions
  - $27 million environmental non-government organizations (ENGOs)
- the direct industry economic impacts of the ocean sector from the $11.6 billion in revenues in 2005 were:
  - $5.7 billion in GDP
  - $4.2 billion in Labour Income i.e., wages & benefits
  - 84,400 person-years of employment
- the public sector has direct Labour Income comprising over half of sector revenues whereas the private sector has direct Labour Income at one-third of revenues overall (Table B)

- public sector direct wages per person-year (PY) are higher than private sector direct wages per person-year - the seafood and ocean recreation sectors have the lowest annual wage rates of all business sectors considered

- the total direct, indirect supplier plus induced consumer spending economic impacts of the ocean sector in 2005 were:
  - $11.1 billion in GDP
  - $7.6 billion in Labour Income i.e., wages & benefits
  - 167,800 person-years of employment

- the industry spinoff indirect and induced effects essentially double the direct impacts
- indirect and induced employment generally is lower paying than direct ocean industry employment
- the above total ocean sector impacts comprise 7-8% of the total BC economy
- there are substantial opportunities for all private sector components of the BC ocean economy to grow. The most promising sectors for future growth are: high technology, ocean recreation, and ports & shipping

4. Potential Energy Sectors

- federal and provincial policy moratoria prohibiting offshore oil & gas exploration and development in BC remain in place, and there are significant regulatory uncertainties associated with potential development of offshore energy resources, as well as uncertainties about the size of the oil and gas resources. Based on an estimated 1.6 billion barrels of oil and 6.1 tcf of gas that appear economic to extract in the Queen Charlotte Basin, the value of potential production is $129 billion CDN over the project life (at prices of $50 US per barrel for oil and $6 US per mcf for gas) (Table C)
- the construction & operation phases of oil & gas projects could result in total project lifetime benefits of $137 billion GDP, $14 billion Labour Income and 269,500 person-years of employment
- offshore wind resources have substantial potential to generate electricity (Table C). About 1,500 MW of wind generating capacity could be developed, resulting in project lifetime benefits of an estimated $13 billion GDP, $2 billion Labour Income and 42,600 person-years of employment
- there is also significant potential to harness the immense energy embodied in the ocean's waves, tides, and currents, but a quantitative assessment of the potential economic impacts associated with tidal and wave energy in BC is not possible at this time

5. Conclusions

- the ocean-based economy of BC
  - is much larger than previously estimated
  - is more broad, diversified than previously thought
  - is not well-understood
- the components of the ocean sector in total comprise 7-8% of the BC economy
- there is substantial potential for growth, both from existing sectors and also from new, potential energy sectors
- this study implemented substantial improvements in sector coverage and procedures, nevertheless further methodological advances are still possible
- the Final Report should be distributed to users to solicit feedback and to marshal support for a regular reporting on the BC-ocean based economy

Table A: BC Ocean Sector and the BC Economy

A-1 BC Ocean Sector Impact Summary 2005

	2005 Impacts			
	Direct	**Indirect**	**Induced**	**Total**
Output $ millions	11,617	NA	NA	NA
GDP $ millions	5,727	2,896	2,434	11,057
Labour Income $ millions	4,174	1,915	1,461	7,550
Employment PYs	84,430	45,875	37,500	167,805

A-2 Ocean Subsector Shares of Total BC Impacts 2005

		2005 Industry Shares of Total Impacts		
		GDP	**Labour Income**	**Employment**
Private Sector	- Seafood	.12	.11	.13
	- Forestry	.02	.02	.02
	- Ship & Boat Building	.03	.03	.03
	- Ocean Construction	.02	.02	.02
	- Ocean High Tech	.09	.09	.08
	- Ocean Recreation	.33	.31	.36
	- Ocean Transport	.29	.30	.28
Public Sector	- Federal Government	.08	.10	.07
	- Provincial Government	.01	.01	.01
Non-Government Sector	- Universities & Research	.01	.01	<.01
	- ENGOs	<.01	<.01	<.01
All Ocean Sectors		1.00	1.00	1.00

A-3 Ocean Sector Share of BC Economy 2005

	2005 Ocean Share of BC Economy					
	GDP		**Labour Income**		**Employment**	
Ocean Economy	$11.1 billion	7%	$7.6 billion	8%	167,805 PYs	8%
Other Sectors	143.8 billion	93%	90.6 billion	92%	1,962,695 PYs	92%
Total BC Economy	$154.9 billion		$98.2 billion		2,130,500 PYs	

Source: Ocean sector – Table 18 Main Report
Total economy – BC Stats

Table B: BC Ocean Sector Impact Summary

	2002				2003				2004				2005			
	Output	GDP	LI	EM	Output	GDP	LI	EM	Output	GDP	LI	EM	Output	GDP	LI	EM
DIRECT IMPACTS																
Private Sector																
Seafood	1,310	750	450	12,970	1,300	745	445	12,600	1,290	740	445	12,300	1,380	790	475	12,900
Forestry	269	100	60	960	256	90	58	930	308	118	59	910	283	108	60	910
Ship & Boat Bldg	378	165	131	2,520	422	186	148	2,740	380	168	134	2,410	398	175	139	2,490
Marine Construction	110	47	35	720	117	50	37	750	161	69	52	990	216	93	69	1,330
Ocean High Tech	925	465	300	5,010	995	500	320	5,280	1,050	530	340	5,450	1,125	565	365	5,730
Ocean Recreation	3,351	1,610	1,080	28,500	3,397	1,630	1,100	28,800	3,610	1,740	1,170	30,100	3,791	1,820	1,220	32,200
Ocean Transport	2,930	1,330	1,040	19,400	3,050	1,380	1,080	19,800	3,190	1,450	1,130	20,200	3,330	1,510	1,180	20,700
Subtotal	9,273	4,467	3,096	70,080	9,537	4,581	3,188	70,900	9,989	4,815	3,330	72,360	10,523	5,061	3,508	76,260
Public Sector																
Federal Gov't	772	530	530	6,870	760	535	535	6,880	819	555	555	6,770	854	580	580	7,010
Provincial Gov't	103	20	20	300	141	25	25	350	151	31	31	430	153	32	32	430
Subtotal	875	550	550	7,170	901	560	560	7,230	970	586	586	7,200	1,007	612	612	7,440
Non-Government Sector																
Universities & Research	41	27	27	275	48	31	31	310	52	34	34	330	60	39	39	370
ENGOs	20	11	11	290	24	13	13	340	26	15	15	360	27	15	15	360
Subtotal	61	38	38	565	72	44	44	650	78	49	49	690	87	54	54	730
TOTAL	10,209	5,055	3,684	77,815	10,510	5,185	3,792	78,780	11,037	5,450	3,965	80,250	11,617	5,727	4,174	84,430

	2002			2003			2004			2005		
	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM
INDIRECT IMPACTS												
Private Sector												
Seafood	240	170	4,680	230	170	4,550	230	170	4,430	250	180	4,640
Forestry	97	67	1,290	92	64	1,200	111	77	1,420	102	71	1,280
Ship & Boat Bldg	85	41	970	98	47	1,080	89	42	960	92	44	980
Marine Construction	34	22	560	36	23	590	50	32	790	67	43	1,040
Ocean High Tech	220	140	3,720	240	150	3,940	255	160	4,100	275	170	4,300
Ocean Recreation	920	580	14,600	930	580	14,700	980	620	15,700	1,030	650	16,500
Ocean Transport	850	590	14,100	880	610	14,400	920	640	14,700	960	670	15,100
Subtotal	2,446	1,610	39,920	2,506	1,644	40,460	2,635	1,741	42,100	2,776	1,828	43,840
Public Sector												
Federal Gov't	85	64	1,570	84	63	1,540	91	68	1,640	96	72	1,680
Provincial Gov't	4	3	75	5	4	90	7	4	110	7	5	110
Subtotal	89	67	1,645	89	67	1,630	98	72	1,750	103	77	1,790
Non-Government Sector												
Universities & Research	6	3	85	7	4	95	8	4	100	9	5	115
ENGOs	6	4	100	7	5	120	8	5	125	8	5	130
Subtotal	12	7	185	14	9	215	16	9	225	17	10	245
TOTAL	2,547	1,684	41,750	2,609	1,720	42,305	2,749	1,822	44,075	2,896	1,915	45,875

Table B: BC Ocean Sector Impact Summary (continued)

	2002			2003			2004			2005		
	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM
INDUCED IMPACTS												
Private Sector												
Seafood	250	150	4,050	250	150	3,940	250	150	3,860	260	160	4,030
Forestry	51	30	810	49	29	780	54	33	850	52	31	840
Ship & Boat Bldg	69	41	1,120	78	47	1,250	70	42	1,100	73	44	1,130
Marine Construction	23	14	370	24	14	380	34	20	530	45	27	690
Ocean High Tech	175	105	2,870	190	110	3,010	200	120	3,140	215	130	3,290
Ocean Recreation	660	400	10,800	670	400	10,800	710	430	11,200	750	450	11,500
Ocean Transport	650	390	10,600	680	410	10,800	710	420	11,100	740	440	11,400
Subtotal	1,878	1,130	30,620	1,941	1,160	30,960	2,028	1,215	31,780	2,135	1,282	32,880
Public Sector												
Federal Gov't	240	145	3,880	240	145	3,830	250	150	3,910	260	155	4,010
Provincial Gov't	9	6	150	11	7	180	14	8	220	14	9	220
Subtotal	249	151	4,030	251	152	4,010	264	158	4,130	274	164	4,230
Non-Government Sector												
Universities & Research	12	7	190	14	8	220	15	9	235	17	10	270
ENGOs	6	4	100	7	4	120	8	5	130	8	5	120
Subtotal	18	11	290	21	12	340	23	14	365	25	15	390
TOTAL	2,145	1,292	34,940	2,213	1,324	35,310	2,315	1,387	36,275	2,434	1,461	37,500

	2002			2003			2004			2005		
	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM
TOTAL IMPACTS												
Private Sector												
Seafood	1,240	770	21,700	1,225	765	21,090	1,220	765	20,590	1,300	815	21,570
Forestry	248	157	3,060	231	151	2,910	283	169	3,180	262	162	3,030
Ship & Boat Bldg	319	213	4,610	362	242	5,070	327	218	4,470	340	227	4,600
Marine Construction	104	71	1,650	110	74	1,720	153	104	2,310	205	139	3,060
Ocean High Tech	860	545	11,600	930	580	12,230	985	620	12,690	1,055	665	13,320
Ocean Recreation	3,190	2,060	53,900	3,230	2,080	54,300	3,430	2,220	57,000	3,600	2,320	60,200
Ocean Transport	2,830	2,020	44,100	2,940	2,100	45,000	3,080	2,190	46,000	3,210	2,290	47,200
Subtotal	8,791	5,836	140,620	9,028	5,992	142,320	9,478	6,286	146,240	9,972	6,618	152,980
Public Sector												
Federal Gov't	855	739	12,320	859	743	12,250	896	773	12,320	936	807	12,700
Provincial Gov't	33	29	525	41	36	620	52	43	760	53	46	760
Subtotal	888	768	12,845	900	779	12,870	948	816	13,080	989	853	13,460
Non-Government Sector												
Universities & Research	45	37	550	52	43	625	57	47	665	65	54	755
ENGOs	23	19	490	27	22	580	31	25	615	31	25	610
Subtotal	68	56	1,040	79	65	1,205	88	72	1,280	96	79	1,365
TOTAL	9,747	6,660	154,505	10,007	6,836	156,395	10,514	7,174	160,600	11,057	7,550	167,805

Source: Sections 3 and 4 Main Report.

Legend: Output - Gross Output/Revenues/Expenditures ($ millions).
GDP - Gross Domestic Product ($ millions).
LI - Labour Income ($ millions).
EM - Employment (Person-Years).

Table C: Illustrative Potential Energy Scenarios

A. Oil Scenario - 1.615 billion bbls oil at $50 US/bbl (5% quality adjustment) worth an estimated $90.2 billion CDN

	Total Project			Annual Impacts[a]		
	Direct	Indirect & Induced	Total	Direct	Indirect & Induced	Total
GDP $ millions CDN	84,520	10,310	94,830	3,520	430	3,950
Labour Income $ millions CDN	3,470	5,320	8,790	145	220	365
Employment PYs	52,300	114,800	167,100	2,180	4,780	6,960

a Total construction and operation impacts divided by 24 year construction and operation phase

B. Gas Scenario - 6.06 tcf gas at $6 US/mcf (10% losses) worth an estimated $38.5 billion CDN

	Total Project			Annual Impacts[a]		
	Direct	Indirect & Induced	Total	Direct	Indirect & Induced	Total
GDP $ millions CDN	36,260	5,880	42,140	1,170	190	1,360
Labour Income $ millions CDN	2,350	3,070	5,420	75	100	175
Employment PYs	35,600	66,800	102,400	1,150	2,150	3,300

[a] Total construction and operation impacts divided by 31 year construction and operation phase

C. Wind Energy Scenario - 1,500 MW development at $100/Mwh worth an estimated $10.5 billion CDN

	Total Project			Annual Impacts[a]		
	Direct	Indirect & Induced	Total	Direct	Indirect & Induced	Total
GDP $ millions CDN	10,090	2,500	12,590	480	120	600
Labour Income $ millions CDN	940	1,340	2,280	45	65	110
Employment PYs	13,600	29,000	42,600	650	1,380	2,030

a Total construction and operation impacts divided by 21 year construction and operation phase (40% capacity factor)

Note: 1. all financial figures given in undiscounted 2006 dollars
2. $1 CDN = $0.85 US

Acronyms

ACOA	–	Atlantic Canada Opportunities Agency
bbl	–	barrel
BC	–	British Columbia
bcf	–	billion cubic feet
BCIT	–	BC Institute of Technology
CFIA	–	Canadian Food Inspection Agency
CTC	–	Canadian Tourism Commission
COINPacific	–	Cooperative Ocean Information Network Pacific
CTSA	–	Canadian Transportation Satellite Account
DFO	–	Canada Department of Fisheries & Oceans
DND	–	Department of National Defence
EBITDA	–	Earnings Before Interest, Taxes, Depreciation and Amortization
EC	–	Environment Canada
EI	–	Employment Insurance
EMPR	–	BC Ministry Energy, Mines & Petroleum Resources
ENGO	–	Environmental Non-Government Organization
FTE	–	Full Time Equivalent
GDP	–	Gross Domestic Product
GST	–	Goods & Services Tax (a federal consumption tax)
Gwh	–	gigawatt-hour
HRDC	–	Human Resources Development Canada (now Service Canada)
IOS	–	Institute of Ocean Sciences (an arm of DFO)
ILMB	–	Integrated Land Management Branch (an arm of MAL)
LNG	–	Liquefied Natural Gas
LI	–	Labour Income (wages, salaries & supplementary labour income)
MAL	–	BC Ministry of Agriculture & Lands
mcf	–	thousand cubic feet
MED	–	BC Ministry of Economic Development
mmcf	–	million cubic feet
MOE	–	BC Ministry of Environment
MOT	–	BC Ministry of Transportation
MPA	–	Marine Protected Area
MTSA	–	BC Ministry of Tourism, Sport and the Arts

Acronyms (cont'd)

MW	–	megawatt
Mwh	–	megawatt-hour
NAICS	–	North American Industry Classification System
NEPTUNE	–	North-East Pacific Time Series Undersea Networked Experiments
NRCan	–	Natural Resources Canada
NSERC	–	National Science and Engineering Research Council of Canada
OREG	–	Ocean Renewable Energy Group
PBS	–	Pacific Biological Station (an arm of DFO)
PC	–	Parks Canada
PEI	–	Prince Edward Island
PST	–	Provincial Services Tax (a provincial consumption tax)
PY	–	Person Year
QCB	–	Queen Charlotte Basin
ROPOS	–	Remotely Operated Platform for Ocean Science
SFU	–	Simon Fraser University
SLI	–	Supplementary Labour Income i.e. employer paid benefits
SSHRC	–	Social Sciences and Humanities Research Council of Canada
Stats Can	–	Statistics Canada
SWOT	–	Strengths, Weaknesses, Opportunities, Threats
TC	–	Transport Canada
tcf	–	trillion cubic feet
TSA	–	Tourism Satellite Account
UBC	–	University of British Columbia
UVic	–	University of Victoria
VENUS	–	Victoria Experimental Network Under Sea
WCVI	–	West Coast Vancouver Island
WD	–	Western Economic Diversification
WUP	–	Water Use Plan

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1.0 Introduction

The ocean environment of British Columbia includes some 29,000 km of coastline, 6,500 islands, and 450,000 sq km of internal and offshore waters. The ocean is integral not just to the economy, but also to our culture, way of life, and collective identity as well as to the natural ecosystems of which we are a part.

The influence of the Pacific Ocean on the lives and livelihoods of British Columbians has been profound. The early settlement patterns of First Nations and Europeans alike were guided by proximity to the ocean and its tributary waterways. Even today, three-quarters of British Columbia's population lives within 200 kilometres of the Coast.

The province's first market economies were built around ocean-related resource industries, such as ship building, fishing, and coastal logging. Over the years, the growth of export-oriented sectors from mining and forest products to agricultural goods and petroleum production depended on ocean transportation for access to markets. Now in the 21st Century, emerging industries like ocean tourism and marine technology development are helping to drive the economy.

There are tremendous economic opportunities in BC's coastal and offshore waters ranging from recreation and tourism to fisheries and aquaculture development to ocean research and energy production. At the same time, the ocean environment faces formidable challenges, notably from ocean and land-based pollution, global climate change, and the resulting threats to marine species. These challenges and opportunities are of concern to all British Columbians and Canadians.

Under Canada's 1997 *Oceans Act* and subsequent Memorandum of Understandings (MOUs), the responsibility for planning and managing ocean activities lies with both the federal and provincial governments - the Federal Department of Fisheries and Oceans has lead responsibility. The BC Ministry of Environment (MOE) co-chairs an Oceans Coordinating Committee (OCC) with the federal Department of Fisheries and Oceans (DFO). In order to meet their joint responsibilities, MOE and DFO have a critical interest in understanding the contribution that the ocean sector makes to the BC economy.

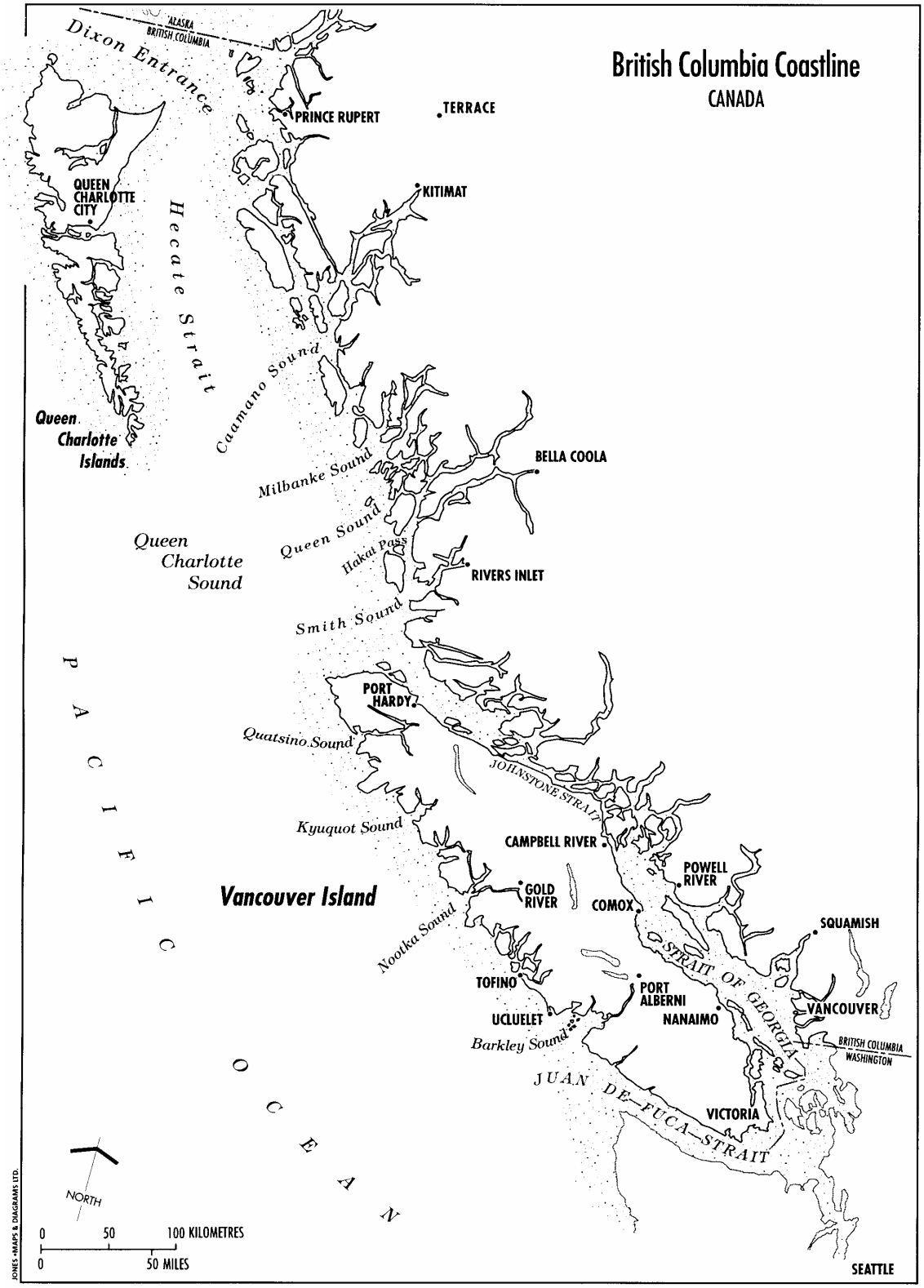
To date, the rising interest in the ocean and its economic role has not been matched by supporting information and analysis. The oceans sector is not well-represented by conventional statistics. This study is a first step in filling the data gaps to help all levels of government, First Nations, key stakeholders, and the public at large to better comprehend the ocean's economic significance.

1.1 Study Objectives

The intent of this study is to:

- define, describe, and quantify the various market (commercial) activities that comprise BC's ocean sector
- estimate in a consistent manner the direct, indirect, and induced impacts of these commercial activities to the BC economy
- assess the growth potential of the ocean sector

MAP of BC Coastline



An additional task is to illustrate the economic potential of some other ocean sectors, in particular offshore oil and gas development and offshore wind power generation.

The study does not encompass some key areas of valuation, specifically ecosystem values, First Nations traditional use values, and other non-market values. It is recognized that an assessment of these other non-commercial values is essential to appreciate fully the ocean's economic, social, and environmental value to BC. The Oceans Coordinating Committee sponsored a literature and methodological review of non-commercial valuation of ocean resources that lays the groundwork for future work in this area (Philcox, 2007).

1.2 Regional Resolution

The focus of this study is the economic contribution of the oceans sector to the province as a whole. The study does provide the approximate distribution of employment for some subsectors, in percentage terms, for four broad subprovincial regions (see Map):

- the North - Haida Gwaii/Queen Charlotte Islands plus the Mainland north of Vancouver Island i.e., the Rivers Inlet - Bella Bella - Bella Coola area plus the Prince Rupert and surrounding area
- Vancouver Island - all of Vancouver Island plus the very sparsely populated Mainland along the east side of Johnstone Strait
- Lower Mainland - the Sunshine Coast south of the Powell River area plus Greater Vancouver and the Fraser Valley
- other - the remainder of the Province i.e., the Interior

The estimation of the economic contribution of the oceans sector, at a fine regional level, on par with provincial estimates is a formidable task. Such an exercise would involve an effort level an order of magnitude greater than allocated for this study.

1.3 Information Sources

To conduct an economic study of this kind is daunting since official government statistics and industry classification systems do not define ocean industries as a distinct category. As a result, it is necessary to designate which industry sectors, in whole or in part, comprise ocean-related industries and to estimate their economic contribution attributable to the ocean. These tasks necessitated a substantial research program.

The study has involved both primary (interviews and surveys) and secondary (literature review) research, including:

- the review of 16 other marine sector economic impact studies
- the acquisition and review of more than 80 other publications, including data purchases from BC Stats and Statistics Canada (see the Bibliography)
- an interview program with over 60 representatives from the provincial and federal governments and the private sector

- four targeted special surveys of provincial and federal agencies, university and research institutions, and Environmental Non-Government Organizations (ENGOs) with respect to their ocean-related spending and activities

The lead consultant also visited and interviewed BC Stats and Statistics Canada personnel in Victoria and Ottawa, respectively.

1.4 Report Outline

The next section presents an overview of the BC ocean economy, its activities and sectors, and the approach for measuring the economic contribution of each sector. The study results are presented and summarized in the remainder of the report:

Section	Subject
2	Approach and Methodology
3	The BC Ocean Economy – Private Sectors
4	The BC Ocean Economy – Public & Non-Government Sectors
5	Total Ocean Sector Impacts Today and in the Future
6	Potential Sectors and their Estimated Impacts
7	Conclusions

In addition, several appendices provide supplemental material.

The terms "ocean" and "marine" are used interchangeably in the report. The term "ocean" in this study refers to the subtidal area off coastal BC to the western outer boundary of the Canadian Exclusive Economic Zone (EEZ), the area extending 200 nautical miles seaward from the BC coast.

Note that all dollar figures are presented in nominal or current dollars unless otherwise stated (and not constant, inflation adjusted dollars). Our research and discussions with practitioners in other jurisdictions suggest that nominal dollar impacts are more useful and more transparent than constant dollar impacts.

2.0 Approach & Methodology

Our methodology for assessing the economic dimensions of the ocean sector in Canada draws on "lessons learned" from previous work in and outside Canada, and on a set of underlying principles. These are identified in this section as well as the list of ocean sectors to be considered for analysis.

2.1 Previous Work

A variety of marine sector economic impact studies have been completed for specific provinces within Canada and for specific countries around the world. We reviewed 7 Canadian impact studies (for Canada, Newfoundland & Labrador, PEI, Nova Scotia, New Brunswick, Quebec and the North), 5 international impact studies (for California and Florida in the US, United Kingdom, Australia and New Zealand) and 4 methodology studies (DFO Halifax 2002, Colgan 2003, APEC 2004, and GSGislason 2007). Only one of these studies - the Roger A. Stacey Consultants Ltd. (RASCL) 2003 report - addressed Pacific Region ocean sector impacts, part of an analysis of national ocean sector impacts (see Table 1). The RASCL Report estimated the economic contribution of the BC ocean's sector as $6.0 billion in Gross Output and $2.8 billion in Gross Domestic Product, or 2% of the provincial total in 2000.

However, several potential improvements to this initial work, in terms of methodology and sector coverage, have been identified (GSGislason 2007). Many of these suggestions have been implemented in this current report. The review of previous studies and our research/interviews suggest the following "lessons learned":

- the work to date within and outside Canada differs significantly e.g., non-Canadian studies do not address the public (government) sector, Canadian studies treat marine tourism differently, the inclusion of universities and research organizations is sporadic, some studies address direct effects only whereas other studies address direct, indirect and induced effects.
- certain sectors seem not to be addressed in any of the studies analyzed e.g., Environmental Non-Government Organizations (ENGOs), environmental consulting, subsistence (except for the North in Canada).
- financial data for the shipping component of water transport is difficult to access due to confidentiality concerns i.e., national and not provincial figures are reported by Statistics Canada.
- the tourism industry is a notoriously difficult sector to measure in all jurisdictions in the world; isolating the marine component adds one more layer of difficulty.
- double counting is an issue i.e., one sector's output can be another sector's input (for example, fish harvesting output is an input to fish processing).

Analyzing the ocean sector involves a considerable amount of professional judgement - and approaches can and should vary across jurisdictions depending on the importance of each sector, data availability and other factors. A May 2002 workshop sponsored by DFO suggested that there was no standard methodology for measuring the economic contribution of the ocean sector.

Table 1: RASCL Estimates of Ocean Contribution to Canadian Economy 2000

Direct Impacts	Atlantic Canada			Pacific Canada			Canada		
	Gross Output	GDP	Employment	Gross Output	GDP	Employment	Gross Output	GDP	Employment
	•••$ millions•••		PYs	•••$ millions•••		PYs	•••$ millions•••		PYs
Private Sector									
1. Seafood - Primary Fishing	1,765	1,322	17,500	369	329	3,500	2,134	1,650	21,000
- Aquaculture	281	160	4,530	292	139	2,420	573	299	6,950
- Processing	2,988	896	17,500	476	190	2,660	3,464	1,087	20,160
Subtotal	3,269	2,378	39,530	768	658	8,580	4,037	3,036	48,110
2. Offshore Oil & Gas	5,265	4,721	5,910	0	0	0	5,265	4,721	5,910
3. Ocean Transport - Ports	179	62	1,140	195	86	1,120	374	148	2,260
- Shipping	705	143	7,460	1,175	238	7,440	1,880	381	14,900
- Ship/Boat Building	427	224	3,630	392	235	4,370	819	459	8,000
Subtotal	1,311	429	12,230	1,762	559	12,930	3,073	988	25,160
4. Marine Tourism - Angling	96	39	980	466	186	4,760	561	225	5,740
- Coastal Tourism	167	67	1,710	221	88	2,260	389	155	3,970
- Cruise Passengers	18	7	190	65	26	660	83	33	850
Subtotal	281	113	2,880	752	300	7,680	1,033	413	10,560
5. Marine Constⁿ - Buildings	75	36	410	152	73	820	227	109	1,230
- Oil & Gas Rigs	1,678	805	9,110	0	0	0	1,678	805	9,110
- Marine Works	262	126	1,420	81	39	440	343	165	1,860
Subtotal	2,015	967	10,940	233	112	1,260	2,248	1,079	12,200
6. Ocean Mfg & Services - Comm & Elec Equip	186	110	1,140	67	40	370	253	150	1,510
- Marine Technology	304	188	2,990	280	174	2,610	584	362	5,600
- Aquaculture	293	156	2,370	482	258	3,730	775	414	6,100
- Prof Services	329	144	3,800	439	194	4,870	768	338	8,670
Subtotal	1,112	598	10,300	1,268	666	11,580	2,380	1,264	21,880
TOTAL Private Sector	13,253	9,206	81,790	4,783	2,295	42,030	18,036	11,501	123,820
Public Sector									
7. Federal Gov't - DFO	1,072	415	6,600	357	138	2,200	1,429	553	8,800
- Transport Canada	0	0	0	0	0	0	0	0	0
- DND	1,466	568	10,390	489	189	3,470	1,955	757	13,860
- Other	838	324	3,310	279	108	1,100	1,117	432	4,410
Subtotal	3,376	1,307	20,300	1,125	435	6,770	4,501	1,742	27,070
2. Provincial Gov't - Fish & Aquaculture	69	25	400	10	5	50	77	30	450
- Marine Transport	54	19	430	43	19	150	99	38	580
- Oil & Gas	8	3	50	0	0	0	8	3	50
Subtotal	131	47	880	53	24	200	184	71	1,080
TOTAL Government	3,508	1,354	21,180	1,178	459	6,970	4,685	1,813	28,150
TOTAL Private & Public Sectors	16,761	10,560	102,970	5,961	2,754	49,000	22,721	13,314	151,970

Source: RASCL "Canada's Ocean Industries: Contribution to the Economy 1988-2000" Prepared for DFO, September 2003.

Note: 1. The Atlantic Region includes Quebec, DFO expenditures include Canadian Coast Guard.
2. GDP is GDP at Factor Cost, PYs is person-years, $ are nominal.
3. The Atlantic - Pacific split of national totals for government sectors is estimated.

2.2 Principles for Analysis

Our investigations suggest five general principles for measuring the economic contribution of the ocean sector:

- Principle #1: marine sector definitions should be NAICS-based to the extent possible (it is realized that ocean-based recreation will need to be treated in a different manner)
- Principle #2: the analysis for subsectors should use BC Stats/Statistics Canada data and concepts to the extent possible (this confers consistency with procedures used for measuring the economic contribution of other sectors of the economy)
- Principle #3: it is important to designate a marine share of relevant NAICS industries e.g., not all DFO expenditures are marine-based, not all boat building is marine-based
- Principle #4: double counting should be avoided (where one sector's output is an input to another sector the economic activity should be recorded at the point closest to consumption)
- Principle #5: land-based processing/distribution of marine resources should be included where the resource does not undergo drastic transformation e.g., seafood processing and marketing should be included.

These principles underly our approach to the study.

2.3 The Ocean Economy of BC - Definition & Sector Coverage

Definition. The ocean sector is comprised of the private industries, research and education organizations, and various levels of government that depend on the ocean environment as a medium for transportation, operation, innovation, or recreation, or as a source of extractable resources. That is, the ocean sector includes not only fishing and offshore oil and gas, but also such industries as ocean transport, ship building, and ocean tourism.

The Challenge. Standard industry classification systems such as the North America Industry Classification System (NAICS) were designed to group producers into industries on the basis of similarities in their production processes and their outputs. NAICS was not designed to measure economic activity of industries with similar use of resources such as the ocean. Therefore, one has to examine the component parts of industries and decide whether they comprise, in whole or in part, ocean-related activity.

Industry Sectors. Table 2 identifies the various ocean sectors addressed in the study. The sectors include the main sectors addressed in other studies, and comprise the sectors for which we can make reasonable estimates of economic activity. The sector coverage represents a substantial expansion over sectors covered in the original RASCL Report (Table 1). This notwithstanding, several sectors such as ocean high technology and ocean recreation should be considered works-in-progress subject to more intensive analysis in future studies.

Years for Analysis. We present estimates for four years 2002 through 2005. The latter two years should be considered preliminary as many Statistics Canada data series for provinces, a key underpinning to the analysis, presently are only available up to 2003 (the National Accounts Division of Statistics Canada just released 2003 Gross Output and Gross Domestic Product estimates by industry at the provincial level in November 2006). There is close to a 3 year lag in release of data.

Table 2: BC Ocean Sectors for Analysis

Existing Private Sectors

NAICS/Sector		Data Source for Gross Revenue
1. Seafood		
114	Fishing	MOE
1125	Aquaculture	MOE
3117	Processing	MOE
	Marketing & Distn	Secondary Sources
2. Forestry-Marine Component		
113	Forestry & Logging	Stats Can/Interviews
321	Wood Mfg	"
322	Paper Mfg	"
3. Marine Construction		
DFO		Interviews
DND		Interviews
Port Authorities		Annual Reports
BC Ferries		Annual Reports
4. Ship & Boat Building		
336611	Ship Building Repair	Stats Can
336612	Boat Building	Stats Can
5. Ocean-Related High Technology		
Manufacturing		BC Stats Satellite
Services inc. Env Consulting		"
6. Ocean Recreation		
Saltwater Angling		DFO Survey
Ferries		Annual Reports
Cruise Tourism		Secondary Sources
Other		BC Stats Satellite
7. Ocean Transport		
483115	Shipping exc. Ferries	Secondary Sources
4883	Services to Water Transport	"
	Related Services	"

Existing Public Sectors

NAICS/Sector	Data Source for Gross Revenue
1. Federal Government	
CFIA	Survey/Interviews
DFO	"
DND	"
Parks Canada	"
Environment Canada	"
Transport Canada	"
Service Canada (formerly HRDC)	"
WD	"
NRCan	"
NSERC & SSHRC	"
other	"
2. Provincial Government	
Agriculture & Lands	Survey/Interviews
Economic Development	"
Environment	"
Tourism BC	"
Sports, Arts & Culture	"
EMPR	"
Innovation Council	"
Transportation	"
BC Hydro	"
other	"

Existing Non-Government Sectors

NAICS/Sector	Data Source for Gross Revenue
1. University/R&D	Survey/Interviews
2. Environmental Non-Gov't Organizations	Survey/Interviews

Potential Energy Sectors

NAICS/Sector	Data Source for Gross Revenue
1. Offshore Oil & Gas	Secondary Sources
2. Offshore Wind Energy	Secondary Sources

2.4 Economic Indicators

The basic information to profile any industry as a whole, whether it be forestry, mining, tourism, or fishing includes - product/activity volumes, sales values, employment, and markets. Without this basic information an industry cannot present its stature and assert its legitimacy to the public and to competing resource users. One cannot conduct even the barest minimum policy analysis without this basic information. Simply put, legitimate industries can describe their basic economic parameters.

Four Main Indicators. The key indicators for this economic impact analysis of the contribution of the BC ocean sector to the BC economy are:

- Gross Output and/or Revenues
- Gross Domestic Product (GDP)
- Labour Income (Wages, Salaries & Supplementary Labour Income or SLI)
- Employment (measured in person-years or PYs)

GDP measures the unduplicated value of production as the "value added" by producers to intermediate inputs in generating output i.e., Gross Output less Intermediate Purchases of Goods & Services. When measured at basic prices, an industry's GDP is the sum of factor incomes - Wages & Salaries, SLI, Mixed Income (combined return to capital & labour of the self-employed) and operating surplus - plus indirect taxes less subsidies on capital and labour inputs (see Statistics Canada "Provincial GDP by Industry and Sector", Cat. No. 15-209-XCB).

Labour Income is the return to labour and is included in GDP - Labour Income includes wages, salaries, and employer contributions to Employment Insurance, Canada Pension Plan, private pension plans, health/dental plans etc. The Operating Surplus component of GDP is the return to capital and includes pre-tax profits, depreciation, and interest paid.

As noted earlier, all dollar figures are expressed in nominal dollars.

The Importance of the Gross Output Measure. Gross Output drives the estimation of GDP, Labour Income and Employment. If one has an estimate of sector revenues, then one can apply a GDP, Labour Income or Employment direct impact multiplier or ratio to estimate direct impacts. Alternatively, one could use more sector-specific information on the cost structure of the industry in question, if available, to estimate direct impacts.

In some cases BC Stats or Statistics Canada can provide the relevant Gross Output data directly e.g., Statistics Canada, "Provincial Gross Output by Industry and Sector", Cat. No. 15-210-XCB. In other cases, the data may need to be adjusted to conform to the appropriate ocean sector focus e.g., eliminating the freshwater or non-marine component. In still other cases, the researcher will have to estimate Gross Output independent of BC Stats or Statistics Canada data.

2.5 Economic Multipliers

In addition to direct impacts, the ocean sector has impacts on the economy through backward linkages to suppliers of goods and services (called indirect impacts), and through the respending of wage incomes earned at the direct and indirect stages (called induced impacts).

Typically these spinoff indirect and induced impacts are analyzed through economic "multipliers". For example, an activity may generate direct GDP of $0.50 from each $1 of direct industry output. The indirect supplier and induced consumer spending impacts may add $0.40 to GDP. The total GDP multiplier - direct plus spinoff - per $1 direct output then would be $0.90.

For this study, we utilize Statistics Canada inter-provincial input-output multipliers for British Columbia for the year 2003, the latest year available (Statistics Canada, "Provincial Input-Output Multipliers 2003", Cat. No. 15F0046XDB, 2006). We chose to use Statistics Canada multipliers for British Columbia rather than BC Stats multipliers since the Statistics Canada multipliers are more recent, and are more detailed (the most current set of BC Stats multipliers refer to the year 2001). Appendix M presents our multiplier analysis.

Note that there are several limitations and/or embedded assumptions to input-output models (see GE Bridges 2004a p.4) e.g., impacts are assumed to be instantaneous, marginal changes equal average changes, any changes in output results in proportional changes in capital, labour and intermediate inputs etc.

3.0 The BC Ocean Economy - Private Sectors

There are many businesses and business activities that are dependent on the ocean environment. These business sectors include: 1) resource extraction, processing and distribution e.g., seafood, 2) goods construction and manufacturing e.g., ship building, and 3) services e.g., ocean transport and ocean-based recreation.

The analysis of the economic dimensions of private sector businesses tied to the ocean environment include:

- seafood
- forestry
- ship & boat building
- marine construction
- high tech manufacturing & services
- ocean recreation
- ocean transport (ports & shipping)

Each business sector is analyzed under several headings: 1) definition, 2) activities & output, 3) data adjustments & assumptions, 4) regional employment, and 5) direct impacts. Regional employment from 2001 Census for some ocean-related business sectors is given in Appendix A.

3.1 Seafood Sector

Definition. The BC seafood industry produces, processes, and markets fish and shellfish into intermediate or finished food products for consumers. The industry involves several linkages or phases of activity between the natural resource in its marine environment and the final products available to consumers (GSGislason 2004).

- *Production* - Fish and shellfish are harvested using a variety of nets, hooks and lines, traps, diving techniques, or other gear. In addition, they are cultured from birth through rearing and feeding to market size.
- *Processing* - Raw fish and shellfish reach commercial processors via delivery by sea to processing plants, custom unloading at transhipment points, and trucking. Processors transform the raw material into a variety of live, fresh, whole, frozen whole, fillet, steak, smoked, canned, roe, and other products.
- *Distribution* - Final processed products are delivered to consumers through wholesale and retail food channels.

These three industry elements also exist for the food business in general.

Appendix B provides background information on the seafood sector.

Activities & Output. In recent years the BC seafood industry has produced 300,000-350,000 tonnes of output worth $600 to $700 million at the primary landed or farm gate level, approximately $1.1-1.2 billion at the wholesale (processed) level and $1.3-1.4 billion at the distribution level.

Approximately 20-30% by volume and 30-40% by value is tied to aquaculture production, mainly farmed salmon production - see Figure 1.

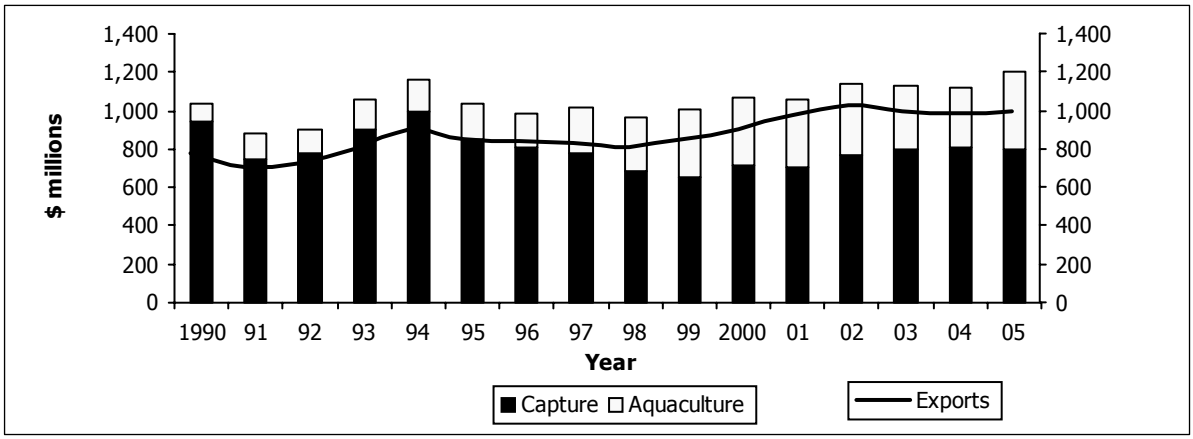
Figure 1: BC Seafood Sector Profile

A. Seafood Production 2005

		Seafood Value Chain		
		Production	**Landed/Farm Value**	**Wholesale Value**
		'000 tonnes	$ millions	$ millions
Capture	- salmon	26	33	212
	- herring	30	31	86
	- shellfish	18	122	178
	- groundfish	168	157	286
	- other	11	21	37
Subtotal		253	364	799
Aquaculture	- salmon	71	319	371
	- shellfish	10	17	32
Subtotal		81	336	403
Total		334	700	1,202

Source: BC Ministry of Environment (MOE), "Seafood Industry Year in Review", Annual.

B. Seafood Sales Value and Export Value 1990-2005



Source: Sales Value - "Seafood Industry Year in Review".
Export Value - BC Stats, "BC Fisheries & Aquaculture Sector", occasional.

C. Seafood Regional Employment 2002

	% Employment				
	Fishing	**Aquaculture**	**Processing**	**Distribution**	**All**
Region					
North	16%	2%	10%	6%	10%
Vancouver Island	46%	91%	34%	25%	44%
Lower Mainland	35%	7%	56%	65%	44%
Interior	3%	-	<1%	4%	2%
	100%	100%	100%	100%	100%

Source: GSGislason & Associates Ltd., "SWOT" Study, 2004.

At one time the BC seafood sector was dominated by wild (capture) salmon and herring sectors - but their importance has declined over the past 20 years. In contrast, there has been an increase in the contribution of wild shellfish and groundfish fisheries, and a substantial growth of the aquaculture (farm) sector, especially farmed salmon.

Data Adjustment & Assumptions. Adjustments were required to Statistics Canada information for the seafood sector, and the BC Stats "4 Sector Report" which relies on Statistics Canada data, because:

- the Statistics Canada data excludes some establishments
- Statistics Canada allocates vertically integrated salmon farming-processing-marketing companies in their entirety to aquaculture - there is a need to segment farming and processing functions
- Statistics Canada does not include crew payments and employment of self-employed individuals as part of Labour Income and Employment for the fishery sector - as a result the wage share of fish harvesting revenues, according to Statistics Canada, is very low at under 5%
- the Cost of Production profile used by Statistics Canada for the fishery sector is 15+ years old and does not reflect current financial circumstances

Therefore we used benchmark information and values for the year 2002 from a comprehensive SWOT study to provide more realistic estimates of GDP, Labour Income and Employment ratios to Sales Value (GSGislason 2004). Wholesale and landed/farm gate values were taken from BC Environment "Seafood Industry Year in Review". The SWOT study suggested that 10% of BC seafood output is consumed/sold in the province with the remaining 90% exported to Eastern Canada and out-of-country markets. Direct exports of raw seafood are included in the sales value.

No adjustment to subtract non-marine components is needed since essentially all fish production for sale comes from the ocean.

Regional Employment. The bulk of seafood sector employment occurs on Vancouver Island and the Lower Mainland (each with 44% of total provincial seafood employment in 2002) - see Figure 1. Vancouver Island has over 90% of total aquaculture farm level employment whereas the Lower Mainland has more than half of processing and distribution employment.

Economic Impacts. The BC seafood sector in 2005 had sales of $1,380 million, contributed $790 million to provincial GDP, had Labour Income of $475 million, and employed 12,900 on a full-year basis - see Table 3. The spinoff indirect supplier and induced consumer spending impacts add about 70% to the GDP, Labour Income and Employment figures. The labour component of the seafood sector is higher than many other business sectors.

3.2 Forestry

Definition. A variety of industrial complexes are located on the BC coast. In many cases these businesses have part of their workforce dedicated to loading and unloading ships at their private docks. For example, the Elk Falls forest complex at Campbell River and the Alcan aluminium plant at Kitimat have private dock facilities.

Table 3: BC Seafood Sector Economic Impacts

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Sales Value $ millions				
Harvesting & Farm Level	663	645	636	700
Processing Margin	473	485	486	502
Retail/Distn Margin	174	170	168	178
	1,310	1,300	1,290	1,380
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions	750	745	740	790
Labour Income $ millions	450	445	445	475
Employment PYs	12,970	12,600	12,300	12,900
Indirect Impacts				
GDP $ millions	240	230	230	250
Labour Income $ millions	170	170	170	180
Employment PYs	4,680	4,550	4,430	4,640
Induced Impacts				
GDP $ millions	250	250	250	260
Labour Income $ millions	150	150	150	160
Employment PYs	4,050	3,940	3,860	4,030
Total Impacts				
GDP $ millions	1,240	1,225	1,220	1,300
Labour Income $ millions	770	765	765	815
Employment PYs	21,700	21,090	20,590	21,570

Source: Production Sales Value - MOE "Seafood Year in Review", Annual.
Processing Margin - MOE "Seafood Year in Review", Annual.
Distn Margin - estimated as 15% of processed value.
Direct Impacts - GSGislason, "SWOT Study" 2004 (Appendix M).
Indirect & Induced Impacts - Stats Can Input-Output Multipliers (Appendix M).

For this study we restrict ourselves to analysis of the marine component of the forest industry, where the forest industry is defined as logging plus manufacturing of wood products and pulp & paper. Information for other industrial sectors are not readily available.

We did contact the Aggregate Producers Association of BC as to the marine component of sand & gravel mining. They indicated that almost no material is directly extracted from the ocean floor, that Texada Island and the Sechelt Peninsula are important mining sites for Lower Mainland producers, and that most barges and tugs used to transport the mined material from Texada and Sechelt to Vancouver are contracted to third parties i.e., this tug/barge activity would be included under our "Ocean Transport" category.

Appendix C provides background data on the BC forest industry.

Activities & Output. The Coastal forest industry in BC makes extensive use of the sheltered waterways along the West Coast including the North, Central and South Coast as well as Haida Gwaii/Queen Charlotte Islands and Vancouver Island. These waterways facilitate the transport of logs from the woodlands scattered along Coastal BC to a large number of wood manufacturing facilities mainly located in the Greater Vancouver area and on Vancouver Island. Chips from wood manufacturing facilities are in turn shipped by water to various pulp and paper facilities along the Southern Coast, and products are shipped directly by water to export markets from these facilities.

Coastal wood manufacturing facilities in the Greater Vancouver area typically use rail and trucks to ship their final products, although some also ship their final products by water. The wood manufacturing facilities on Vancouver Island rely on port facilities to ship their products offshore.

There are eight primary pulp and paper facilities in Coastal BC, and all have direct docking facilities at the mill site.

In the last 10 years the BC forest industry has harvested an average of 74 million m^3 of logs with 30% derived from the coast region. Total BC industry revenues in 2005 were an estimated - $6.8 billion Logging, $12.1 billion Wood Products Manufacturing, $6.0 billion Paper Manufacturing (see Table C.1, Appendix C).

About 6% of BC logs - 21% of coastal logs and 1% of interior logs - are exported today. The export share has been increasing over the past decade (see Table C.1, Appendix C).

Data Adjustments & Assumptions. Statistics Canada provides information on forest sector activities and revenues. These aggregate statistics need to be prorated to reflect the 30% share that the coastal industry comprises, and the share of the coastal forest sector workforce that has a marine focus.

Discussion with individuals in the forest industry suggest the following approximations for the marine share of coastal forest activity:

- Logging - 2% marine component reflecting workers sorting logs (note that essentially all tugboat/barge operators are independent contractors - they are included under the category "Ocean Transport" discussed later).
- Wood products - 5% marine component reflecting workers in dewatering functions (i.e., getting logs out of the water into the mill), and loading ships.
- Pulp & paper - 5% marine component reflecting in-house shipping crew at the dockside.

Table 4: BC Forest Sector Economic Impacts - Ocean Component

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Sales Value $ millions				
Forestry & Logging[a]	90	89	123	107
Secondary Manufacturing	179	167	185	176
	269	256	308	283
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions[a]	100	90	118	108
Labour Income $ millions	60	58	59	60
Employment PYs	960	930	910	910
Indirect Impacts				
GDP $ millions	97	92	111	102
Labour Income $ millions	67	64	77	71
Employment PYs	1,290	1,200	1,420	1,280
Induced Impacts				
GDP $ millions	51	49	54	52
Labour Income $ millions	30	29	33	31
Employment PYs	810	780	850	840
Total Impacts				
GDP $ millions	248	231	283	262
Labour Income $ millions	157	151	169	162
Employment PYs	3,060	2,910	3,180	3,030

Source: Appendix C.

a Includes $3 million annually in log loan tenure payments.

The result is that an estimated 0.6% of total BC Logging activity, 1.5% of total BC Wood Products activity, and 1.5% of total BC Pulp Manufacturing activity should be allocated to the marine sector i.e., 30% of the above percentages.

Regional Employment. The regional share of coastal BC production employment would be approximately 20% North Coast, 60% Vancouver Island, and 20% Lower Mainland. Head office activity and administration employment are concentrated in Vancouver.

Economic Impacts. The direct and spinoff economic impacts of the marine component of the forest industry are given in Table 4. The Gross Output and GDP estimates includes the $3 million paid annually by forest companies for log boom tenures (payments comprise part of the indirect tax component of GDP).

The estimates do not include the ocean contribution of large industrials other than forest companies such as Alcan. These could be included in future work.

3.3 Ship & Boat Building

Definition. The Ship & Boat Building industry NAICS 3366 has two major components:

- Ship Building & Repairing - establishments primarily engaged in operating a ship yard
- Boat Building - establishments primarily engaged in manufacturing boats

Shipyards are fixed facilities with dry docks and fabrication equipment capable of building a ship, a watercraft for other than personal or recreational use. Boats are defined as watercraft for personal or recreational use.

Appendix D provides background information on the sector.

Activities & Output. Gross output or sales of the sector has been $380-420 million in recent years. Large shipyards include Victoria Shipyards, Nanaimo Shipyards, Vancouver Shipyards and Allied Shipbuilders (the latter two are in North Vancouver).

The BC Yacht Building Association has about 65 builders, designers, and supplier members. Boat builders include ABD Aluminium Yachts of North Vancouver, Coast Craft Welded Aluminium Boats Ltd. of Gibsons and Philbrook's Boatyard in Sidney. A significant share of yachts built in BC are exported – see Table D.2, Appendix D.

The nature of the ship & boat building business is that it is lumpy i.e., a few large orders can create a spike in business activity followed by a business lull thereafter.

Data Adjustments & Assumptions. Some Boat Building activity is directed at freshwater markets e.g., canoes, skiffs with outboards etc. For the purpose of this analysis we assume that 100% of Ship Building and about 90% of Boat Building activity is marine-related.

Regional Employment. The 2001 Census had the following distribution of Ship & Boat Building industry employment for coastal BC - 1% North, 35% Vancouver Island, and 64% Lower Mainland.

Table 5: BC Ocean-Related Ship Building & Boat Building Economic Impacts

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Sales Value $ millions				
Ship Building & Repairing	175	217	200	200
Boat Building	203	205	180	198
	378	422	380	398
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions	165	186	168	175
Labour Income $ millions	131	148	134	139
Employment PYs	2,520	2,740	2,410	2,490
Indirect Impacts				
GDP $ millions	85	98	89	92
Labour Income $ millions	41	47	42	44
Employment PYs	970	1,080	960	980
Induced Impacts				
GDP $ millions	69	78	70	73
Labour Income $ millions	41	47	42	44
Employment PYs	1,120	1,250	1,100	1,130
Total Impacts				
GDP $ millions	319	362	327	340
Labour Income $ millions	213	242	218	227
Employment PYs	4,610	5,070	4,470	4,600

Source: Table D.1, Appendix D.

Economic Impacts. The ocean component of the BC Ship & Boat Building sector in 2005 had estimated revenues of $398 million, contributed $175 million to provincial GDP, had Labour Income of $139 million, and had Employment of 2,490 person-years. Trickle down effects on supplier and retail sectors create additional economic activity.

3.4 Ocean Construction

Definition. The category Ocean Construction can not be allocated to a specific NAICS code. This category comprises marine structures such as docks, wharves, and dredging.

Appendix E provides information on construction activities of the six Port Authorities in BC.

Activities & Outputs. There currently are no marine-related oil & gas-related construction expenditures in BC. The current oil & gas industry and related construction industry is restricted to land-based activities mainly in Northeast BC.

The Federal Department of National Defence spends significant monies on shore infrastructure at its CFB Esquimalt naval facility.

The Small Craft Harbour (SCH) division of DFO is responsible for the capital program for the network of close to 100 Small Craft Harbour facilities up and down the coast. BC Ferries spends money on berthage, buildings and equipment related to their marine ferry operations (the construction of ferries is not included in this sector).

Port development and construction is an important sector component. The six federal Port Authorities have capital programs for marine construction. For example, the Port of Prince Rupert is undergoing a substantial container terminal expansion.

Data Adjustments & Assumptions. The ocean construction expenditures are relatively modest since capital expenditures on ships and their repair have already been addressed. It is likely that the above estimates are conservative as private sector initiatives are not included.

Regional Employment. It is likely that the regional employment pattern for marine construction would be similar to that for Ship & Boat Building i.e., 1% North, 35% Vancouver Island and 64% Lower Mainland.

Economic Impacts. The marine construction industry impacts are given in Table 6.

3.5 High Tech Manufacturing & Services

Definition. The marine technology industry does not comprise a separate NAICS industry code or set of codes. It is diverse and includes:

- **Acoustics Systems and Equipment:** Equipment and systems that use sound underwater. For example hydrophones record underwater sounds, echo sounders use sound to measure water depth, multi beam sonar uses sound beams to image the bottom, acoustic telemetry sends signals by means of sound, etc. Products include sonars, echo sounders, sub bottom profilers, and data acquisition and processing systems.

Table 6: BC Ocean Construction Economic Impacts

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Sales Value $ millions				
BC Ferries	33	34	70	101
DFO	26	36	25	27
DND	11	7	23	55
Ports	40	40	43	33
	110	117	161	216
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions	47	50	69	93
Labour Income $ millions	35	37	52	69
Employment PYs	720	750	990	1,330
Indirect Impacts				
GDP $ millions	34	36	50	67
Labour Income $ millions	22	23	32	43
Employment PYs	560	590	790	1,040
Induced Impacts				
GDP $ millions	23	24	34	45
Labour Income $ millions	14	14	20	27
Employment PYs	370	380	530	690
Total Impacts				
GDP $ millions	104	110	153	205
Labour Income $ millions	71	74	104	139
Employment PYs	1,650	1,720	2,310	3,060

Source: Gross Output - Interviews (DFO & DND).
- Annual Reports (BC Ferries & Port Authorities).
Economic Impacts - based on Stats Can "2003 BC Input Output Multipliers" for engineering construction (see Appendix M).

- **Defence Oceans Technology**: Ocean technology products or services for the naval market, e.g., anti submarine warfare (ASW), military underwater vehicles, stealth buoys, surveillance systems etc.
- **Imaging Oceans Technology**: This category is largely remote sensing for ocean applications, e.g., software for visualization of large hydrographic data sets, geomatics, etc.
- **Instrumentation and Information Systems**: Sensors and systems that measure marine parameters, e.g., oceanographic instruments, drifting buoys, data collection systems, cabled seafloor observatories & their components etc.
- **Marine Communications**: Companies primarily engaged in marine navigation, communications and information technology, e.g., information seaway, marine geomatics, marine information skyway, marine intelligent systems, and wireless R&D.
- **Platforms and Vehicles**: This category includes ocean vehicles ROVs (Remotely Operated Vehicles), AUVs (Autonomous Underwater Vehicles), Submersibles, Ocean Platforms, Handling Systems etc.
- **Services**: Marine services are similar to land based, but undertaken in the marine environment, e.g., marine survey, marine engineering, naval architecture, marine environmental services, vessel operations, marine simulation, marine training etc.

Appendix F provides background information on the sector.

Activities & Output. It is difficult to designate an all-inclusive grouping for ocean technology firms and activities, one component of a larger aggregate called "High Technology". BC Stats has defined High Technology firms as those belonging to 30+ industry groupings - see Table F.3, Appendix F.

The marine component of this larger group of companies providing goods and services would comprise a small component of High Technology firms. Some evidence as to the size or marine share includes:

- a recent study of the Vancouver Island technology industry indicated that the ocean component was the primary focus of 7% of technology companies surveyed (Innovation and Science Council of British Columbia, 2004).
- the 1990 revenues of high tech ocean activities in BC was an estimated $300 million (SPARK, 1993).

For the purposes of this study we assume that the marine technology sector comprises 20% of total high tech manufacturing plus 5% of total high tech services, about 7-8% of the overall high tech sector. The manufacturing share is higher since there are several large marine firms in the group e.g., MacDonald, Dettwiler & Associates Ltd. in Vancouver. The estimated ocean shares of high tech are based on discussions with high tech industry representatives and professional judgement.

The marine technology sector has been growing rapidly and presently exceeds $1.1 billion annually in revenues.

Data Adjustment & Assumptions. The non-marine component of the technology sector already has been netted out of the activity estimates as explained above.

Table 7: BC Ocean High Tech Manufacturing & Services Economic Impacts

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Sales Value $ millions				
Ocean High Tech Manufacturing	425	450	465	500
Ocean High Tech Services	500	545	585	625
	925	995	1,050	1,125
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions	465	500	530	565
Labour Income $ millions	300	320	340	365
Employment PYs	5,010	5,280	5,450	5,730
Indirect Impacts				
GDP $ millions	220	240	255	275
Labour Income $ millions	140	150	160	170
Employment PYs	3,720	3,940	4,100	4,300
Induced Impacts				
GDP $ millions	175	190	200	215
Labour Income $ millions	105	110	120	130
Employment PYs	2,870	3,010	3,140	3,290
Total Impacts				
GDP $ millions	860	930	985	1,055
Labour Income $ millions	545	580	620	665
Employment PYs	11,600	12,230	12,690	13,320

Source: Gross Output - 20% of total high tech manufacturing + 5% of total high tech services (see Table F.1, Appendix F for total high tech).
Economic Impacts - multipliers based on Table F.1 (see Appendix F and Appendix M).

Regional Employment. The industry is concentrated in the Greater Vancouver area although a significant technology cluster exists in the Greater Victoria area. Our estimates of the regional distribution of employment are: 1% North, 25% Vancouver Island, 70% Vancouver, and 4% Interior (the regional distribution of employment from 2001 Census for NAICS 3345 – Navigational, Measuring, Medical & Control Instruments Manufacturing – is provided in Appendix A).

Economic Impacts. The ocean technology sector in 2005 had estimated revenue of $1,125 million, contributed $565 million to GDP and $365 million to Labour Income, and employed 5,730 people on a year round basis. Spinoff effects add to these direct impacts.

3.6 Ocean-Based Leisure/Recreation

Definition. The ocean-based recreation sector is the most difficult of the private sectors to analyze in that it does not fit into a NAICS grouping of (supply side) industries - rather the recreation sector encompasses a variety of consumer (demand scale) activities/expenditures that are tied to the ocean environment. These activities include saltwater angling, whale watching, ocean boating and sailing, scuba diving, guided kayak trips, beach activities, marine park visitation and the like. There are definitional challenges as many shore-based activities such as walking on beaches or biking on seaside trails are enhanced or driven by the presence of the nearby ocean.

Ocean-based recreation should not be restricted only to tourists (traditionally defined as people, including business persons, travelling 80 km or more from their normal residence). Non-tourists or locals comprise an important component of the overall ocean-based recreation sector.

In short, one needs to develop a customized approach based on consumer motivations and activity in order to isolate the ocean-based component of overall recreation. For the purpose of this study, we propose the following four segments for ocean recreation:

- saltwater angling (including fishing lodges and charters, shellfish harvesting)
- cruise ship visitation
- ferry travellers
- ocean activities e.g., boating/sailing, whale watching

It is important to include both tourist and non-tourist/local activity. Almost all cruise ship and ferry passengers would be tourists i.e., they would travel 80 km or more.

We have chosen to include the category "Ferries" in Ocean Recreation rather than the Ocean Transport section to follow as marine tourists are the final consumer (Principle #4, Section 2.2).

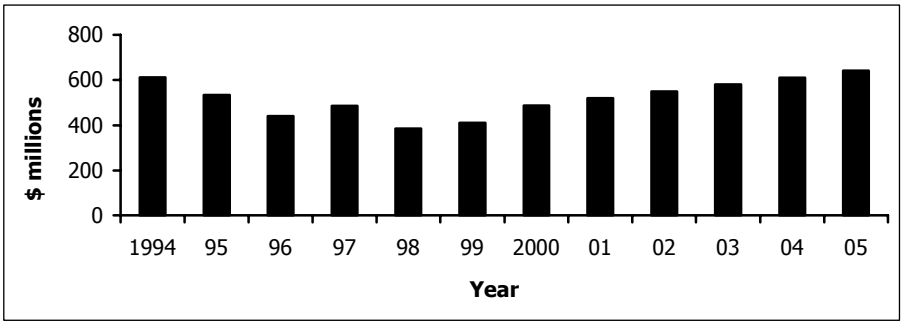
Appendix G provides background information on the ocean recreation sector.

Activities & Output. Figure 2 displays some trends for ocean recreation indicators.

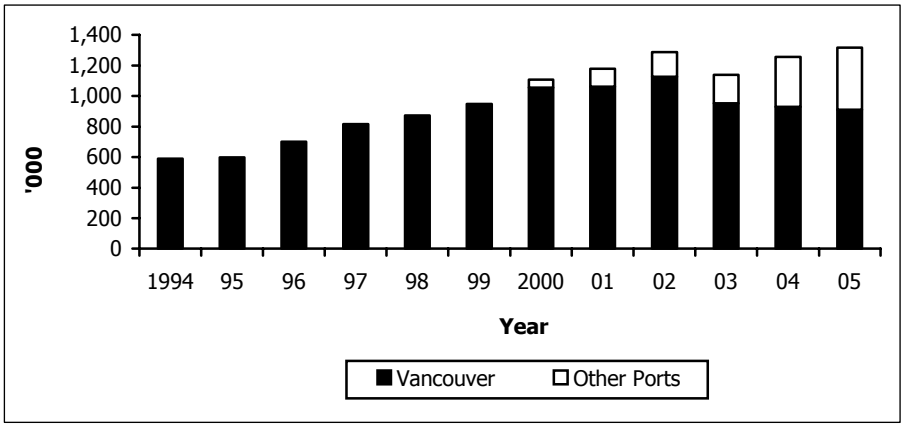
BC saltwater angling started to decline in the mid 1990s due to chinook and coho salmon resource concerns and due to regulatory uncertainty and/or changes in regulations. In recent years, chinook and coho stocks have rebounded, the regulatory environment has been stable and saltwater angling activity has increased. In 2005, saltwater anglers purchased 316,500 fishing licences and spent an estimated $642 million on 2.3 million saltwater angling days (DFO, preliminary data).

Figure 2: BC Ocean Recreation Sector Profile

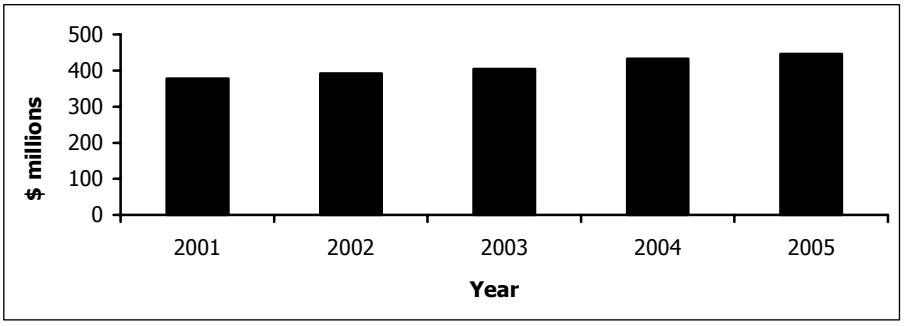
A. BC Saltwater Angling Expenditures



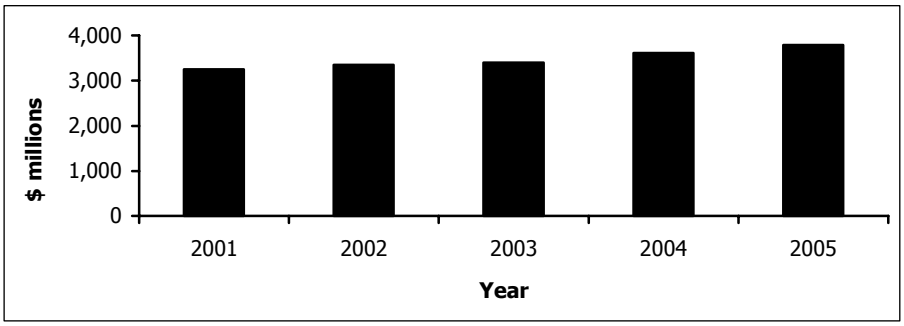
B. BC Cruise Ship Passengers



C. BC Ferries Revenues



D. BC Ocean Recreation Expenditures



Source: A - GSGislason & Associates Ltd. "GSG" estimates.
B - Transport Canada, "Transportation in Canada", Annual Report and BC Cruise.
C - BC Ferries Annual Report.
D - Table G.5, Appendix G (angling, cruise, ferries & other).

The cruise ship subsector involves both large international vessels handling 1,500+ passengers that go to Alaska and back as well as much smaller "pocket cruise" vessels with under 100 passengers that cruise within BC waters. Vancouver cruise ship passenger counts increased every year through the 1990s and through 2002 but have declined since then. Vancouver is primarily a port of departure and arrival for Alaska cruises. The Port of Vancouver is under increasing competition from the Port of Seattle for cruise ship traffic.

Victoria is primarily a port of call for Alaska cruises that originate in US ports (BREA 2004). Cruise passenger volumes at the Port of Victoria have more than tripled since 2000. Cruise ships have visited Prince Rupert and Nanaimo in recent years - and Campbell River and Port Alberni are planning to have cruise ship terminals. Total cruise passenger volume was 1.3 million passengers in 2005. Cruise passengers and crew spent an estimated $270 million in British Columbia in 2005.

In April 2003, BC Ferries was transformed from a provincial crown corporation to an independent operating entity. Today the corporation carries 22 million passengers, over 8 million cars, in over 30 vessels, over a variety of routes along coastal BC. Revenue growth has been steady in recent years. There also are ferries not operated by BC Ferries that provide service between Greater Victoria and Washington State.

The "other" category is a diverse mix of boating/sailing, nature observation, and other activities. Very little economic information is available on this sector and its separate components, and what little information is available usually addresses the guided fee-for-service component only e.g., whale watching tours, scuba diving tours/lessons, sea kayaking tours. The much larger self-directed ocean recreation experience is not included. We have estimated the 2005 sales revenues/expenditures by this "other" category to be $2.4 billion in total – see Table G.5, Appendix G.

The ocean economic study for California estimated approximately 464 million ocean recreation days for the 34 million state residents in 2000 (Kildow and Colgan 2005 – see Table G.6 Appendix G). If BC had half the per capita participation rates as California, this still would amount to close to 30 million ocean recreation days for the province's 4.1 million residents. Ocean activities are an important recreation choice for British Columbians.

Data Adjustments & Assumptions. The key assumptions underlying the revenue estimates are given in Table G.5, Appendix G. We had to estimate the share of tourist expenditures, other than angling, cruising and ferries, that is ocean-related. BC Tourism only estimates overnight tourists and their expenditures.

Ocean recreation spending in 2005 is an estimated $3.8 billion - $3.0 billion by tourists and $0.8 by non-tourists e.g., Vancouver residents boating, windsurfing in English Bay (Appendix G). The $3.0 billion marine spending by tourists represents 22% of the $13.8 total tourism spending. As a point of comparison, we note the following marine tourism shares of total tourism spending in other jurisdictions - 35% Australia (Allen Consulting Group 2004), 28% California (Kildow & Colgan 2005), 25% UK (Pugh & Skinner 2002) and 18% Newfoundland (Government of Newfoundland & Labrador 2005). Our 22% share appears reasonable in comparison to these figures.

Table 8: BC Ocean-Related Recreation Economic Impacts

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Sales Value $ millions				
Saltwater Angling	550	580	610	642
Cruise Ship Spending	270	270	270	270
Ferries	392	404	433	446
Other	2,139	2,143	2,297	2,433
	3,351	3,397	3,610	3,791
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions	1,610	1,630	1,740	1,820
Labour Income $ millions	1,080	1,100	1,170	1,220
Employment PYs	28,500	28,800	30,100	32,200
Indirect Impacts				
GDP $ millions	920	930	980	1,030
Labour Income $ millions	580	580	620	650
Employment PYs	14,600	14,700	15,700	16,500
Induced Impacts				
GDP $ millions	660	670	710	750
Labour Income $ millions	400	400	430	450
Employment PYs	10,800	10,800	11,200	11,500
Total Impacts				
GDP $ millions	3,190	3,230	3,430	3,600
Labour Income $ millions	2,060	2,080	2,220	2,320
Employment PYs	53,900	54,300	57,000	60,200

Source: Gross Output - Appendix G.
Impact Multipliers - Appendix M.

Regional Employment. The ocean recreation sector creates employment in a variety of coastal communities. We estimate the regional distribution of employment to be: 10% North, 50% Vancouver Island, and 40% Lower Mainland.

Economic Impacts. The marine recreation or leisure sector in BC had 2005 revenues of $3.8 billion, contributed $1.8 million to provincial GDP and $1.2 billion to provincial Labour Income, and employed 32,200 people on a person-year basis.

3.7 Ocean Transport

Definition. The BC ocean transport industry involves the shipping of freight plus the wide variety of services required to support the shipping activities e.g., ports, tugboats, pilotage etc (but ferry services are treated as part of the ocean recreation sector).

The ocean transport sector, for this study, also includes a wide variety of ancillary services such as import/export, freight forwarding, maritime law, bunker fuel sales, marine engineering and others. We have also included the important British Columbia supplier role for cruise ships operating from BC ports (the Alaska cruise ships are foreign-flagged so that their direct employment, capital returns etc are not considered part of BC impacts).

The ocean transport sector then includes:

- shipping and support activities to shipping e.g., pilotage, tugs
- cruise ship suppliers, and
- other services e.g., ship chandlery, maritime law

Activities & Outputs. Over 70 ports along the coast handle in excess of 120 million tonnes of domestic and international marine cargo annually. The six port authorities - Vancouver, Fraser River, North Fraser, Prince Rupert, Nanaimo and Port Alberni - handle in excess of 75% of the total. The cargo traffic includes a wide variety of bulk, break bulk and container traffic e.g., grains, forest products, minerals, coal, seafood, automobiles etc. The Vancouver Port is by far the largest with over half the provincial traffic total (Figure 3). The network of ports is also important for coastal deliveries of goods to a variety of communities.

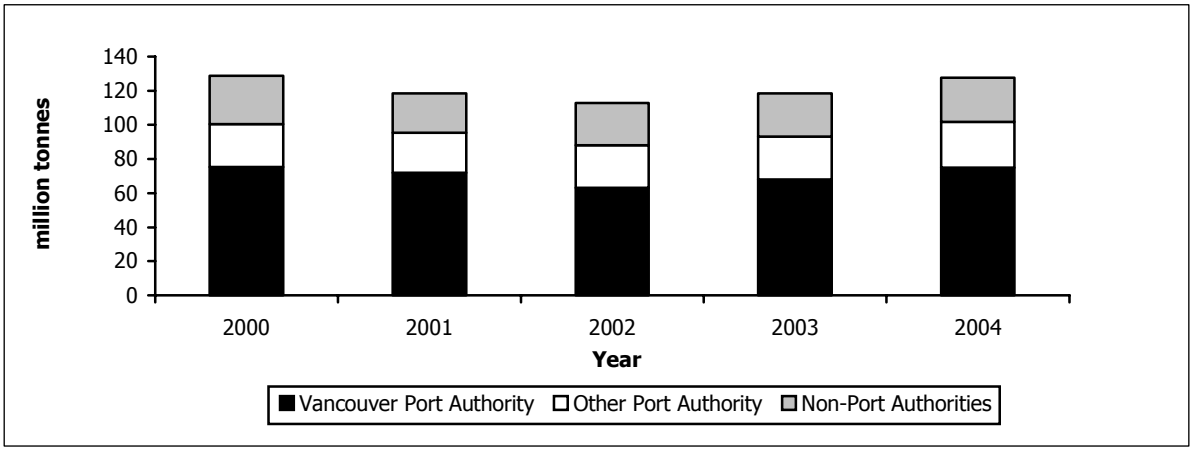
Tugboat and barge operations are critical to a wide variety of industries, in particular the forest industry. The vast majority of tugs involved in forest operations are third party contractors and are therefore included in the ocean transport sector.

Data Adjustment & Assumptions. There is very little data available from Statistics Canada as to the revenue base of the ocean transport sector in BC - data are suppressed for provinces in publications due to confidentiality concerns.

The LECG study (2004) did have a 2000 revenue estimate of shipping (inc. ferries) plus support services, essentially NAICS categories 483 and 4883 - of $1,959 million. We subtracted a BC Ferries revenue figure of $365 to come to a 2000 revenue estimate excluding ferry operations of $1.6 billion - we then escalated this figure to the year 2005 based on growth in the Canadian water transport sector.

Figure 3: BC Ocean Transport Volumes and Revenues

A. BC Port Cargo Traffic Volumes



Source: Transport Canada and Appendix H.

Table 9: BC Ocean Transport Economic Impacts

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Sales Value $ millions				
Shipping & Support Activities	1,800	1,900	2,000	2,100
Cruise Ship Suppliers	410	390	390	390
Other Services	720	760	800	840
	2,930	3,050	3,190	3,330
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions	1,330	1,380	1,450	1,510
Labour Income $ millions	1,040	1,080	1,130	1,180
Employment PYs	19,400	19,800	20,200	20,700
Indirect Impacts				
GDP $ millions	850	880	920	960
Labour Income $ millions	590	610	640	670
Employment PYs	14,100	14,400	14,700	15,100
Induced Impacts				
GDP $ millions	650	680	710	740
Labour Income $ millions	390	410	420	440
Employment PYs	10,600	10,800	11,100	11,400
Total Impacts				
GDP $ millions	2,830	2,940	3,080	3,210
Labour Income $ millions	2,020	2,100	2,190	2,290
Employment PYs	44,100	45,000	46,000	47,200

Source: Gross Output - Shipping & Support: LECG (2004) escalated at rate of growth for CDN water transport output.
- Cruise Ship Suppliers: BREA (2003) estimates adjusted for changes in passenger volume.
Impact Multipliers - Appendix M.

The Business Research & Economic Advisors (BREA) 2004 study provided a figure of $390 million in 2003 as expenditures in BC for outfitting cruise lines with goods and services (cruise passenger and crew spending was included under Ocean Recreation in Section 3.6). We then modified this for other years to reflect changes in passenger volumes (Table 9) and general inflation.

The initial InterVISTAS (2001) study outlined in detail the variety of related businesses tied to Vancouver Port operations e.g., businesses such as maritime law, import/export, shipping agents etc. InterVISTAS data suggest that there are about 40 extra related person-years of employment for every 100 person-years in shipping, pilotage, tug operations, etc. Another 20 extra person-years per hundred in trucking (and still many more in rail operations) are also related to the initial 100 person-years - see Table H.5, Appendix H.

For this study, we conservatively assign 40% additional activity over and above the base shipping and port operations to account for these related, marine-dependent services (we do not include any trucking or rail activity).

Regional Employment. Greater Vancouver is the hub of provincial shipping activity. The 2001 Census had the following regional distribution of Deep Sea Transport plus Support Activities for Water Transport: 4% North, 33% Vancouver Island and 63% Lower Mainland.

Economic Impacts. The direct economic impacts of Ocean Transport, as defined for this study, are given in Table 9. These figures are substantially higher than previous estimates such as RASCL (2003) and LECG (2004) due to the inclusion of provisioning cruise ships outfitting and related ocean transport services.

We note that Statistics Canada, in a pilot exercise, has developed a Canadian Transportation Satellite Account (CTSA) – involving both "for-hire" transportation industries, such as Water Transport and Support Services, and "own account" transportation service commodities e.g., tugboat and water taxis operated by a forest, mining or other company (Transport Canada, "Transportation in Canada – Annual Report", 2005 p. 13-14). Statistics Canada found that the "own account" activity, not traditionally considered part of Ocean Transport, exceeded the "for hire" component of Ocean Transport nationally. This implies that traditional approaches to measuring Ocean Transport economic activity can result in severe underestimates.

3.8 Other Ocean Sectors

There are many other sectors in the BC economy that are dependent on the ocean environment. However, most of these sectors will be addressed implicitly in the analysis of indirect supplier impacts to follow in Section 5. For example, many sectors have active industry associations. These associations include: the BC Seafood Alliance, the BC Salmon Farmers Association, the BC Shellfish Growers Association, the Sport Fishing Institute, the Chamber of Shipping, the Council of Marine Carriers, the Northwest Cruise Ship Association, the Forest Council of BC, the Council of Tourism Associations (COTA), the BC Yacht Building Association and a myriad of others.

These associations receive funding from two main sources: 1) levies on members, and 2) government grants. These two sources of funds in turn comprise expenditures by parent private and public sector entities - and the impacts of these expenditures on the economy are included in the forthcoming analysis of indirect impacts (see Section 5).

4.0 The BC Ocean Economy – Public & Non-Government Sectors

Many public (government) and non-government sector activities are tied to the promotion and regulation of ocean-based business activities, ocean-related education and research, and ocean environmental stewardship. This includes the work of federal and provincial governments, academic and research institutions, and environmental non-government organizations (ENGOs).

For this study, special surveys and/or interviews were conducted with public sector representatives because data were not available from Statistics Canada or BC Stats at the level of detail required. A special effort was made to have these representatives isolate the marine component of their expenditures rather than to arbitrarily allocate the total budgets of these organizations to the ocean.

The surveys of federal and provincial agencies, universities and research institutions, and ENGOs represent a considerable improvement over past efforts to measure the public and non-government sector components of the ocean economy in Canada.

4.1 Federal Government

Activities. The Department of *Fisheries and Oceans (DFO)* has the lead oceans role and is responsible for co-ordinating federal policies and programs related to the oceans. DFO operates the Canadian Coast Guard, undertakes extensive marine science and fisheries management activities, conducts policy planning, and operates two major research institutes – the Pacific Biological Station in Nanaimo and the Institute for Ocean Sciences in Sidney.

The *Department of National Defence (DND)* operates the CFB Esquimalt naval facility. Facility staff undertake sovereignty patrols, security operations, search and rescue, and naval exercises as well as operating a major engineering/maintenance naval shipyard.

Transport Canada's direct involvement in marine activities decreased substantially after the devolution of port operations to Port Authorities across Canada in the late 1990s. There are six such authorities in BC. Nevertheless, the Department is still involved in the regulation, inspection, and certification of ships and boats for both Canadian and foreign-flagged vessels. It also subsidizes coastal ferry operations in BC through a direct grant.

These three departments traditionally have comprised 85-90% of federal government marine-related expenditures in the province. Other departments also play an ocean sector role, including:

- *Service Canada (formerly HRDC)* – runs a special Employment Insurance program for commercial fishermen (in the 1998 period the Department spent significant monies on the Pacific Fisheries Restructuring and Adjustment Program, a program now lapsed)
- *Western Economic Diversification (WD)* – provides grants for marine businesses and business assistance analyses e.g., cruise ship and port developments
- *Parks Canada* – operates three national parks along the Pacific Coast in BC (Pacific Rim National Park, Gwaii Haanas National Park Reserve and Haida Heritage Site, Gulf Islands National Park Reserve) which have a direct or indirect connection with the adjacent ocean; Parks Canada reports to the Minister of the Environment
- *Environment Canada* – delivers science and programming related to conservation and protection of ecosystems and species, marine pollution prevention and remediation, weather and environmental prediction, and environmental assessment

Table 10: Federal Government Ocean-Related Expenditures in BC

	$ millions			
	2002	2003	2004	2005
Federal Departments				
CDN Food Inspection Agency	2	3	3	3
DFO	260	238	257	258
DND	384	388	416	427
Environment Canada	6	7	6	6
NRCan	1	1	2	2
Parks Canada	11	12	13	13
Service Canada (formerly HRDC)	36	37	36	33
Transport Canada	28	28	38	29
WD	2	4	3	35
NSERC & SCHRC Grants etc.	3	4	4	5
Other	39	38	41	43
Total	772	760	819	854

Source: Departmental representatives (see material in Appendix I for individual departments).

Notes: 1. DFO expenditures exclude freshwater component & capture only 50% of SEP-related expenditures, DND expenditures exclude activity related to other branches of the Armed Forces e.g., airbase of CFB Comox.

2. Service Canada expenditures are special Employment Insurance (EI) payments to fishermen.

3. Transport Canada expenditures are primarily the federal subsidy to BC Ferries (a small share of total Canadian marine expenditures by Transport Canada have been included as well).

4. Excludes capital expenditures.

5. Supplementary Labour Income & Benefits estimated as 20% of Wages & Salaries.

6. "other" estimated as 5% of total.

7. The $35 million WD expenditure in 2005/06 includes $30 million for the Prince Rupert Container Terminal Development.

Table 11: Federal Government Ocean-Related Economic Impacts

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Expenditures $ millions				
Subsidies/Transfers[a]	60	61	60	58
Other	712	699	759	796
	772	760	819	854
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions	530	535	555	580
Labour Income $ millions	530	535	555	580
Employment person-years	6,870	6,880	6,770	7,010
Indirect Impacts				
GDP $ millions	85	84	91	96
Labour Income $ millions	64	63	68	72
Employment person-years	1,570	1,540	1,640	1,680
Induced Impacts				
GDP $ millions	240	240	250	260
Labour Income $ millions	145	145	150	155
Employment person-years	3,880	3,830	3,910	4,010
Total Impacts				
GDP $ millions	855	859	896	936
Labour Income $ millions	739	743	773	807
Employment person-years	12,320	12,250	12,320	12,700

a BC Ferries subsidy plus special Employment Insurance payments to fishermen.

Source: Expenditures - survey of federal government departments.
Impact Multipliers - Appendix M.

- *Agriculture and Agri-Food Canada (AAFC)* – delivers a seafood inspection program under the Canadian Food Inspection Agency
- *Natural Resources Canada (NRCan)* – conducts scientific and economic analysis of potential offshore energy and mineral resources and operates Geomatics Canada

In addition, the *Natural Science and Engineering Research Council of Canada (NSERC)* and the *Social Sciences and Humanities Research Council of Canada (SSHRC)* support scholarships, fellowships and prizes, research chairs, and targeted research at BC post secondary institutions.

Expenditures. Table 10 displays estimated ocean-related expenditures of various federal government departments (see Appendix 1 for further details). The 2005 ocean expenditures by all federal departments were an estimated $854 million.

Economic Impacts. The federal government economic impacts are given in Table 11.

4.2 Provincial Government

Activities. The BC government contributes to the ocean sector economy through its primary jurisdiction over provincial resources and shared responsibilities for commercial fisheries and other marine resources. Areas of exclusive provincial jurisdiction include the seabed of the Strait of Georgia, and the seabed within the "jaws of land". The Province has the authority to issue tenures for temporary and permanent uses on Crown foreshore and seabed, and it regulates discharges to the ocean, aquaculture operations, and designates protected areas.

As the lead agency for aquaculture in BC, the *Ministry of Agriculture and Lands* (MAL) develops policy, issues aquaculture licences, conducts compliance reviews of site management plans, inspects existing and proposed sites, and collects facility reporting data, among other duties. MAL's Integrated Land Management Bureau (ILMB) created in 2005 leads marine and coastal zone planning for the province.

The *Ministry of Economic Development* (MED) supports some marine-related projects and policies through its Economic Competitiveness Division. Funding in the last several years has gone to marine museum expansion, policy development and feasibility studies (e.g., for BC ports, terminal facilities), and various capital projects and assessments funded provincially or with the federal government (e.g., cruise ship terminals, public wharves).

The *Ministry of Energy, Mines and Petroleum Resource's* (MEMPR's) Offshore Oil and Gas Branch was established in May 2003 to help develop BC's offshore resources in a scientifically sound and environmentally responsible manner. Recently, the Ministry's Alternative Energy Policy Branch has turned its attention to ocean (wave, wind, and tidal) energy, given the growing interest in developing BC's resource potential. In 2005/06, funding went to monitoring equipment for the Race Rocks tidal energy demonstration and work continues with ILMB on a Crown land tenure policy for ocean energy projects.

The *Ministry of Environment's (*MOE's*)* Ocean and Marine Fisheries Division was created in June 2005. The new Division brought together the commercial fisheries and seafood development responsibilities formerly under the Ministry of Agriculture, Food and Fisheries (now MAL) with a greater focus on coordinating BC's diverse interests in marine resources. Provincial work on marine fisheries and seafood development has included support for the Pacific Salmon Forum, a program to reduce discards in groundfish fisheries, marketing of BC seafood at international trade fairs, and major reports on seafood traceability and sustainability.

Elsewhere in the Ministry, there are ocean-related activities underway, including the regulation of finfish aquaculture waste, emergency preparedness for marine oil spills, the development and monitoring of coastal environmental indicators, and the continuing development and management of a provincial marine protected area system. Key oceans programs include leading the development of provincial oceans interests and objectives, creating collaborative provincial-federal resource management strategies, and developing shared governance frameworks.

The *Ministry of Tourism, Sport and the Arts* (MTSA) is implementing a program to double tourism revenues in BC. Recent ocean-focused activities have included development work on the cruise ship industry, the facilitation of tenure applications for marine resorts and marine-based adventure tourism (e.g., guided sea kayaking, bear viewing), a marine trail strategy, an angler market development plan, and research and data analysis on marine tourism and recreation.

As the Crown agency responsible for tourism marketing, *Tourism BC* is involved in a number of marine-focused initiatives, including the promotion of tidal angling, coastal cruises, and marine adventure tourism, as well as research and tracking for key business sectors (e.g., sea kayaking, scuba diving, nature-based commercial tourism). Moreover, much of its general marketing and promotion of specific destinations, including Vancouver and Victoria, features the ocean environment – for example, whale viewing and storm watching – in its images and branding.

The Marine Branch of the *Ministry of Transportation* (MOT*)* oversees the coastal ferry services contract between the Province and the now independently operated British Columbia Ferry Corporation (BC Ferries).

BC Hydro spent $16 million over 1999 to 2003 on a variety of Water Use Plans (WUPs) associated with hydroelectric developments - WUPs are plans to increase water flows to protect fish stocks e.g., Cheakamus, Campbell River, Puntledge River. BC Hydro also spent $1-2 million annually on the fish components of the Bridge River Compensation Program (50% of WUP and compensation program dollars are allocated to the ocean sector).

The *BC Innovation Council* is a Crown Corporation created in October 2004 (from a merger between the Innovation and Science Council of BC and the Advanced Systems Institute of BC) to accelerate science and technology-based economic development. Key ocean initiatives include sector development activities in aquaculture and fisheries science, ocean energy (including the Ocean Renewable Energy Group or OREG), ocean and maritime engineering, maritime and port security technologies and ocean observing systems technologies.

Expenditures. Ocean-related expenditures for these provincial ministries and agencies are presented in Table 12 (see details in Appendix J). Total provincial government expenditures were $153 million in 2005.

Economic Impacts. The economic impacts for the provincial government are shown in Table 13.

The bulk of provincial expenditures is the BC Ferries subsidy, which does not create GDP, Wages, and Employment. That explains why the impacts are relatively modest. (The subsidy is included, however, in the GDP calculation for BC Ferries operations as part of the Ocean Recreation sector – see Section 3.6).

4.3 University and Research Institutions

Several major universities, colleges, and research organizations were contacted to gather data for this study. Of these, two (the University of Northern British Columbia and Royal Roads University in Victoria) indicated that their marine-related expenditures were not large.

Table 12: BC Provincial Government Ocean Sector Expenditures

	$ millions			
	2002/03	2003/04	2004/05	2005/06
Provincial Ministries/Agencies				
Ministry of Agriculture and Lands	8	8	8	11
Ministry of Economic Development	<1	<1	11	6
Ministry of Energy, Mines and Petroleum Resources	1	4	3	3
Ministry of Environment	2	3	2	5
Ministry of Tourism, Sport and the Arts	~1	~1	1	1
Ministry of Transportation	74	106	107	108
BC Hydro	~2	~2	~1	~1
BC Innovation Council	<1	<1	<1	<1
Tourism BC	~10	~10	~10	~10
Other	5	7	8	8
Total	103	141	151	153

Source: Survey/interviews with Ministry and agency officials.

Notes: 1. Expenditures for the Ministry of Agriculture and Lands include marine fisheries and seafood development prior to June 2005 (now with the Ministry of Environment).

2. Assumes an allocation of 20% of Tourism BC's total expenditures to the marine sector, to cover general and destination tourism marketing as well as marine-focused promotion (the 20% is approximately the share that marine tourism comprises of total tourism in BC).

3. BC Ferries entered into an agreement with the province in April 2003 to provide ferry services that would not be commercially viable under the current regulated rate structure. The Company provides agreed ferry levels in exchange for fees - the figures provided are the level of this fee/subsidy (prior to 2003/04 the entity received a fuel subsidy).

4. "other" estimated as 5% of total.

5. Supplementary Labour Income estimated as 20% of Wages & Salaries.

Table 13: Provincial Government Ocean-Related Economic Impacts

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Expenditures $ millions				
Subsidies/Transfers[a]	74	106	107	108
Other	29	35	44	45
	103	141	151	153
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions	20	25	31	32
Labour Income $ millions	20	25	31	32
Employment person-years	300	350	430	430
Indirect Impacts				
GDP $ millions	4	5	7	7
Labour Income $ millions	3	4	4	5
Employment person-years	75	90	110	110
Induced Impacts				
GDP $ millions	9	11	14	14
Labour Income $ millions	6	7	8	9
Employment person-years	150	180	220	220
Total Impacts				
GDP $ millions	33	41	52	53
Labour Income $ millions	29	36	43	46
Employment person-years	525	620	760	760

a Provincial subsidy to BC Ferries.

Source: Expenditures - survey of provincial government departments.
Impact Multipliers - Appendix M.

Activities. The *British Columbia Institute of Technology's* School of Transportation provides training in navigation, marine engineering, nautical sciences, seamanship, and maritime security. Its Pacific Marine Training Campus in North Vancouver includes laboratories, tanks, and simulators to support this training.

Malaspina University-College in Nanaimo offers training for fisheries, aquaculture, and resource management technicians and prepares undergraduate students for graduate degrees in marine sciences. Recent research has been focused in areas ranging from the detection and quantification of shellfish toxins to succession in kelp forest communities. There are three marine-related research institutions affiliated with Malaspina and/or located on the campus:

- Centre for Coastal Health – an independent, non-profit organization investigating the interactions of human, animal, and environmental health
- Centre for Shellfish Research – engaged in research and development, training, and technology transfer for the shelffish aquaculture industry
- Institute for Coastal Research – an interdisciplinary research organization exploring the physical, ecological, and social dynamics of the BC Coast

Among their recent activities, these research centres have been involved in West Nile and avian flu surveillance, shellfish aquaculture research and training for First Nations, and the development of an aquaculture web portal.

Simon Fraser University takes part in marine education and research through its Biological Sciences Department. In 2005, the Tom Buell Chair in Aquatic Conservation was established, with an initial focus on salmon species and their ecosystems. SFU's School for Resource and Environmental Management (SREM), through the Fisheries Science and Management Research Group, conducts research on marine fisheries and related areas, such as marine mammals, invertebrates, and their habitats. Recent expenditures have included the purchase of a marine research vessel and a remotely operated underwater vehicle.

The Cooperative Resource Management Institute on the SFU Burnaby Campus brings together SFU faculty from various disciplines with DFO staff to provide research and policy advice on fisheries management issues. The Centre for Coastal Studies is coordinating the Linking Science and Local Knowledge node of the national Ocean Management Research Network funded by DFO and the Social Sciences and Humanities Research Council.

The University of British Columbia's ocean-related education and research is focused in several key areas. The Department of Earth and Ocean Sciences offers degrees in oceanography and carries out research in ocean physics, oceanographic measurement, and measuring biological activity in marine waters. The Civil Engineering Department's Coastal and Ocean Engineering Program is concerned with the design of offshore structures and the conduct of oil recovery and other offshore activities. The Zoology Department's Fisheries and Marine Biology Program has research interests ranging from the social interactions among marine mammals to the impact of human development and harvesting on marine ecosystems.

UBC's Fisheries Centre conducts research on the restoration of fisheries, conservation of aquatic life, and the rebuilding of marine ecosystems.

Table 14: BC University & Research Institution Ocean Sector Expenditures

	$ millions			
	2002/03	2003/04	2004/05	2005/06
University/College/Research Centre				
British Columbia Institute of Technology (BCIT)	2	2	2	2
Malaspina University College	1	6	3	4
Simon Fraser University (SFU)	2	2	2	3
University of British Columbia (UBC)	26	27	27	25
University of Victoria (UVic)	6	7	13	21
Bamfield Marine Sciences Centre	4	4	4	5
BC Centre for Aquatic Health Sciences	0	0	1	1
Total	41	48	52	60

Source: Survey/interviews with academic and research organization representatives.

Notes: 1. Supplementary Labour Income or Benefits estimated as 20% of Wages & Salaries.

2. The increase in 2003/04 for Malaspina College was tied to construction of a new building.

Table 15: BC University & Research Ocean-Related Economic Impacts

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Expenditures $ millions	41	48	52	60
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions	27	31	34	39
Labour Income $ millions	27	31	34	39
Employment person-years	275	310	330	370
Indirect Impacts				
GDP $ millions	6	7	8	9
Labour Income $ millions	3	4	4	5
Employment person-years	85	95	100	115
Induced Impacts				
GDP $ millions	12	14	15	17
Labour Income $ millions	7	8	9	10
Employment person-years	190	220	235	270
Total Impacts				
GDP $ millions	45	52	57	65
Labour Income $ millions	37	43	47	54
Employment person-years	550	625	665	755

Source: Expenditures - survey of educational institutions.
Impact Multipliers - Appendix M.

The *University of Victoria* has assembled one of the most extensive programs in ocean sciences and marine technologies. Marine education and research is distributed over various faculties and departments, with expertise in areas such as marine biology and microbiology, ocean physics, remote sensing, underwater acoustics, ocean and climate dynamics, earthquake studies, clean energy technologies, and marine protected areas. UVic has several marine-related research institutions including:

- BC Centre for Applied Remote Sensing, Modelling, and Simulation
- Canadian Centre for Climate Modelling and Analysis
- Canadian Institute for Climate Studies
- Canadian Marine Acoustic Remote Sensing Facility
- Centre for Earth and Ocean Research
- Institute for Integrated Energy Systems
- Marine Protected Areas Research Group
- Whale Research Laboratory
- Aquatic Research Group
- Boundary Layer Airflow and Sediment Transport Research Unit

Major programs in the last several years have included the NEPTUNE (North-East Pacific Time-series Undersea Networked Experiment) and VENUS (Victoria Experimental Network Under Sea) projects, global climate modelling, and technology development on the ROPOS (Remotely Operated Platform for Ocean Science) submersible. UVic is Canada's leader on the $300-million international NEPTUNE project to establish a high-tech underwater laboratory for monitoring ocean floor conditions from Vancouver Island to Oregon. The Centre for Earth and Ocean Research was also involved in the Coasts Under Stress program to examine the impacts of socio-economic restructuring on coastal communities and ecosystems.

The *Bamfield Marine Sciences Centre* in Barkley Sound is a non-profit educational and research organization funded by Western Canadian universities. Its major activities are university-level teaching, school and public education programs in the field, marine and coastal scientific research, and applied research and technology commercialization.

The new *BC Centre for Aquatic Health Sciences* in Campbell River conducts research into aquatic animal health, food safety, and environmental and welfare issues. Current projects include vaccine development, fish health assessments, and First Nations training in sea lice and environmental monitoring.

Expenditures. Marine-related expenditures for academic and research institutions are shown in Table 14. The estimated total in 2005 was $60 million.

Economic Impacts. The estimated economic direct impacts for these institutions are given in Table 15.

4.4 Environmental Organizations

There are numerous Environmental Non-Government Organizations (ENGOs) involved in marine-related environmental education, research, and stewardship in BC. These include larger ENGOs that are either completely focused on the ocean or have significant marine programs underway. In addition, many smaller organizations along the Coast deliver important "on-the-ground" environmental services for their local areas, often primarily through volunteers.

Table 16: ENGO Ocean-Related Expenditures & Activities in BC

	2002	2003	2004	2005
ENGO Budgets (14 organizations) $ millions				
Ocean-Related	20	24	26	27
Non-Ocean	7	10	10	12
Total	27	34	36	39

ENGO	Ocean Activities
1. CDN Parks & Wilderness Society	education & communication on marine conservation
2. David Suzuki Foundation	sustainable aquaculture & marine fisheries, wild salmon conservation, marine use planning & MPAs
3. Ducks Unlimited	Crown foreshore habitat protection, database of estuaries, waterfowl surveys & research, land acquisition, policy development
4. Ecotrust Canada	aquaculture & marine fisheries, fisheries licence bank
5. Galiano Conservation Society	coastal & marine education, MPA development
6. Georgia Strait Alliance	marine water pollution, wildlife & habitat protection, green boating, sustainable salmon aquaculture, marine stewardship
7. Living Oceans Society	marine planning & MPA development, marine mapping & analysis, opposition to offshore oil and gas & tanker traffic, sustainable aquaculture & fisheries
8. Sea Change Marine Conservation	marine education, conservation & restoration
9. Sierra Club of Canada	sustainable fisheries & seafood
10. Straitwatch	vessel monitoring in marine mammal areas
11. TBuck Suzuki Foundation	education on the environmental impacts on fish & fish habitat
12. Vancouver Aquarium	aquarium, education & marine mammal rescues
13. Veins of Life	marine mammal monitoring & beach cleanups
14. World Fisheries Trust	sustainable fisheries & co-management, conservation of marine biodiversity & equitable use

Source: Survey of Environmental Non-Government Organizations (ENGOs).

Note: Covers only those ENGOS contacted that were able to provide expenditure information.

Table 17: BC ENGO Ocean-Related Economic Impacts

	2002	2003	2004	2005
A. GROSS OUTPUT				
Direct Expenditures $ millions	20	24	26	27
B. ECONOMIC IMPACTS				
Direct Impacts				
GDP $ millions	11	13	15	15
Labour Income $ millions	11	13	15	15
Employment person-years	290	340	360	360
Indirect Impacts				
GDP $ millions	6	7	8	8
Labour Income $ millions	4	5	5	5
Employment person-years	100	120	125	130
Induced Impacts				
GDP $ millions	6	7	8	8
Labour Income $ millions	4	4	5	5
Employment person-years	100	120	130	120
Total Impacts				
GDP $ millions	23	27	31	31
Labour Income $ millions	19	22	25	25
Employment person-years	490	580	615	610

Source: Expenditures - survey of ENGOs.
Impact Multipliers - Appendix M.

ENGOs are an off-neglected group - but they should be considered part of the oceans sector and, for this reason, we launched a special interview/survey program to profile their activities and economic contribution.

It was not possible to conduct a thorough ENGO survey for this study. Approximately 40 organizations were contacted. Of these, some were no longer active or were just escalating marine-related work (e.g., Greenpeace Canada). Others had difficulty isolating the ocean component of their expenditures or indicated that the majority of their relevant efforts were being done by volunteers whose contribution was not captured in financial records (e.g., the Federation of BC Naturalists). And many other groups contacted did not respond or refused participation in the survey.

Fourteen (14) organizations were interviewed and provided information on their ocean-related spending and employment.

Early on, several respondents noted that the narrow focus on ocean environmental work overlooked the importance of inland activities, such as ensuring freshwater quality and protecting fish and wildlife habitat, on the marine environment. For this reason, the survey was extended to include some of the major organizations engaged in streamkeeping and land and estuary conservation (but also with a strong marine element).

Activities. The ENGOs surveyed for this study are active in a number of areas of ocean-related education, lobbying, research, and conservation, including (Table 16):

- sustainable marine fisheries
- sustainable aquaculture
- the protection and restoration of fish and wildlife habitat and marine biodiversity
- marine use planning, including Marine Protected Areas (MPAs)
- mapping, surveying, monitoring, and biological research (e.g., marine and estuary habitat, fish populations, marine mammals, waterfowl)
- opposition to offshore oil and gas development and coastal tanker traffic
- marine pollution from sewage, urban runoff, industrial effluents, and other sources
- marine-related public environmental education and school programs

The locally based groups surveyed were engaged in various activities ranging from ocean habitat tours to beach cleanups to habitat mapping and restoration (e.g., salt marshes, eelgrass beds). On some of the issues noted above, ENGOs have joined forces in an alliance to better pursue their goals (e.g., the Coastal Alliance for Aquaculture Reform, Marine Conservation Caucus, Oil Free Coast Alliance).

The *Vancouver Aquarium's Marine Science Centre* is a self-supporting, non-profit organization that provides marine education and research. Ongoing activities are its exhibits and displays of BC ocean life, research and conservation initiatives for coastal species (including marine mammal rescue and rehabilitation), and education programs targeted at school children. We recognize that the Aquarium is not strictly an ENGO – it has been included here as this category, of those considered in this study, is the most closely aligned.

Expenditures. The 2005 total for marine-related spending was about $27 million. The figures have been aggregated across all the organizations shown for confidentiality reasons (Table 16).

Economic Impacts. The economic impacts for the 14 ENGOS providing data are given in Table 17:

The above figures underestimate the role of environmental organizations in marine matters. For example, there are thousands of volunteers who spend tens of thousands of hours annually on beached bird programs, estuary cleanups, and the like. In addition, many volunteers with professional backgrounds write letters, analyze issues, etc. This valuable work is not reflected in the market-based economic impact estimates above.

5.0 Total Ocean Sector Impacts Today and in the Future

This section synthesizes and positions the economic analysis of private sector, public sector, and non-government sector components of the ocean economy from previous sections. Figure 4 summarizes the results. Table 18 at the end of the section presents the results for individual subsectors.

5.1 Direct and Total Ocean Sector Impacts

The direct impacts of the ocean sector in 2005 were: $11.6 billion in Gross Output, $5.7 billion in Gross Domestic Product (GDP), $4.2 billion in Labour Income, and 84,400 person-years of employment (Figure 4). Note that the direct GDP of $5.7 billion is $11.6 billion of Gross Output less $5.9 billion in Intermediate Inputs.

Figure 4 also displays the total economic impacts from ocean sector activities - the direct industry impacts above plus the spinoff or "multiplier" indirect supplier impacts and the induced consumer respending impacts. These backward linkages to suppliers and wage respending impacts essentially double the direct impact measures for 2005 – total impacts of $11.1 billion GDP, $7.6 billion Labour Income and 167,800 person-years of employment.

There are significant differences among subsectors not only in the size of each sector but in the labour intensity and the importance of spinoff effects (see Table 18). We note the following:

- the public sector, in total, has direct Labour Income comprising over half of sector revenues whereas the business sector has direct Labour Income at one-third of revenues overall
- public sector direct wages per person-year (PY) are higher than business sector direct wages per person-year - the seafood and ocean recreation sectors have the lowest wages of all business sectors considered
- forestry and construction have relatively low direct impacts but higher indirect and induced impacts i.e., higher multiplier impacts
- indirect and induced employment generally is lower paying than direct ocean industry employment

Ocean-related economic activity is concentrated in the four private sectors – seafood, ocean high tech, ocean recreation and ports & shipping – and the federal government public sector. These five sectors comprise over 90% of the ocean sector total (Figure 4). Nevertheless, all ocean-related sectors are important as they contribute to a diversified economy throughout Coastal BC.

Our analysis suggests that the ocean economy - direct plus spinoff effects - comprises 7-8% of the total BC economy (see Figure 4).

Finally we note that the economic contribution of the ocean to the BC economy in 2005 is more than double the previous estimate for the year 2000 e.g., direct GDP estimate of $5.7 billion in this study versus $2.8 billion in the previous study (Table 1, Section 2). About 25 to 30% of the difference may be attributable to overall growth in the economy over the intervening five years – but the vast majority of the difference reflects enhanced sector coverage and procedures implemented for this study.

Figure 4: BC Ocean Sector and the BC Economy

A. BC Ocean Sector Impact Summary 2005

	2005 Impacts			
	Direct	**Indirect**	**Induced**	**Total**
Output $ millions	11,617	NA	NA	NA
GDP $ millions	5,727	2,896	2,434	11,057
Labour Income $ millions	4,174	1,915	1,461	7,550
Employment PYs	84,430	45,875	37,500	167,805

B. Ocean Subsector Shares of Total BC Impacts 2005

		2005 Industry Shares of Total Impacts		
		GDP	**Labour Income**	**Employment**
Private Sector	- Seafood	.12	.11	.13
	- Forestry	.02	.02	.02
	- Ship & Boat Building	.03	.03	.03
	- Ocean Construction	.02	.02	.02
	- Ocean High Tech	.09	.09	.08
	- Ocean Recreation	.33	.31	.36
	- Ocean Transport	.29	.30	.28
Public Sector	- Federal Government	.08	.10	.07
	- Provincial Government	.01	.01	.01
Non-Government Sector	- Universities & Research	.01	.01	<.01
	- ENGOs	<.01	<.01	<.01
All Ocean Sectors		1.00	1.00	1.00

C. Ocean Sector Share of BC Economy 2005

	2005 Ocean Share of BC Economy					
	GDP		**Labour Income**		**Employment**	
Ocean Economy	$11.1 billion	7%	$7.6 billion	8%	167,805 PYs	8%
Other Sectors	143.8 billion	93%	90.6 billion	92%	1,962,695 PYs	92%
Total BC Economy	$154.9 billion		$98.2 billion		2,130,500 PYs	

Source: Ocean sector – Table 18
Total economy – BC Stats

5.2 Growth Potential

There are substantial opportunities for all private sector components of the BC ocean economy to grow. We anticipate the fastest growing subsectors over the next 10 to 20 years to be: ocean high tech, ocean recreation and ports & shipping. However, all economic sectors including ocean-based sectors could be affected by climate change.

British Columbia is taking a leadership position on several large scale ocean technology initiatives including the VENUS and NEPTUNE projects at the University of Victoria and the COINPacific (Cooperative Ocean Information Network) initiative which should spur business opportunities. In addition, the global market for ocean observation systems and other technology systems is growing faster than the economy at large (Douglas-Westwood 2006).

Ocean recreation activities by tourists and locals alike are expected to grow significantly with increases in disposable income, with increases in leisure/retirement time, and with increasing awareness of the ocean amenities of the province. The 2010 Winter Olympic Games will highlight the province as a world class tourist destination which has the potential to spur ocean-based recreation in future years.

There are substantial opportunities for increased volumes at BC ports with the buoyancy of East Asian economies and with major increases in public and private infrastructure investments occurring in BC e.g., federal and provincial "Pacific Gateway" investments, Prince Rupert terminal development, the Vancouver Port Authority's planned Terminal 2 project.

There is also growth potential in other ocean sectors. For example, the Kitimat Liquefied Natural Gas (LNG) project is poised to start construction.

Table 18: BC Ocean Sector Impact Summary

	2002				2003				2004				2005			
	Output	GDP	LI	EM	Output	GDP	LI	EM	Output	GDP	LI	EM	Output	GDP	LI	EM
DIRECT IMPACTS																
Private Sector																
Seafood	1,310	750	450	12,970	1,300	745	445	12,600	1,290	740	445	12,300	1,380	790	475	12,900
Forestry	269	100	60	960	256	90	58	930	308	118	59	910	283	108	60	910
Ship & Boat Bldg	378	165	131	2,520	422	186	148	2,740	380	168	134	2,410	398	175	139	2,490
Marine Construction	110	47	35	720	117	50	37	750	161	69	52	990	216	93	69	1,330
Ocean High Tech	925	465	300	5,010	995	500	320	5,280	1,050	530	340	5,450	1,125	565	365	5,730
Ocean Recreation	3,351	1,610	1,080	28,500	3,397	1,630	1,100	28,800	3,610	1,740	1,170	30,100	3,791	1,820	1,220	32,200
Ocean Transport	2,930	1,330	1,040	19,400	3,050	1,380	1,080	19,800	3,190	1,450	1,130	20,200	3,330	1,510	1,180	20,700
Subtotal	9,273	4,467	3,096	70,080	9,537	4,581	3,188	70,900	9,989	4,815	3,330	72,360	10,523	5,061	3,508	76,260
Public Sector																
Federal Gov't	772	530	530	6,870	760	535	535	6,880	819	555	555	6,770	854	580	580	7,010
Provincial Gov't	103	20	20	300	141	25	25	350	151	31	31	430	153	32	32	430
Subtotal	875	550	550	7,170	901	560	560	7,230	970	586	586	7,200	1,007	612	612	7,440
Non-Government Sector																
Universities & Research	41	27	27	275	48	31	31	310	52	34	34	330	60	39	39	370
ENGOs	20	11	11	290	24	13	13	340	26	15	15	360	27	15	15	360
Subtotal	61	38	38	565	72	44	44	650	78	49	49	690	87	54	54	730
TOTAL	10,209	5,055	3,684	77,815	10,510	5,185	3,792	78,780	11,037	5,450	3,965	80,250	11,617	5,727	4,174	84,430

	2002			2003			2004			2005		
	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM
INDIRECT IMPACTS												
Private Sector												
Seafood	240	170	4,680	230	170	4,550	230	170	4,430	250	180	4,640
Forestry	97	67	1,290	92	64	1,200	111	77	1,420	102	71	1,280
Ship & Boat Bldg	85	41	970	98	47	1,080	89	42	960	92	44	980
Marine Construction	34	22	560	36	23	590	50	32	790	67	43	1,040
Ocean High Tech	220	140	3,720	240	150	3,940	255	160	4,100	275	170	4,300
Ocean Recreation	920	580	14,600	930	580	14,700	980	620	15,700	1,030	650	16,500
Ocean Transport	850	590	14,100	880	610	14,400	920	640	14,700	960	670	15,100
Subtotal	2,446	1,610	39,920	2,506	1,644	40,460	2,635	1,741	42,100	2,776	1,828	43,840
Public Sector												
Federal Gov't	85	64	1,570	84	63	1,540	91	68	1,640	96	72	1,680
Provincial Gov't	4	3	75	5	4	90	7	4	110	7	5	110
Subtotal	89	67	1,645	89	67	1,630	98	72	1,750	103	77	1,790
Non-Government Sector												
Universities & Research	6	3	85	7	4	95	8	4	100	9	5	115
ENGOs	6	4	100	7	5	120	8	5	125	8	5	130
Subtotal	12	7	185	14	9	215	16	9	225	17	10	245
TOTAL	2,547	1,684	41,750	2,609	1,720	42,305	2,749	1,822	44,075	2,896	1,915	45,875

Table 18: BC Ocean Sector Impact Summary (continued)

	2002			2003			2004			2005		
	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM
INDUCED IMPACTS												
Private Sector												
Seafood	250	150	4,050	250	150	3,940	250	150	3,860	260	160	4,030
Forestry	51	30	810	49	29	780	54	33	850	52	31	840
Ship & Boat Bldg	69	41	1,120	78	47	1,250	70	42	1,100	73	44	1,130
Marine Construction	23	14	370	24	14	380	34	20	530	45	27	690
Ocean High Tech	175	105	2,870	190	110	3,010	200	120	3,140	215	130	3,290
Ocean Recreation	660	400	10,800	670	400	10,800	710	430	11,200	750	450	11,500
Ocean Transport	650	390	10,600	680	410	10,800	710	420	11,100	740	440	11,400
Subtotal	1,878	1,130	30,620	1,941	1,160	30,960	2,028	1,215	31,780	2,135	1,282	32,880
Public Sector												
Federal Gov't	240	145	3,880	240	145	3,830	250	150	3,910	260	155	4,010
Provincial Gov't	9	6	150	11	7	180	14	8	220	14	9	220
Subtotal	249	151	4,030	251	152	4,010	264	158	4,130	274	164	4,230
Non-Government Sector												
Universities & Research	12	7	190	14	8	220	15	9	235	17	10	270
ENGOs	6	4	100	7	4	120	8	5	130	8	5	120
Subtotal	18	11	290	21	12	340	23	14	365	25	15	390
TOTAL	2,145	1,292	34,940	2,213	1,324	35,310	2,315	1,387	36,275	2,434	1,461	37,500

	2002			2003			2004			2005		
	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM	GDP	LI	EM
TOTAL IMPACTS												
Private Sector												
Seafood	1,240	770	21,700	1,225	765	21,090	1,220	765	20,590	1,300	815	21,570
Forestry	248	157	3,060	231	151	2,910	283	169	3,180	262	162	3,030
Ship & Boat Bldg	319	213	4,610	362	242	5,070	327	218	4,470	340	227	4,600
Marine Construction	104	71	1,650	110	74	1,720	153	104	2,310	205	139	3,060
Ocean High Tech	860	545	11,600	930	580	12,230	985	620	12,690	1,055	665	13,320
Ocean Recreation	3,190	2,060	53,900	3,230	2,080	54,300	3,430	2,220	57,000	3,600	2,320	60,200
Ocean Transport	2,830	2,020	44,100	2,940	2,100	45,000	3,080	2,190	46,000	3,210	2,290	47,200
Subtotal	8,791	5,836	140,620	9,028	5,992	142,320	9,478	6,286	146,240	9,972	6,618	152,980
Public Sector												
Federal Gov't	855	739	12,320	859	743	12,250	896	773	12,320	936	807	12,700
Provincial Gov't	33	29	525	41	36	620	52	43	760	53	46	760
Subtotal	888	768	12,845	900	779	12,870	948	816	13,080	989	853	13,460
Non-Government Sector												
Universities & Research	45	37	550	52	43	625	57	47	665	65	54	755
ENGOs	23	19	490	27	22	580	31	25	615	31	25	610
Subtotal	68	56	1,040	79	65	1,205	88	72	1,280	96	79	1,365
TOTAL	9,747	6,660	154,505	10,007	6,836	156,395	10,514	7,174	160,600	11,057	7,550	167,805

Source: Sections 3 and 4.

Legend: Output - Gross Output/Revenues/Expenditures ($ millions). LI - Labour Income ($ millions).
GDP - Gross Domestic Product ($ millions). EM - Employment (Person-Years).

6.0 Potential Energy Sectors & Their Estimated Impacts

There are a variety of potential ocean sector activities that could contribute to the provincial economy in the future. These include ocean energy (offshore oil & gas, offshore wind, tidal and wave), marine plant harvesting and neutracuticals, and others.

In this section we examine three potential energy sectors: i) offshore oil & gas, ii) offshore wind farms, and iii) tidal and wave energy. A quantitative assessment is provided for offshore oil & gas and offshore wind farms as there is some information available on their resource potential and economics. Nevertheless, the following analysis should be considered illustrative and not a prediction. There are significant technical, economic, and regulatory uncertainties associated with these prospective developments.

The intent is to identify the broad magnitude of activity and economic benefits associated with these potential energy projects. All financial figures are expressed in constant undiscounted dollars.

As there is limited information available pertaining to wave and tidal energy, this potential sector is addressed in qualitative terms only.

6.1 Offshore Oil & Gas

Background. The Geological Survey of Canada suggests that there are substantial amounts of oil and gas in the Queen Charlotte Basin in the waters off Northern BC (Hannigan 2001). The Queen Charlotte Basin (QCB) is one of several basins offshore that have oil and gas potential (the other basins are the Winona, the Tofino, and the Georgia). The QC Basin appears to be the most promising and has had some exploration work. The QCB may contain 9.8 billion barrels (bbls) of oil and 26 trillion cubic feet (tcf) of gas. Therefore our analysis focuses on this basin.

Since 1972 there have been federal and provincial policy moratoria in place that effectively prohibit offshore oil and gas exploration and development. Any energy development in the BC offshore needs to consider and protect environmental sensitivity and marine productivity of the region.

There are substantial uncertainties in analyzing oil & gas potential. The most recent seismic survey in QC Basin was conducted in 1988 when the Geological Survey of Canada recorded 1,000 km of marine seismic data. Existing exploratory work is dated and does not reflect current technological advances. It is thus unknown as to how much oil & gas is potentially in place. The feasibility of extracting the resources, the potential time frame, the technology that may be used (including transportation) and the requirements that could be in place for environmental review, First Nations and community consultations, and other regulatory requirements are also significant sources of uncertainty. Moreover, uncertainty exists as to future prices for oil & gas which in turn depend on future energy supply and demand worldwide and on the availability and prices of energy substitutes.

Potential Production. A number of recent reports have addressed some aspects of the economics of potential oil & gas development and their impacts to the province (Scarfe 2003, Simon Fraser University 2004, GE Bridges 2004 a,b,c,d, Schofield and Sandhu 2005, Locke 2006). We have drawn on this work in developing an economic profile of potential offshore petroleum resource exploration, development and production and their potential impacts to BC.

Table 19: BC Illustrative Offshore Oil & Gas Economic Impacts

A. Oil Scenario - 1,615 million bbls worth $76.72 billion US lifetime
- construction cost of $9.4 billion US
- lifetime operating costs of $7.28 billion US, transport costs of $2.42 billion US

Lifetime Impacts	Construction Phase				Operations Phase				Total Project			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
GDP $ millions CDN	3,539	1,769	973	6,281	80,985	5,706	1,861	88,552	84,524	7,475	2,834	94,833
Labour Income $ millions CDN	1,327	1,106	584	3,017	2,141	2,511	1,116	5,768	3,468	3,617	1,700	8,785
Employment PYs	16,590	22,120	14,600	53,310	35,685	50,220	27,900	113,805	52,275	72,340	42,500	167,115

B. Gas Scenario - 6,060 bcf worth $32.72 billion US lifetime
- construction cost of $6.0 billion US
- lifetime operating costs of $5.1 billion US

Lifetime Impacts	Construction Phase				Operations Phase				Total Project			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
GDP $ millions CDN	2,259	1,129	621	4,009	33,999	3,000	1,128	38,127	36,258	4,129	1,749	42,136
Labour Income $ millions CDN	847	706	373	1,926	1,500	1,320	677	3,497	2,347	2,026	1,050	5,423
Employment PYs	10,590	14,120	9,320	34,030	25,000	26,400	16,920	68,320	35,590	40,520	26,240	102,350

C. Both Oil & Gas - 1,615 million bbls oil & 6,060 bcf gas worth $109.44 billion US lifetime
- construction costs of $15.4 billion US
- lifetime operating & transportation costs of $14.8 billion US

Lifetime Impacts	Construction Phase				Operations Phase				Total Project			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
GDP $ millions CDN	5,798	2,898	1,594	10,290	114,984	8,706	2,989	126,679	120,782	11,604	4,583	136,969
Labour Income $ millions CDN	2,174	1,812	957	4,943	3,641	3,831	1,793	9,265	5,815	5,643	2,750	14,208
Employment PYs	27,180	36,240	23,920	87,340	60,685	76,620	44,820	182,125	87,865	112,860	68,740	269,465

Source: Oil & gas scenarios - Wade Locke 2006 and Appendix K
Impact estimates - direct: Appendix K
- indirect & induced: impact coefficients derived from G.E. Bridges 2004 c and Statistics Canada
Exchange rate - assumed $1 CDN = $0.85 US
Dollars - all financial figures in 2006 undiscounted constant dollars

In particular, we rely on the Locke report for potential production levels, revenues and costs as it is the most recent and comprehensive in terms of oil and gas economics, and in fact is the benchmark reference used by BC Energy Mines & Petroleum Resources. The Locke report also is the only one of those listed above that estimates the amount of resources that are economic to extract, so-called "reserves", based on specific price, cost and target rate of return parameters.

The Locke analysis presents illustrative economic parameters and identifies reserves - at ten different price points and two different recovery factors - for each of oil and gas that yield an after-tax real rate of return of at least 12%. A general rule in the industry used to be that one third of the oil and two thirds of the gas was recoverable. Recent engineering advances such as horizontal drilling and re-injection of produced gas and water has led to improved recoveries.

In our analysis we have used the Locke results corresponding to:

- oil - $50 US/bbl price, 25% recovery factor, Terra Nova offshore Newfoundland technology/cost structure (24 years construction and operations)
- gas - $6 US/mcf price, 60% recovery factor, Sable Island offshore Nova Scotia technology/ cost structure (31 years construction and operations)

The analysis corresponds to the lower recovery rate scenarios for each of oil and gas. The prices selected lie in the range of long term post 2010 prices suggested by Locke, namely $40-$50 US/bbl for oil and $6-$7 US/mcf for gas. The $50 US price for oil is broadly consistent with a recent long term oil price forecast (GLG 2007).

These assumptions result in lifetime economic production of (see Locke 2006):

- oil - 1,615 millions bbls worth $77 billion US
- gas - 6,060 bcf worth $33 billion US

These amounts are about 25% of the in-place volumes suggested by the Geological Survey of Canada. The costs associated with construction and production are given in Appendix K.

Economic Impacts. The direct industry, indirect supplier, and induced consumer respending impacts of the illustrative oil and gas scenarios are summarized in Table 19. Development of the offshore oil and gas reserves, at the production levels postulated, confer lifetime economic impacts to the Province of $137 billion in provincial GDP, $14 billion in Wages & Benefits, and 269,500 person-years of employment over the construction and operations phases.

The bulk of the potential benefits occur during the on-going production phase rather than the construction phase. Additionally, the bulk of wage and employment impacts result from the indirect supplier and induced consumer/retail spending activity rather than directly in construction or operations. In contrast, over 85% of the contribution to provincial GDP is derived from direct industry activity, mainly the operation phase. These attributes reflect the capital intensity and the high income-earning potential of oil & gas sector developments. The distribution of earnings between the proponent and various levels of government is a matter of negotiation as to the royalty/tax regime.

Table 20: Illustrative Lifetime and Annual Impacts for Oil & Gas Development

A. Lifetime Oil & Gas Development Impacts to BC from Development of a Single Oil and a Single Gas Field

Lifetime Impacts	Lifetime Oil				Lifetime Gas			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
GDP $ millions CDN	84,524	7,475	2,834	94,833	36,258	4,129	1,749	42,136
Labour Income $ millions CDN	3,468	3,617	1,700	8,785	2,347	2,026	1,050	5,423
Employment PYs	52,275	72,340	42,500	167,115	35,590	40,520	26,240	102,350

B. Annual Oil & Gas Development Impacts to BC from a Single Oil and a Single Gas Field*

Annual Impacts	Annual Oil				Annual Gas			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
GDP $ millions CDN	3,522	311	118	3,951	1,170	133	56	1,359
Labour Income $ millions CDN	145	151	71	367	76	65	34	175
Employment PYs	2,180	3,015	1,770	6,965	1,150	1,305	845	3,300

** Lifetime impacts divided by 24 year for oil and 31 years for gas.*

Source: Derived from Table 19.

It is not appropriate to compare the potential lifetime impacts for offshore oil & gas development, such as Table 19, to the annual ongoing impacts of existing ocean sectors presented in Section 6. One could project existing ocean sector impacts into the future and compare these existing lump sum impacts to the aggregate impacts of Table 19. Alternately, one could convert the lifetime oil & gas developments to an annual stream. We chose the latter approach as it is simpler and 30 year forecasts of seafood, ocean transport and other ocean sector activities do not exist.

Table 20 presents such annual benefit stream from a single oil field and a single gas field and based on construction plus operation time lines of 24 years for oil and 31 years for gas - see Tables K.1 and K.2 respectively in Appendix F for timelines. It should be noted that Cook Inlet in Alaska, which is generally viewed as an analogue for QC Basin, has been in production since 1959 - today Cook Inlet has 7 producing oil fields and 17 producing gas fields with the most recent field placed in production in 2000 (Hite, 2005).

The estimated impacts on an annual basis are:

- oil - annual total impacts of $3,951 million GDP, $367 million Wages & Benefits, and 6,965 person-years of employment
- gas - annual total impacts of $1,359 million GDP, $175 million Wages & Benefits, and 3,300 person-years of employment

However, the annualized impacts for the oil & gas offshore sector are speculative having been derived from estimated revenue streams occurring in the distant future, which in turn are based on projections of production and prices. In contrast, the impacts for existing ocean sectors reflect current activity and revenues realized over the recent past. That is, potential oil & gas impacts, even after conversion to an annual basis, are not strictly comparable to existing ocean sector annual impacts for recent years.

As noted earlier, there are great uncertainties with development of the offshore oil & gas resources in BC. The assumptions, projections, and results should be viewed as illustrative of the economic potential rather than a prediction of that potential.

6.2 Offshore Wind Energy

Background. There is significant potential for wind farms in offshore areas in the Hecate Strait off the coasts of the Queen Charlotte Islands and Stephens and Porcher Islands (Garrad Hassan 2005). Mean annual wind speeds are in the range of 8.0 metres/second to 9.5 metres/second.

Offshore wind energy technology has achieved full commercial status in Europe (IEA 2005). Several projects are being proposed for the BC offshore. The 700 MW NaiKun Wind Project offshore in Hecate Strait is one of the most advanced in planning. BC Hydro held a two day wind energy workshop in 2005 at which time technical, price, transmission and other topics were addressed (BC Hydro 2005). The Province recently announced the formation of an "Innovative Clean Energy Fund" to help promising clean power technology projects succeed (EMPR 2007).

Potential Production. Potential capacity of 15,000 MW offshore has been identified (Garrad Hassan 2005). We assume, for illustrative purposes, that 10% of the above or 1,500 MW would be realized (this is the same assumption that Garrad Hassan made). We also assume a 40% capacity factor which is consistent with the IEA project review (IEA 2005).

Table 21: BC Illustrative Wind Energy Economic Impacts

A. Wind Scenario (Project Lifetime)
- 1,500 MW (5-300 MW projects), 40% capacity factor, $100/Mwh CDN price
- 1 year construction cost of $4.17 billion CDN (5 projects x $834 million)
- lifetime operating costs of $2.2 billion CDN over 20 years

Lifetime Project Impacts	Construction Phase				Operations Phase				Total Project			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
GDP $ millions CDN	1,334	667	367	2,368	8,752	1,100	370	10,222	10,086	1,767	737	12,590
Labour Income $ millions CDN	500	417	220	1,137	440	484	222	1,146	940	901	442	2,283
Employment PYs	6,250	8,340	5,500	20,090	7,335	9,680	5,540	22,555	13,585	18,020	11,040	42,645

B. Annual Wind Energy Development Impacts to BC* - const^{n} plus operations

Lifetime Impacts	Annual Wind*			
	Direct	Indirect	Induced	Total
GDP $ millions CDN	481	84	35	600
Labour Income $ millions CDN	45	43	21	109
Employment PYs	650	860	520	2,030

** Project lifetime impacts above divided by 21 years*

Source: Wind scenarios - Garrad Hassan and Appendix L
Impact estimates - direct: Appendix K
- indirect & induced: impact coefficients derived from BC sourcing share similar to oil & gas
Dollars - all financial figures in 2006 undiscounted constant dollars

To make these assumptions, we drew on the work of Garrad Hassan in developing an economic profile of offshore wind energy project construction and production – see Appendix L. The viability of wind energy depends on prices, costs, technology and other factors. There are substantial constraints/issues related to: financial feasibility of projects, transmission, environmental planning and energy demand/prices.

The Garrad Hassan analysis presents economic parameters and identifies a threshold price necessary to yield an after tax real rate of return of 20% (the "hurdle rate" is high due to the substantial uncertainties associated with wind energy) – the price determined was approximately $100/MWH. We scaled up the Garrad Hassan standard 300 MW facility to 1,500 MW.

Economic Impacts. The direct industry, indirect supplier and induced consumer respending impacts of the illustrative offshore wind energy scenario is summarized in the top part of Table 21. The projects totalling 1,500 MW in installed capacity confer large project lifetime economic impacts to the Province over the construction and operation phases - $12.6 billion in provincial GDP, $2.3 billion in Wages & Benefits, and 42,600 person-years of employment.

The bulk of the benefits occur during the on-going operations phase rather than the construction phase.

It is not appropriate to compare the potential project lifetime impacts for offshore wind development, such as the top part of Table 21, to the annual ongoing impacts of existing ocean sectors presented in Section 5. As with the oil & gas scenarios analysis, we converted the project lifetime developments to an annual stream (see bottom part of Table 21). The impacts are significant.

This analysis notwithstanding, there are great uncertainties with development of the offshore wind resources in BC. The assumptions, projections, and results should be viewed as illustrative of the economic potential rather than a prediction of that potential.

6.3 Tidal and Wave Energy

There is potential to harness the immense energy embodied in the ocean's waves, tides and currents. Energy potential includes: 1) tidal energy – extracting the kinetic energy using undersea equipment similar to wind turbines, and 2) wave energy – extracting the wave crest to trough energy.

The BC government has indicated that the province has significant ocean energy potential, including over 6,000 MW of wave energy potential and 2,000 MW of tidal energy potential. Worldwide ocean energy potential from wave, tidal, marine currents, thermal and salinity gradients is estimated at 10-20 terawatts which is two to four times the existing electricity consumption in the world (EMPR, "Ocean Energy - New Ocean Energy Project Application Directive", 2007).

There currently are two large scale tidal power projects in operation in the world - the 240 MW experimental La Rance tidal project in Brittany France that was commissioned in 1966, and the 20 MW pilot tidal power project at Annapolis Royal, Nova Scotia in Canada's Bay of Fundy that was launched in 1984. There is a small demonstration tidal power project near Race Rocks just outside Victoria (Pembina Institute 2006).

However, as the development of tidal and wave energy technology is not well established, a quantitative assessment of its potential for British Columbia is not possible at this time.

7.0 Conclusions

The Importance. Through a variety of business and non-business sector activities, the ocean sector makes a very important contribution to the economy of British Columbia. In 2005 ocean sector total impacts – direct industry, induced supplier plus induced consumer spending – from $11.6 in Gross Output were $10.9 billion in Gross Domestic Product, $7.4 billion in Labour Income and 166,200 person-years employment. These economic contributions represent 7-8% of the total BC economy.

This study has demonstrated that the economic contribution of the ocean to the BC economy is larger and is more broad-based than previously estimated. Nevertheless, the ocean-related economy has not been well-understood and, in large measure, is "under the radar". It often is not realized that several knowledge-based components to the ocean sector exist, and that improvements in technology processes and infrastructure are transforming many of the traditional goods and service components such as seafood and ocean transport.

The influence of the ocean on the lives and livelihoods of British Columbians is more pervasive than indicated by these market-based economic contributions. The ocean is integral not just to the economy, but also to our culture, way of life, and collective identity. The ocean also provides key ecosystem services that underpin many of the identified industries and make coastal life as we know it possible. These other contributions may be analyzed through non-market studies. The Oceans Coordinating Committee has sponsored a review of appropriate techniques for measuring non-market benefits of the ocean. British Columbians and Canadians have the expectation that each ocean sector will allow other users and society at large to continue to enjoy the benefits, market and non-market alike, that flow from the ocean environment.

Offshore oil & gas and wind farm activity may have the potential to expand the economic contribution of the ocean environment. But activities such as ocean high technology, ocean recreation and ocean transport also may have substantial potential for growth.

Future Research. This study has incorporated significant improvements in sector coverage and improved procedures for analyzing individual sectors. Further methodological advances are still possible. The three high growth private sectors – ocean high tech, ocean recreation, and ports & shipping – are prime candidates for such improvements. For example, the measurement of the ocean recreation/leisure-based economy would benefit immensely from targeted research. The research arm of the Canadian Tourism Commission (CTC), admittedly having a market demand focus, recently has relocated to Vancouver. A federal-provincial joint venture could be launched.

Next Steps. Finally, we note that several federal, provincial and industry agencies/or organizations have expressed interest in our work as the study is closely aligned with their core activities. It would be useful to distribute the Final Report to these interests and solicit feedback with a view to refining the approach and data for future work. This first assessment should be considered a pilot upon which to build support for a regular reporting of the economic contribution of the BC ocean sector.

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Appendix A

2001 Census Employment in BC

Table A.1: 2001 BC Census Employment in Marine-Related Private Industries - British Columbia Total

NAICS/Sector		Employment Category		
		Employed	Unemployed	Labour Force
A. Marine-Related Sectors				
1. Seafood				
1141	Fishing	3,335	1,690	5,025
1125	Aquaculture	NA	NA	NA
3117	Seafood Processing	4,390	1,065	5,460
	Subtotal	NA	NA	NA
2. Forestry & Related Manufacturing				
113	Forestry & Logging	16,960	6,850	23,815
321	Wood Product Mfg	41,815	4,215	46,025
322	Paper Mfg	15,660	675	16,335
	Subtotal	74,435	11,740	86,175
3. Other Manufacturing				
3345	Navigational Measuring etc Mfg	1,650	110	1,765
3366	Ship & Boat Building	4,385	340	4,720
	Subtotal	6,035	450	6,485
4. Marine Transport				
4831	Deep Sea Transport (inc Ferries)	5,415	345	5,755
4883	Support Activities - Water Transport	4,510	230	4,755
	Subtotal	9,925	575	10,510
B. Other Sectors		1,785,855	160,450	1,946,285
C. Total Province - All Sectors		1,883,975	175,970	2,059,940

Source: 2001 Census of Canada

Note: 1. Labour Force = Employed + Unemployed

Table A.2: 2001 BC Census Employment in Marine-Related Private Industries - North Coast

NAICS/Sector	Employment Category		
	Employed	Unemployed	Labour Force
A. Marine-Related Sectors			
1. Seafood			
1141 Fishing	360	315	670
1125 Aquaculture	NA	NA	NA
3117 Seafood Processing	400	360	760
Subtotal	NA	NA	NA
2. Forestry & Related Manufacturing			
113 Forestry & Logging	1,240	590	1,830
321 Wood Product Mfg	1,945	340	2,285
322 Paper Mfg	1,375	85	1,465
Subtotal	4,560	1,015	5,580
3. Other Manufacturing			
3345 Navigational Measuring etc Mfg	10	0	10
3366 Ship & Boat Building	55	15	70
Subtotal	65	15	80
4. Marine Transport			
4831 Deep Sea Transport (inc Ferries)	200	55	260
4883 Support Activities - Water Transport	145	20	165
Subtotal	345	75	425
B. Other Sectors	31,035	4,935	35,960
C. Total Region - All Sectors	36,765	6,715	43,475

Source: 2001 Census of Canada

Note: 1. Labour Force = Employed + Unemployed

Table A.3: 2001 BC Census Employment in Marine-Related Private Industries - Vancouver Island

NAICS/Sector	Employment Category		
	Employed	Unemployed	Labour Force
A. Marine-Related Sectors			
1. Seafood			
1141 Fishing	1,640	835	2,470
1125 Aquaculture	NA	NA	NA
3117 Seafood Processing	1,355	160	1,510
Subtotal	NA	NA	NA
2. Forestry & Related Manufacturing			
113 Forestry & Logging	6,390	1,175	7,560
321 Wood Product Mfg	4,495	1,005	5,505
322 Paper Mfg	5,085	190	5,280
Subtotal	15,970	2,370	18,345
3. Other Manufacturing			
3345 Navigational Measuring etc Mfg	425	0	435
3366 Ship & Boat Building	1,345	100	1,435
Subtotal	1,770	100	1,870
4. Marine Transport			
4831 Deep Sea Transport (inc Ferries)	2,560	145	2,710
4883 Support Activities - Water Transport	640	45	690
Subtotal	3,200	190	3,400
B. Other Sectors	295,180	27,705	322,875
C. Total Region - All Sectors	319,115	31,360	350,470

Source: 2001 Census of Canada

Note: 1. Labour Force = Employed + Unemployed

Table A.4: 2001 BC Census Employment in Marine-Related Private Industries - Lower Mainland

NAICS/Sector	Employment Category		
	Employed	Unemployed	Labour Force
A. Marine-Related Sectors			
1. Seafood			
1141 Fishing	1,240	460	1,720
1125 Aquaculture	NA	NA	NA
3117 Seafood Processing	2,615	520	3,140
Subtotal	NA	NA	NA
2. Forestry & Related Manufacturing			
113 Forestry & Logging	2,625	390	3,035
321 Wood Product Mfg	13,395	1,445	14,825
322 Paper Mfg	4,900	115	5,010
Subtotal	20,920	1,950	22,870
3. Other Manufacturing			
3345 Navigational Measuring etc Mfg	1,035	100	1,135
3366 Ship & Boat Building	2,505	175	2,700
Subtotal	3,540	275	3,835
4. Marine Transport			
4831 Deep Sea Transport (inc Ferries)	2,550	125	2,650
4883 Support Activities - Water Transport	3,645	150	3,795
Subtotal	6,195	275	6,445
B. Other Sectors	1,097,215	86,545	1,183,745
C. Total Region - All Sectors	1,131,725	90,025	1,221,755

Source: 2001 Census of Canada

Note: 1. Labour Force = Employed + Unemployed

Table A.5: 2001 BC Census Employment in Marine-Related Private Industries - Other BC

NAICS/Sector	Employment Category		
	Employed	Unemployed	Labour Force
A. Marine-Related Sectors			
1. Seafood			
1141 Fishing	95	80	165
1125 Aquaculture	NA	NA	NA
3117 Seafood Processing	20	25	50
Subtotal	NA	NA	NA
2. Forestry & Related Manufacturing			
113 Forestry & Logging	6,705	4,695	11,390
321 Wood Product Mfg	21,980	1,425	23,410
322 Paper Mfg	4,300	285	4,580
Subtotal	32,985	6,405	39,380
3. Other Manufacturing			
3345 Navigational Measuring etc Mfg	180	10	185
3366 Ship & Boat Building	480	50	515
Subtotal	660	60	700
4. Marine Transport			
4831 Deep Sea Transport (inc Ferries)	105	20	135
4883 Support Activities - Water Transport	80	15	105
Subtotal	185	35	240
B. Other Sectors	362,425	41,265	403,705
C. Total Region - All Sectors	396,370	47,870	444,240

Source: 2001 Census of Canada

Note: 1. Labour Force = Employed + Unemployed

Appendix B

Background - Seafood

Table B.1: BC Seafood Production and Values

		1997	1998	1999	2000	2001	2002	2003	2004	2005
Production '000 tonnes										
Capture	- salmon	49	30	17	19	25	33	39	26	26
	- herring	32	34	27	28	24	27	30	25	30
	- shellfish	19	20	17	18	20	19	20	22	18
	- groundfish	143	139	140	75	116	115	128	181	168
	- other	2	2	5	6	7	6	9	15	11
Subtotal		245	225	206	146	192	200	226	269	253
Aquaculture	- salmon	36	42	50	50	68	84	73	62	71
	- shellfish	6	6	6	6	9	9	10	9	10
Subtotal		42	48	56	56	77	93	83	71	81
Total		287	273	262	202	269	293	309	340	334
Landed/Farm Value $ millions										
Capture	- salmon	109	54	26	50	37	57	49	53	33
	- herring	67	37	49	50	46	49	45	34	31
	- shellfish	112	94	94	118	130	109	124	128	122
	- groundfish	128	122	131	137	125	131	137	149	157
	- other	3	1	11	17	21	13	16	31	21
Subtotal		419	308	311	372	359	359	371	395	364
Aquaculture	- salmon	176	229	291	282	271	289	256	225	319
	- shellfish	9	9	11	12	17	15	18	16	17
Subtotal		185	238	302	294	288	304	274	241	336
Total		604	546	613	666	647	663	645	636	700
Wholesale Value $ millions										
Capture	- salmon	306	208	171	200	162	199	188	219	212
	- herring	117	108	122	129	113	130	109	91	86
	- shellfish	147	137	140	169	182	181	193	193	178
	- groundfish	199	219	209	195	224	236	280	260	286
	- other	9	8	15	24	26	23	27	44	37
Subtotal		778	680	657	717	707	769	797	807	799
Aquaculture	- salmon	229	264	334	326	323	339	302	288	371
	- shellfish	11	16	18	23	26	28	31	27	32
Subtotal		240	280	352	349	349	367	333	315	403
Total		1,018	960	1,009	1,066	1,056	1,136	1,130	1,122	1,202

Source: BC Ministry of Environment

Notes: 1. Wholesale value includes processed value of raw fish imported from outside the province.

2. Production is round (whole) weight.

Table B.2: Exports of BC Fish and Seafood Products

	$ millions						
	Wild Salmon	Farmed Salmon	Herring	Other Finfish	Shellfish	Other NES	All
1990	457	12	155	87	50	15	776
1991	353	45	127	110	56	12	703
1992	312	93	118	114	77	14	728
1993	299	112	151	134	91	13	800
1994	346	140	127	158	117	12	900
1995	187	176	152	170	147	16	848
1996	191	149	194	148	149	14	845
1997	190	208	98	172	147	14	829
1998	144	241	89	206	120	13	813
1999	104	255	94	269	118	13	853
2000	117	227	127	278	139	15	903
2001	135	360	96	221	141	18	974
2002	156	385	91	256	118	23	1,029
2003	157	311	81	268	153	26	996
2004	181	236	84	285	179	19	984
2005	154	302	82	273	164	19	994

Source: Statistics Canada as reported by BC Stats, "British Columbia's Fisheries and Aquaculture Sector, 2006 Edition", Draft, 2006.

Notes: 1. The term "export value" is not the same as "wholesale value" i.e., "export value" can include freight and insurance charges.

2. "Farmed salmon" refers to fresh farmed salmon (whole and fillets) - all other salmon exports are deemed to be "wild salmon".

3. "NES" means Not Elsewhere Specified.

Appendix C

Background - Forestry

Table C.1: BC Forest Sector Profile

A. BC Log Production 1997 to 2005

	1997	1998	1999	2000	2001	2002	2003	2004	2005	10 Year Average
Log Production million m³										
Coast	22	19	24	23	22	22	17	28	22	22 30%
Interior	46	46	52	50	50	51	51	64	61	52 70%
	68	65	76	73	72	73	68	92	83	74

Source: Coast Forest Products Association and BC Stats

B. BC Log Exports

	BC Log Exports as % of Log Production		
	Coast	**Interior**	**All**
Selected Years			
1996	NA	NA	0.6%
2001	NA	NA	3.9%
2005	21.0%	0.7%	6.1%

Source: Bill Dumont & Don Wright, "Generating More Wealth from British Columbia's Timber: A Review of British Columbia's Log Export Policies", Report to British Columbia Minister of Forests and Range, December 2006

C. BC Forest Sector Commodity Data

	1997	1998	1999	2000	2001	2002	2003	2004	2005
Lumber Production million m³	31.6	30.2	32.4	34.3	32.6	36.6	36.0	39.9	41.0
Market Pulp Shipments '000 tonnes	4,530	4,460	5,000	5,150	4,710	4,480	4,760	4,720	4,930
Newsprint, Other Paper & Paperboard '000 tonnes	2,650	2,570	3,020	3,130	2,880	2,900	2,920	2,980	2,980

Source: BC Stats

Table C.2: Direct Impacts of Forest Sector in BC

	2002	2003	2004	2005
A. Total Forest Sector				
Forestry & Logging NAICS 113				
Gross Output $ millions	5,740	5,609	7,800[a]	6,800[a]
GDP $ millions	2,713	2,566	3,670[a]	3,200[a]
Labour Income $ millions	1,714	1,645[a]	1,755[a,b]	1,780[a,b]
Employment PYs	26,630	25,020	26,140	26,000[a,b]
Wood Products NAICS 321				
Gross Output $ millions	11,777	10,728	13,400[a]	12,100[a]
GDP $ millions	3,979	3,464	4,560[a]	4,110[a]
Labour Income $ millions	2,200	2,250[a]	2,335	2,325
Employment PYs	37,590	37,650	38,290	37,400
Paper Manufacturing NAICS 322				
Gross Output $ millions	5,592	5,739	6,300[a]	6,000[a]
GDP $ millions	1,453	1,240	1,700[a]	1,620[a]
Labour Income $ millions	1,060	1,060[a,b]	1,090[a,b]	1,085[a,b]
Employment PYs	16,260	16,000	16,060	15,680
B. Ocean-Related Forest Sector				
Gross Output $ millions[c]	269	256	308	283
GDP $ millions	100	90	118	108
Labour Income $ millions	60	58	59	60
Employment PYs	960	930	910	910

Source: Gross Output & GDP - Statistics Canada Input Output Division
Labour Income & Employment - Statistics Canada Labour Division

a estimates

b assumed wage rates increase 2% per year, the increase in the Consumer Price Index (CPI)

c ocean-related output = .015 wood products & paper output (30% coastal share x 5% ocean share of coastal) plus logging output x .02 ocean share of coastal logging x share of provincial logging output exported from the coast (4.5% in 2002, 5% in 2003, 5.5% in 2004, 6% in 2005 i.e., 6% = 30% coastal share x 20% export share in 2006) plus $3 million spent annually in log boom tenures.

Appendix D

Background - Ship & Boat Building

Table D.1: Direct Impacts of Ship & Boat Building in BC

	2002	2003	2004	2005
A. Total Ship Building & Boat Building				
Ship Building & Repairing NAICS 33661				
Gross Output $ millions	175	217	200[b]	200[b]
GDP $ millions	83	105	96[b]	96[b]
Labour Income $ millions	70	87	80	80
Employment PYs	1,070	1,300	1,180	1,150
Boat Building NAICS 33662				
Gross Output $ millions	225	228	200[b]	220[b]
GDP $ millions	88	92	80[b]	88[b]
Labour Income $ millions	68	68	60	66
Employment PYs	1,610	1,600	1,370	1,480
B. Ocean-Related Ship & Boat Building[a]				
Gross Output $ millions[c]	378	422	380	398
GDP $ millions	162	188	168	175
Labour Income $ millions	131	148	134	139
Employment PYs	2,520	2,740	2,410	2,480

Source: *Gross Output & GDP* - *Statistics Canada Input Output Division*

Labour Income & Employment - *40% of Gross Output for Ship Building/30% of Gross Output for Boat Building (based on Stats Can "2003 Provincial Input-Output Multipliers – British Columbia", Cat. No. 15-210-XIE)*

Employment - *6 per $1 million Gross Output for Ship Building/7 per $1 million Gross Output for Boat Building (2003 ratios from above Stats Can multipliers)*

- *ratios for other years adjusted based on 2% inflation rate*

a ocean-related - *100% of Ship Building + 90% Boat Building (10% estimate for freshwater boat construction)*

b estimate

Table D.2: Exports of Ships and Boats from BC

	$ millions		
	Fishing Vessels & Factory Ships	Pleasure Boats & Motors	Subtotal
1997	4	50	54
1998	4	93	97
1999	5	109	114
2000	6	86	92
2001	8	173	181
2002	10	177	187
2003	9	155	164
2004	10	98	198
2005	11	97	108

Source: Statistics Canada as reported by BC Stats, "British Columbia's Fisheries and Aquaculture Sector, 2006 Edition, Draft 2006.

Appendix E

Background - Marine Construction

Table E.1: Capital Investments by BC Port Authorities

	$ millions	
Port Authority	**2004**	**2005**
Vancouver	33.8	21.9
Fraser River	5.3	5.0*
North Fraser	0.3	0.1
Prince Rupert	2.3	5.0
Nanaimo	1.0	0.9
Port Alberni	0.5	0.3
	43.2	33.2

Source: Port Authority Financial Statements (excludes land purchases/sales).

** Estimate (Apr/06 year-end financials for Fraser River Port Authority will not be released until June/07).*

Appendix F

Background - Ocean High Tech

Table F.1: The BC High Technology Sector

	Revenues $ millions			GDP $ millions		
	Mfg	Services	Total	Mfg	Services	Total
1997	1,763	7,226	8,988	743	4,354	5,096
1998	1,845	7,920	9,764	734	4,689	5,423
1999	2,267	8,494	10,761	920	4,590	5,509
2000	2,819	8,870	11,689	1,254	4,944	6,198
2001	2,524	8,900	11,424	1,096	5,156	6,252
2002	2,122	9,961	12,082	871	5,715	6,586
2003	2,241	10,860	13,101	939	6,233	7,172
2004	2,333	11,662	13,996	1,010	6,627	7,637
2005[e]	2,500	12,500	15,000	1,075	7,150	8,225

	Employment person-years			Wages & Salaries $ millions		
	Mfg	Services	Total	Mfg	Services	Total
1997	10,790	43,950	54,730	386	2,296	2,682
1998	11,230	42,730	53,970	448	2,121	2,569
1999	13,620	45,880	59,500	506	2,217	2,723
2000	15,050	49,260	64,310	555	2,526	3,081
2001	15,200	52,720	67,920	633	2,752	3,385
2002	14,080	51,310	65,380	712	2,691	3,403
2003	12,940	53,290	66,230	697	2,901	3,598
2004	12,270	52,390	64,660	680	2,928	3,608
2005[e]	13,150	55,750	68,900	750	3,200	3,950

Source: BC Stats & Leading Edge British Columbia, "Profile of the British Columbia High Technology Sector - 2005 Edition", January 2006.

Notes: 1. See Table F.3 for industries comprising the High Tech sector:

2. "e" denotes estimate.

3. Wages & Salaries do not include SLI of about 15%.

Table F.2: The BC High Technology Sector - Exports

	Exports $ millions		
	Goods	**Services**	**All**
1997	581		
1998	769	1,650	2,419
1999	840	1,640	2,480
2000	823	2,090	3,013
2001	748	1,885	2,633
2002	685	2,063	2,748
2003	629	2,203	2,832
2004	673	2,086	2,759

Source: BC Stats & Leading Edge British Columbia, "Profile of the British Columbia High Technology Sector - 2005 Edition", January 2006.

Table F.3: Industries in the High Technology Sector

NAICS	Industry
Manufacturing	
325189	Other Inorganic Chemicals
325410	Pharmaceutical and Medicine
333310	Commercial and Service Industry
334110	Computer and Peripheral
334210	Telephone Apparatus
334220	Radio, Television Broadcasting & Wireless Communications Equipment
334290	Other Communications Equipment
334310	Audio and Video Equipment
334410	Semiconductor and Other Electronic Components
334511	Navigational and Guidance Instruments
334512	Measuring, Medical and Controlling Devices
334610	Manufacturing and Reproducing Magnetic and Optical Media
335315	Switchgear and Switchboard, and Relay and Industrial Control Apparatus
335920	Communication and Energy Wire and Cable
335990	All Other Electrical Equipment and Component
336410	Aerospace Products and Parts
339110	Medical Equipment and Supplies
Service	
511210	Software Publishers
512110	Motion Picture and Video Production
512190	Post-Production and Other Motion Picture and Video Industries
515210	Pay and Specialty Television
516110	Internet Publishing and Broadcasting
517110	Wired Telecommunications Carriers
517210	Wireless Telecommunications Carriers (Except Satellite)
517310	Telecommunications Resellers
517410	Satellite Telecommunications
517510	Cable and Other Program Distribution
518111	Internet Service Providers
518112	Web Search Portals
518210	Data Processing, Hosting and Related
541330	Engineering
541360	Geophysical Surveying and Mapping Services
541370	Surveying and Mapping (Except Geophysical) Service
541380	Testing Laboratories
541510	Computer Systems Design and Related
541620	Environmental Consulting
541690	Other Scientific and Technical Consulting
541710	Research and Development in Physical, Engineering and Life Sciences

Source: BC Stats & Leading Edge British Columbia, "Profile of the British Columbia High Technology Sector - 2005 Edition", January 2006.

Appendix G

Background - Ocean Recreation

Table G.1: BC Tidal Waters Sport Fishing Licence Sales and Revenues - Selected Years

	Fiscal Years				
	1986/87	**1991/92**	**1996/97**	**2001/02**	**2005/06**
Licence Type					
Resident*					
Annual	269,498	200,217	130,718	121,958	115,211
5 Day	0	0	6,948	10,170	13,607
3 Day	0	0	14,510	16,654	19,413
1 Day	18,014	41,376	43,604	41,178	32,047
Senior	0	24,080	19,190	19,141	20,183
Juvenile	0	49,198	50,286	49,692	39,403
Subtotal	287,512	314,871	265,256	258,793	239,864
Non-Resident*					
Annual	20,210	16,250	5,485	5,328	5,306
5 Day	3,569	12,564	19,122	22,015	25,834
4 Day	4,333	9,493	0	0	0
3 Day	9,373	14,588	24,331	20,058	18,653
2 Day	8,390	14,180	0	0	0
1 Day	19,673	21,712	32,036	25,656	21,523
	0	6,242	6,496	6,017	5,123
Subtotal	65,548	95,029	87,470	79,074	76,439
Total	353,060	409,900	352,726	337,867	316,303
Licence Revenue**	$2,164,000	$4,307,000	$6,977,000	$6,621,000	$6,572,000

** Resident of Canada*

*** Includes tags/stamps*

Source: DFO

Table G.2: BC Cruise Passenger Counts

	Cruise Passengers '000					
	2000	**2001**	**2002**	**2003**	**2004**	**2005**
Vancouver	987	1,019	1,125	953	930	910
Victoria	53	118	161	186	265	295
Nanaimo	-	-	-	-	-	15
Prince Rupert	-	-	-	-	60	96
Total	1,040	1,137	1,286	1,139	1,255	1,316

Source: Cruise BC

Table G.3: BC Ferries Financial Statements

	01/02	02/03	03/04	04/05	05/06
A. Income Statement $ millions					
Revenues					
Tolls/Activities	378.4	392.3	403.9	433.2	446.1
Prov Subsidy	71.7	74.2	105.8	107.0	108.2
Fed Subsidy	23.0	23.4	24.0	24.3	24.9
Subtotal	473.1	489.9	533.7	564.5	579.2
Expenses					
Wages, Salaries, Benefits	241.6	248.1	234.8	235.7	243.2
Other Operating	165.8	171.7	199.5	216.1	207.8
Subtotal	407.4	419.8	434.3	451.8	451.0
EBITDA					
Interest	1.8	1.4	22.7	24.5	25.1
Amortization	46.1	44.1	47.3	47.7	53.1
Earnings	17.8	24.6	29.4	40.5	50.0
Subtotal	65.7	70.1	99.4	112.7	128.2
B. Capital Purchases $ millions					
Ships	25.0[e]	25.0[e]	25.7	50.1	28.3
Berths, Bldgs etc	29.9	33.2	33.9	69.8	101.4
Subtotal	54.9	58.2	59.6	119.9	129.7
C. Employment FTEs		3,345	3,261	3,375	3,406

Source: BC Ferries Annual Reports.

Notes: 1. The provision of vehicle and passenger ferry services is exempt under the Excise Act for GST purposes.

2. The company entered into an agreement with the Province in April 2003 to provide, in exchange for fees, ferry service on specified routes that would not normally be commercially viable.

3. The company receives revenue provided by the Province from the Government of Canada pursuant to a contract between federal and provincial governments for the provision of ferry, coastal, freight and passenger services in the waters of British Columbia.

4. EBITDA – Earnings Before Interest, Taxes, Depreciation & Amortization.

Table G.4: BC and Canadian Tourist Expenditures

	British Columbia					Canada		
	Expenditures $ millions			GDP $ millions	Employment PYs	Expenditures $ millions	GDP $ millions	Employment PYs
	Same Day	Overnight	Total					
1997				4,700	111,700	42,882	17,997	520,600
1998				4,854	112,400	45,887	19,462	537,500
1999				5,040	111,200	49,000	20,956	588,400
2000				5,280	112,200	53,750	22,406	609,900
2001	2,858	9,242	12,100	5,430	114,700	53,856	22,460	608,500
2002	3,064	9,336	12,400	5,559	115,200	55,975	23,409	610,700
2003	3,347	8,953	12,300	5,528	116,700	54,834	22,890	610,200
2004	3,627	9,473	13,100	5,909	117,300	58,510	24,350	615,700
2005[e]	4,014	9,786	13,800	6,203	119,900	62,741	26,046	625,800

Source: BC - BC Stats (for GDP and Employment)
- Tourism BC - overnight visitor spending (total tourism spending - same day plus overnight - estimates based on GDP being 45% of the total)
Canada - Canadian Tourism Commission

Notes: 1. A tourist is defined as one who travels more than 80km (50 miles) from their normal place of residence.
2. Canadian figures include same day and overnight tourists
3. Spending figures include point of sales taxes such as GST, PST, hotel tax, liquor & cigarette taxes etc.
4. PYs is person-years.
5. BC Stats estimates tourism GDP and Employment independent of the Tourism BC estimates of tourism expenditures i.e., the figures may not be consistent e.g., Tourism BC expenditures refer to overnight visitors only whereas BC Stats GDP refers to both overnight and same day visitors.

Table G.5: Ocean Recreation/Leisure Expenditures in BC

Marine Leisure Category	$ millions 2002	2003	2004	2005
Marine Tourism				
Angling	330	335	340	350
Cruise	270	270	270	270
Ferries	392	404	433	446
Other	1,711	1,693	1,807	1,908
Subtotal	2,703	2,702	2,850	2,974
Marine Leisure by Non-Tourists				
Angling	220	245	270	292
Cruise	0	0	0	0
Ferries	0	0	0	0
Other	428	450	490	525
Subtotal	648	695	760	817
Marine Recreation/Leisure				
Angling	550	580	610	642
Cruise	270	270	270	270
Ferries	392	404	433	446
Other	2,139	2,143	2,297	2,433
Subtotal	3,351	3,397	3,610	3,791

Source: GSGislason & Associates Ltd. estimates.

Notes: 1. Angling - $550 million in 2002 GSGislason & Associates Ltd., "SWOT Study", 2004.

- *assumed 100% of expenditures of out-of-province anglers was tourist spending/1/3 of expenditures by in-province anglers was tourist spending.*

2. Cruise

- *BREA (2004) estimated $270 million in crew spending plus passenger spending.*
- *cruise line expenditures on goods & services comprise part of Ports & Shipping sector.*
- *little change in cruise passenger levels coastwide over period*
- *assume all cruise passengers are tourists.*

3. Ferries

- *expenditures on ferries from BC Ferries Annual Reports re Tolls/Other activity revenues*
- *allocated 100% to tourist component*

4. Other

- *expenditures on boating, sailing, whalewatching, scuba diving, beach/shore activities.*
- *marine tourist amount assumed to be 15% of BC tourist expenditures other than angling, cruising, and ferry trips (Tablet G.1).*
- *non-tourist amount assumed to be 25% of tourist amount in 2002, a conservative assumption (and than escalated by annual growth in provincial GDP thereafter).*

Table G.6: Ocean Recreation Activities by California Residents 2000

Marine Recreation Activity	millions	
	No. of Participants	No. of Days
1. Beach-Related		
• visit beaches	12.6	151
• swimming	8.4	95
• scuba diving	0.3	1
• surfing	1.1	23
• wind surfing	0.1	1[e]
• snorkeling	0.7	4
Subtotal	23.2	275
2. Recreational Fishing/Boating		
• recreational fishing	2.7	20
• motor boating	1.5	12
• sailing	1.1	7
• personal watercraft	0.7	3
• canoeing	0.2	1[e]
• kayaking	0.4	2[e]
• rowing	0.3	2[e]
Subtotal	6.9	47
3. Other		
• visit waterside beside beaches	1.5	21
• bird watching around saltwater	2.6	66
• viewing/photography around saltwater	4.2	50[e]
• hunting waterfowl around saltwater	0.1	1[e]
• other	0.7	4
Subtotal	9.1	142
Total	39.2	464

Source: Judith Kildow and Charles S. Colgan, "California's Ocean Economy", NOEP, July 2005.

Notes: 1. Number of participants are not unique - one person may participate in more than one activity.

2. "e" means estimate.

3. In 2000 California had a population of 33.9 million - 26.2 million in coastal areas plus 7.7 million in other areas (about 75% of the British Columbia population of 4 million lives in coastal areas).

Appendix H

Background – Ocean Transport

Table H.1: Traffic Handled at BC Ports - Domestic & International*

	Millions of Tonnes				
	2000	**2001**	**2002**	**2003**	**2004**
Port Authorities					
Vancouver	75.3	72.0	63.2	68.0	75.0
Fraser River	11.0	11.5	12.5	13.7	14.9
North Fraser	4.1	4.7	5.2	4.7	4.6
Prince Rupert	7.2	4.7	4.4	4.0	4.4
Nanaimo	1.9	2.2	2.3	2.1	2.2
Port Alberni	0.9	0.3	0.5	0.7	0.7
Subtotal	100.4	95.4	88.1	93.2	101.8
Other Ports					
Howe Sound	6.5	5.8	6.8	6.7	6.2
East Coast Vancouver Island	3.9	3.3	3.6	4.0	4.1
Beale Cove	1.3	0.2	0.3	0.7	2.8
Crofton	2.9	2.6	2.7	2.8	2.6
Kitimat	2.1	1.7	1.7	1.6	1.8
Campbell River	1.4	1.3	1.2	1.4	1.3
Jervis Inlet	1.0	1.1	0.8	0.8	1.0
Others (60 locations)	9.3	7.0	7.7	7.2	6.1
Subtotal	28.4	23.0	24.8	25.2	25.9
All Ports	**128.8**	**118.4**	**112.9**	**118.4**	**127.7**

* *Excludes traffic passing through ports that is not loaded or unloaded.*

Source: Transport Canada

Table H.2: Port Authority Revenues in BC

	$ millions					
	2000	2001	2002	2003	2004	2005
Port Authorities						
Vancouver	86.4	92.1	96.0	102.9	100.9	98.7
Fraser River	14.5	13.4	16.1	19.1	17.0	18.0*
North Fraser	2.7	2.6	2.7	2.6	2.6	2.4
Prince Rupert	6.4	5.5	4.8	3.9	4.8	5.5
Nanaimo	5.8	5.5	4.9	5.0	6.3	6.7
Port Alberni	2.6	2.6	2.8	2.8	3.0	2.9
Subtotal	118.4	121.7	127.3	136.3	134.6	134.2

** Estimate (Apr/06 year-end financials for Fraser River Port Authority will not be released until June/07).*

Source: Transport Canada "Transportation in Canada - Annual Report" (based on Port Authorities Financial Statements) plus Port Authority Financial Statements for 2005.

Table H.3: Selected Marine Transport Employment Statistics

	BC Maritime Employer's Association		
	Employees	**Labour Costs $ millions**	**Hours Worked '000**
1997	3,919	194.8	4,669
1998	3,604	187.7	4,326
1999	3,576	205.1	4,579
2000	3,656	227.1	4,956
2001	3,548	213.7	4,523
2002	3,727	226.1	4,599
2003	3,647	253.0	4,918
2004	3,928	279.1	5,230
2005	4,312	303.1	5,547

Source: Transport Canada, "Transportation in Canada - Annual Report", Annual.

Table H.4: Port of Vancouver Direct Economic Impacts for BC 2004 - InterVISTAS

A. Port Traffic 2004

Cargo	- Bulk	57.7	million tonnes
	- Bulk Break	3.3	"
	- Container	14.1	"
	Total	75.1	million tonnes
Cargo Value		$43 billion	
Cruise Passengers		930,000	

B. Direct Impact 2004

	$ millions			person-years
	Output	**GDP**	**Wages**	**Employment**
Port-Related				
Maritime Cargo	2,254	1,021	834	14,185
Cruise Industry	566	234	181	3,855
Capital Investment	162	67	61	1,410
Ship Building & Repair	80	41	39	725
Non-Maritime	67	23	18	745
Total	3,129	1,386	1,133	20,920

Source: InterVISTAS Consulting Inc., "Port of Vancouver Economic Impact Update", Prepared for Vancouver Port Authority, May 2005.

Notes: 1. Maritime Cargo - impacts resulting from processing & handling of bulk, break bulk and contained goods at the Port (plus off-Port activity of shipping agents, insurance brokers, warehouse operators, exporters/importers etc plus a portion of the rail & trucking logistics system).

2. Cruise industry - impacts from Int'l Cruise Industry expenditures by cruise lines for supplies, fuel etc. as well as crew spending and cruise passenger spending.

3. Capital investment - impacts resulting from capital spending - by the Vancouver Port Authority (VPA) and its tenants

4. Ship Building & Repair - activity generated by Port-related shipbuilding and repair activity.

5. Non-maritime activity - impacts from businesses located on VPA land but involved in activities not directly related to cargo, cruise or ship building & repair (including restaurants, marinas, fishing, fish processing and other non-marine enterprises).

Table H.5: Port of Vancouver Employment Impacts 2000 - InterVISTAS

A. Direct Employment by Port Activity 2000

	person years		
	BC	**Western Canada**	**Total**
Port Activity			
Maritime Cargo	13,270	5,210	18,480
Cruise Industry	2,970	1,540	4,510
Capital Investment	1,326	0	1,326
Ship Building & Repair	726	0	726
Non-Maritime	684	0	684
Total	18,976	6,750	25,726

B. Direct Maritime Cargo Employment by Industry 2000

	person-years		person-years
1. Association/Union	2,049	16. Other	103
2. Break Bulk Terminal Operator	138	17. Rail	7,493
3. Bulk Terminal Operator	1,702	18. Retail Fuel Sales/Bunkers	48
4. Construction/Dredging	118	19. Security	70
5. Consulting Engineers	54	20. Ship Broker	86
6. Container Stations	129	21. Ship Chandler	215
7. Container Lease & Repair/Off-Dock	112	22. Ship Pilot	49
8. Container Terminal Operator	471	23. Shipping Agent	639
9. Customs Broker	34	24. Shipping Line Operator	71
10. Exporter/Importer	1,026	25. Trucking	1,433
11. Freight Forwarder	298	26. Tug/Tow/Barge	1,011
12. Government Agency	248	27. Vancouver Port Authority	198
13. Maritime Law	29	28. Warehouse Operator	232
14. Marine Insurance Broker	204	29. Waste Disposal/Ship Cleaning	32
15. Marine/Cargo Surveyor	117	30. Water Taxi	71
			18,480

Source: InterVISTAS Consulting Inc., "Port of Vancouver Economic Impact Study", August 2001.

Appendix I

Background - Federal Government

Table I.1: Fisheries and Oceans Canada Ocean-Related Expenditures in BC

	2002/03	2003/04	2004/05	2005/06
Budget/Expenditures $ millions				
Wages, Salaries, Benefits	156.2	155.7	162.5	162.1
Other	103.7	82.3	94.3	95.4
Total	259.9	238.0	256.8	257.5
Employment FTEs	2,340	2,324	2,174	2,160

Source: DFO Vancouver

Notes: 1. Figures represent 90 to 95% of total Pacific Region budget – budgets from area offices in Whitehorse (Yukon) and Kamloops (Interior BC) are excluded. And only 50% of Salmon Enhancement Program (SEP) budget is included. Figures include operations of Coast Guard, Pacific Biological Stations (PBS), Institute for Ocean Sciences (IOS) and West Vancouver Laboratory.

2. Figures do not include capital expenditures.

3. Assumed Supplementary Labour Income or Benefits were 20% of Wages & Salaries.

Table I.2: Department of National Defence Ocean-Related Expenditures in BC

	2002/03	2003/04	2004/05	2005/06
Budget/Expenditures $ millions				
Wages, Salaries, Benefits	330	334	338	343
Other	54	54	78	84
Total	384	388	416	427
Employment FTEs	3,960	3,960	3,945	3,940

Source: CFB Esquimalt

Notes: 1. Figures represent 65-70% of total Pacific Maritime Command budget (CFB Esquimalt provides services to other sectors of the Armed Forces e.g., CFB Comox).

2. Figures do not include capital expenditures.

3. Major activities include: Search & Rescue, Sovereignty Patrols, Maritime Security Operations Centre, Exercising Navy Capabilities, Engineering & Maintenance of Navy Ships, and Acoustic Data Analysis.

4. Assumed Supplementary Labour Incomes or Benefits were 20% of Wages and Salaries.

Table I.3: Environment Canada Ocean-Related Expenditures in BC

	2002/03	2003/04	2004/05	2005/06
Expenditures $ millions				
Wages, Salaries, Benefits	1.6	2.0	1.9	2.0
Other	4.4	4.5	4.5	4.1
Total	6.0	6.5	6.4	6.1
Employment FTEs	24	26	22	26

Source: Environment Canada, Vancouver

Notes: 1. Covers oceans-related activities and programs within: Meteorological Services of Canada (MSC), Canadian Wildlife Services (CWS), Environmental Protection Service (EP), and Canadian Environment Assessment Act (CEAA) activities.

2. Assumed Supplementary Labour Income or Benefits were 20% of Wages & Salaries.

3. Does not include Parks Canada activities (which are considered separately).

Table I.4: Parks Canada Budget re Oceans Sector

	2002/03	2003/04	2004/05	2005/06
Facility				
Gulf Islands National Park Reserve	1.4	2.4	3.2	3.7
Pacific Rim National Park	NA	NA	NA	5.0
Haida Gwaii National Park	NA	NA	NA	3.7
Service Centre	NA	NA	NA	1.0
Total	11.0	12.0	13.0	13.4

Source: Parks Canada, Victoria

Notes: 1. The three National Parks are located on the ocean.

2. The Western & Northern Canada Service Centre supports the three marine parks.

3. Parks Canada facilities help visitors to enjoy healthy marine resources and activities along the Pacific Coast e.g., boating, swimming, surfing, beach walking, sea viewing/sightseeing, research.

4. Totals for 2002/03 through 2004/05 are estimates.

Table I.5: BC Employment Insurance Fishing Claims

Calendar Year	BC EI Fishing Claims	
	No. of Claims	Amount Paid $ millions
1997	5,343	28.1
1998	4,168	38.2
1999	3,805	32.1
2000	3,670	28.9
2001	4,029	33.6
2002	4,170	36.1
2003	4,195	37.1
2004	4,098	35.6
2005	3,376	33.3
2006	3,883	28.8

Source: HRDC and Service Canada

Note: 1. Today the Department spends less than $0.5 million on marine-related activities in BC (but in the 1998-2001 period the Department spent significant monies on the Pacific Fisheries Restructuring and Adjustment Program).

Table I.6: Transport Canada Ocean-Related Expenditures in BC

	2002/03	2003/04	2004/05	2005/06
Expenditures $ millions				
Ports & Harbours	2.3	2.4	2.9	1.9
BC Ferries Subsidy	23.4	24.0	24.3	24.9
Port Funding/Grants	2.0	2.0	11.0	2.0
Total	27.7	28.4	38.2	28.8

Source: Transport Canada, "Transportation in Canada – Annual Report".

Notes: 1. 10% of Canada-wide expenditures on Ports & Harbours have been allocated to BC (Transport Canada Pacific Region could not produce BC information for this item).

2. Grants to ports estimated (but 2004/05 includes $9 million Transport Canada grant to Ridley Terminal in Prince Rupert).

Table I.7: Western Economic Diversification Investments in the Oceans Area in BC

	2002/03	2003/04	2004/05	2005/06
Expenditures $ millions				
Projects	1.8	3.5	3.0	34.8

Source: Western Economic Diversification (WD), Vancouver

Notes: 1. Notable projects/activities/investments include: Western Canadian Universities Marine Sciences Society, Prince Rupert Cruise Ship terminal, establishment of BC Centre for Aquatic Health Sciences, Campbell River Cruise Ship terminal, and Vancouver Marine Science Centre.

2. Contributed $30 million in 2005/06 to Prince Rupert Container Terminal Development.

3. Figures do not include WD staff salaries.

Table I.8: NRCan Ocean-Related Expenditures in BC

	2002/03	2003/04	2004/05	2005/06
Expenditures $ millions				
Wages, Salaries, Benefits	0.8	0.9	1.1	1.3
Other	0.5	0.5	0.6	0.6
Total	1.3	1.4	1.7	1.9
Employment FTEs	8	9	11	13

Source: NRCan, Sidney

Note: 1. "other" includes about $125,000 per year payments to DFO for Canadian Coast Guard services plus about $60,000 per year payments to DFO for NRCan share of heat, utilities at the Institute for Ocean Sciences (IOS) office complex - DFO is the landlord.

Table I.9: Canadian Food Inspection Agency Seafood-Related Expenditures in BC

	2002/03	2003/04	2004/05	2005/06
Expenditures $ millions				
Wages, Salaries, Benefits	2.1	2.2	2.6	2.9
Other	0.3	0.3	0.4	0.3
Total	2.4	2.5	3.0	3.2
Employment FTEs	34	34	37	39

Source: CFIA, Vancouver

Notes: 1. The Canadian Food Inspection Agency (CFIA) is an arm of the federal department of Agriculture & Agri-Food Canada (AAFC).

2. The figures are the sum of estimates for two regions - BC Mainland/Interior and BC Coastal.

3. Assumed Supplementary Labour Income & Benefits were 20% of Wages & Salaries.

Table I.10: Federal NSERC and SSHRC Grants & Scholarships to BC Universities and Colleges 2005/06

	$ millions		
	NSERC	**SCHRC**	**Total**
BCIT	0.2	-	0.2
UBC	51.3	38.0	89.3
Malaspina	0.1	0.2	0.3
Simon Fraser	15.6	14.8	30.4
UVic	14.6	10.9	25.5
	81.8	63.9	145.7

Source: National Science and Engineering Research Council of Canada (NSERC).
Social Sciences and Humanities Research Council of Canada (SSHRC).

Notes: 1. The above expenditures refer to all disciplines, ocean-related and non ocean-related.

2. We estimate that 5% of NSERC expenditures and 1% of SSHRC expenditures are ocean-related.

Appendix J

Background - Provincial Government

Table J.1: BC Ministry of Environment Ocean-Related Expenditures

	2002/03	2003/04	2004/05	2005/06
Expenditures $ millions				
Wages, Salaries, Benefits	1.2	1.4	1.2	2.3
Other	1.0	1.2	1.1	2.3
Total	2.2	2.6	2.3	4.6
Employment FTEs	17	19	16	30

Source: BC Ministry of Environment, Victoria.

Notes: 1. In 2005/06, a new Oceans & Marine Fisheries Division was created in the Ministry of Environment. Several staff were transferred from the former BC Ministry of Agriculture, Fisheries & Food to the new Division.

2. Assumed Supplementary Labour Income or Benefits were 20% of Wages & Salaries.

3. Current activities include: oceans and marine fisheries management, seafood marketing and development, aquaculture waste regulation, emergency preparedness for marine oil spills, coastal environmental reporting, and provincial marine protected areas management.

Table J.2: BC Ministry of Agriculture & Lands Ocean-Related Expenditures

	2002/03	2003/04	2004/05	2005/06
Expenditures $ millions				
Wages, Salaries, Benefits	5.8	5.5	6.3	5.9
Other	1.9	2.6	1.5	4.7
Total	7.7	8.1	7.8	10.6
Employment FTEs	79	82	83	72

Source: BC Ministry of Agriculture & Lands, Victoria.

Notes: 1. In 2005/06, the Ministry of Agriculture, Food & Fisheries was dissolved and the majority of its staff were transferred to the new Ministry of Agriculture & Lands. Some staff went to the new Oceans & Marine Fisheries Division within the Ministry of Environment.

2. Includes the Integrated Land Management Bureau (ILMB) and the Aquaculture Development Section (Prior to 2005/06, the ILMB function rested with the Ministry of Sustainable Resource Management or MSRM – the figures include estimates for the MSRM function prior to 2005/06).

3 Assumed supplementary Labour Income or Benefits were 20% of Wages & Salaries.

4. Current activities include: aquaculture licensing, compliance reviews, and site inspections; and marine and coastal zone planning.

Table J.3: BC Ministry of Energy, Mines & Petroleum Resources Ocean-Related Expenditures

	2002/03	2003/04	2004/05	2005/06
Expenditures $ millions				
Wages, Salaries, Benefits	0.5	1.1	1.2	1.2
Other	0.5	3.2	1.7	1.9
Total	1.0	4.3	2.9	3.1
Employment FTEs	5	12	12	12

Source: BC Ministry of Energy, Mines & Petroleum Resources, Victoria.

Notes: 1. Assumed supplementary Labour Income or Benefits were 20% of Wages & Salaries.

2. Major activities include community and First Nations consultations, research studies, and regulatory regime development for offshore oil and gas; and funding and policy development for ocean energy.

Table J.4: BC Ministry of Transportation Ocean-Related Expenditures

	2002/03	2003/04	2004/05	2005/06
Expenditures $ millions				
Wages, Salaries, Benefits	0.1	0.1	0.1	0.1
Subsidy to Coastal Ferries	74.2	105.8	107.0	108.2
Total	74.3	105.9	107.1	108.3
Employment FTEs	1	1	1	1

Source: BC Ministry of Transportation, Victoria.
BC Ferries Annual Reports.

Notes: 1. Prior to 2003/04, BC Ferries received a motor fuel tax subsidy. Starting in 2003/04, the motor fuel tax subsidy was eliminated. Thereafter, the company, in exchange for a fee, agreed to provide ferry service levels on specified routes and to administer certain policy initiatives on behalf of the Province.

2. Expenditures do not include the federal ferry subsidy, which is paid to the Province and then passed on to BC Ferries.

3. Major activity is the oversight of the coastal ferry services contract with BC Ferries.

Appendix K

Background - Potential Offshore Oil & Gas

Table K.1: Illustrative Cost Profile for a 500 Million Barrel Offshore Oil Field in Queen Charlotte Basin BC

Year	Production Mbbls	Costs $ million US constant 2006			
		Exploration	Development	Operating	Transportation
1		100			
2		100			
3		100			
4		100			
5			5		
6			11		
7			21		
8			32		
9			278	5	
10			557	16	
11	16.1		820	63	24
12	62.1		131	213	93
13	62.1		100	213	93
14	62.1		205	213	93
15	62.1		89	213	93
16	53.5		110	200	80
17	42.8		95	184	64
18	34.3		58	171	51
19	27.8			162	42
20	22.5			154	34
21	18.2			147	27
22	15.0			142	22
23	11.8			138	18
24	9.6			134	14
Total	500	400	2,511	2,370	750

Source: Taken directly from Wade Locke Economic Consulting et al, "Economic Overview of Oil and Gas Reserves Found in the Queen Charlotte Basin", April 2006 Appendix B p.52.

Notes: 1. The information in developing the semi-submersible cost scenario was based on information submitted by Petro-Canada as part of its development plan application for the Terra Nova project in Newfoundland and Labrador. The financial data was updated to 2006 prices and exchange rates.

2. Operating costs - $120 US million/yr plus $1.50 US/bbl
Transportation costs - $1.50 US/bbl

3. Price adjustment - BC oil priced at 5% discount to world (West Texas crude) oil prices.

Table K.2: Illustrative Cost Profile for a 2TCF Offshore Natural Gas Field in Queen Charlotte Basin BC

Year	Production bcf	Costs $ million US constant 2006		
		Exploration	Development	Operating
1		100		
2		100		
3		100		
4		100		
5			539	
6			522	
7	66.6			68
8	96.9			68
9	133.3		261	68
10	133.3		156	68
11	133.3		104	68
12	133.3			68
13	133.3			68
14	133.3			68
15	133.3			68
16	133.3			68
17	133.3			68
18	133.3			68
19	106.6			68
20	85.3			68
21	68.2			68
22	54.6			68
23	43.7			68
24	34.9			68
25	27.9			68
26	22.4			68
27	17.9			68
28	14.3			68
29	11.4			68
30	9.2			68
31	7.3			68
Total	2,000	400	1,582	1,700

Source: Taken directly from Wade Locke Economic Consulting et al, "Economic Overview of Oil and Gas Reserves Found in the Queen Charlotte Basin", April 2006 Appendix C p.54.

Notes: 1. The information in the developing semi-submersible cost scenario was based on information from the Sable project in Nova Scotia.

2. Operating costs - $68 US million/yr

3. Losses - 10% in gas production

Table K.3: BC Illustrative Oil & Gas Scenarios - Financial Projections for Development of a Single Oil Field and a Single Gas Field in Queen Charlotte Basin BC

			Oil	Gas
A. Project Parameters				
Total Production			1,615M bbls	6,060 bcf
Price			$50US/bbl	$6US/mcf
Quality Adjustment/Losses			5%	10%
Exchange Rate			.85	.85
B. Project Totals $ millions US undiscounted				
Revenue			76,717	32,724
Less: Capital Costs		- Exploration	1,200	1,200
		- Development	8,200	4,800
Operating Costs		- Fixed & Variable	7,280	5,100
		- Transportation	2,420	0
Equals: Net Return Before Taxes/Royalties			57,617	21,624
C. BC Direct Impact Totals $ millions CDN undiscounted				
Direct GDP	-	Exploration & Development i.e. const^{n}	3,539	2,259
	-	Operating/Production	80,985	33,999
	-	Total	84,524	36,258
Wages	-	Exploration & Development i.e. const^{n}	1,327	847
	-	Operating/ Production	2,141	1,500
	-	Total	3,468	2,347
Employment	-	Exploration & Development i.e. const^{n}	16,590	10,590
(person-years)	-	Operating/Production	35,685	25,000
	-	Total	52,275	35,590

Source: Basic economics - Wade Locke Economic Consulting et al, "Economic Overview of Oil & Gas Resources Found in the Queen Charlotte Basin", Prepared for NRCan, April 15 2006. Appendices B and C.

BC content - illustrative assumptions.

Notes: 1. The assumed BC oil price is 95% of the world oil (West Texas crude) oil price/losses of 10% appear in gas production.

2. It is assumed that direct GDP and Labour Income at the construction phase are .32 and .12 respectively (based on GE Bridges 2004 c). Over half of construction expenditures likely will be sourced to non-Canadian firms (GE Bridges 2004 c).

3. It is assumed a 25%:75% wage:non-wage split for all operating expenditures (based on GE Bridges 2004 c).

4. Assumed average wage plus benefits rates - $80,000 CDN per person-years in construction and $60,000 CDN per person-years in operations.

Appendix L

Background - Potential Offshore Wind Farms

Table L.1: Illustrative Offshore Wind Energy Scenario – Financial Projections

			Wind
A.	**Project Parameters**		
	Lifecycle	- Construction	1 year
		- Production	20 years
		- Total	21 years
	Capacity		1,500MW
	Capacity Factor		40%
	Annual Production		5,256 Gwh
	Price		$100/Mwh
B.	**Project Totals $ millions CDN undiscounted**		
	Revenue		10,512
	Less: Construction Costs		4,170
	Operating Costs		2,200
	Equals: Net Return Before Taxes		4,142
C.	**BC Benefit Totals $ millions CDN undiscounted**		
	Direct GDP	- Construction	1,334
		- Operating/Production	8,752
		- Total	10,086
	Direct Wages	- Construction	500
		- Operating/ Production	440
		- Total	940
	Employment	- Construction	6,250
	(person-years)	- Operating/Production	7,335
		- Total	13,585

Source: Basic economics - Garrad Hassan, "Assessment of the Energy Potential and Estimated Costs of Wind Energy in British Columbia", Prepared for BC Hydro, May 2005.

BC content - illustrative assumptions.

Notes: 1. The scenario involves 5-300MW projects.

2. *Construction cost is $834 million for each 300MW block of capacity.*
3. *Annual operating cost is $22 million per year for each 300MW project.*
4. *It is assumed a 20:80 wage:non-wage split for production expenditures (similar to US offshore wind facilities – see Global Insight 2003).*
5. *Operations phase GDP is Revenues less Non-Wage Operating Costs.*
6. *Assumed average wage plus benefits rates - $80,000 per PY in construction and $60,000 per PY in operations.*

Appendix M

Economic Impact Multipliers

Table M.1: Economic Impact Multipliers for BC Oceans Sectors 2003

	Direct			Indirect			Induced			Total		
	GDP[a]	LI[a]	EM[b]	GDP[a]	LI[a]	EM[b]	GDP[a]	LI[a]	EM[b]	GDP[a]	LI[a]	EM[b]
PRIVATE SECTOR												
1. Seafood	.57	.34	9.7	.18	.13	3.5	.19	.11	3.0	.94	.58	16.2
2. Forestry	.35	.23	3.6	.36	.25	4.7	.19	.12	3.1	.90	.60	11.4
3. Ship Building	.48	.40	6.0	.31	.14	3.0	.22	.13	3.5	1.01	.67	12.5
Boat Building	.40	.30	7.0	.15	.08	2.1	.15	.09	2.4	.70	.47	11.5
4. Marine Const[n]	.43	.32	6.4	.31	.20	5.0	.21	.12	3.3	.95	.64	14.7
5. Ocean High Tech - Mfg	.42	.34	5.8	.17	.10	2.7	.18	.11	2.8	.77	.55	11.3
- Services	.57	.31	4.9	.30	.19	5.0	.20	.12	3.2	1.07	.62	13.1
6. Ocean Recreation - Angling	.38	.23	6.4	.22	.12	3.3	.14	.08	2.2	.74	.43	11.9
- Cruise	.41	.32	7.0	.35	.28	4.8	.24	.14	3.8	1.00	.74	15.6
- Ferries	.83	.58	8.1	.15	.08	2.0	.26	.16	4.2	1.24	.82	14.3
- Other	.45	.30	9.3	.30	.19	5.0	.20	.12	3.1	.95	.61	17.4
7. Ocean Transport - Cruise Suppliers	.41	.32	7.0	.35	.28	4.8	.24	.14	3.8	1.00	.74	15.6
- All Others	.46	.36	6.4	.28	.19	4.7	.22	.13	3.5	.96	.68	14.6
PUBLIC SECTOR												
1. Federal Government	.77	.77	9.9	.12	.09	2.2	.34	.21	5.5	1.23	1.07	17.6
2. Provincial Government	.70	.70	10.0	.15	.10	2.5	.32	.19	5.1	1.17	.99	17.6
3. Universities/Education	.65	.65	6.5	.15	.08	2.0	.29	.18	4.7	1.09	.91	13.2
4. ENGOs	.56	.56	14.0	.29	.20	5.0	.30	.18	4.9	1.15	.94	23.9

Sources for Direct:

Seafood	-	*GSGislason "SWOT" 2004*
Forestry	-	*Table C.2, Appendix C*
Ship & Boat Bldg	-	*Table D.1, Appendix D*
Marine Const[n]	-	*Stats Can "2003 BC I-O Multipliers" for engineering const[n]*
Ocean High Tech	-	*Table F.1, Appendix F*
Ocean Recreation	-	*GSGislason "SWOT" 2004 (for angling)*
	-	*InterVISTAS 2005 (for cruise)*
	-	*CDN Tourism Commission ratios for Canada (for other)*
Ocean Transport	-	*InterVISTAS 2005 (for cruise suppliers), LECG 2004 (for all others)*
Federal Govt	-	*survey*
Provincial Govt	-	*survey*
Education	-	*survey*
ENGOs	-	*survey*

for Indirect: *Derived from Stats Can "2003 Provincial Input-Output Multipliers-British Columbia", Cat. No. 15 F0042XDB, 2006*

for Induced: *Estimated GDP as .40 of direct and indirect wages, salaries & SLI, LI as .24 of direct and indirect wages, salaries & SLI, PYs assuming $37,500 per PY in 2003 (figures derived from a special Input-Output run by Statistics Canada)*

Legend: *GDP - Gross Domestic Product.* *EM - Employment**
LI - Labour Income. *PY - Person year*

a Impacts per $1 direct output
b Employment per $1 million direct output