Appendix 'A'
Relevant Legislation & Associated Permits

Potentially Applicable Provincial and Municipal Authorizations

Government Agency	Permit, Authorization, Approval	Activity Requiring Compliance
Department of Environment and Conservation		
Environmental Assessment Division	Release from Environmental Assessment	General
Pollution Prevention Division	Certificate of Approval to Operate a Refinery	General
Water Resources Division	Alteration to a Body of Water (Schedule A to H). This application form is required as well as the appropriate Schedule application form (see below).	Any activity in or near any body of water Permit required for any infilling of any water bodies including marine infilling.
Water Resources Division	Schedule A - Environmental Approval of Culverts	New road construction
Water Resources Division	Schedule B - Environmental Approval of Bridges	New road construction
Water Resources Division	Schedule C - Environmental Approval of Dams	
Water Resources Division	Schedule D - Environmental Approval of Fording	
Water Resources Division	Schedule E - Environmental Approval of Pipe Crossing – Water Intake	
Water Resources Division	Schedule F - Environmental Approval of Stream Modification or Diversion	New road construction
Water Resources Division	Schedule G - Environmental Approval of Small Bridges	New road construction
Water Resources Division	Schedule H - Environmental Approval of Other Alterations	Other works within 15 meters of a Body of Water.
Water Resources Division	Certificate of Approval for Site Drainage	Water run-off from the project site.
Water Resources Division	Permit for Construction of a Non-Domestic Well	
Water Resources Division	Water Use Authorization	
Water Resources Division	Certificate of Approval – Water & Sewer Distribution System	
Water Resources Division	Certificate of Approval for Temporary AGM (ARD) Storage	

Government Agency	Permit, Authorization, Approval	Activity Requiring Compliance
Pollution Prevention Division	Certificate of Approval for Industrial Facilities or Processing Work	A certificate of Approval may be required for any industrial or processing works.
Pollution Prevention Division	Certificate of Approval – Waste Disposal Facility	
	Environmental Protection Plan (EPP) – Construction	General
	Emergency Response Plan	General
	Environmental Effects Monitoring Plan	Also has to be submitted to Department of Fisheries and Oceans.
Department of Natural Resources		
Forestry Resources Branch	Commercial Cutting/ Operating Permit	
Forestry Resources Branch	Burning Permit	
Mines and Energy Branch	Magazine Licence	
Mines and Energy Branch	Explosives Transportation Permit	
Mines and Energy Branch	Application for Exploration Approval and Notice of Planned Mineral Exploration Work	
Mines and Energy Branch	Quarry Permit	
Mines and Energy Branch	Reclamation Plan (Including Financial Assurance)	
Department of Government Services		
Government Services	Licence to Occupy Crown Land	
Government Services	Certificate of Approval – Sewage Treatment Plant	
Government Services	Certificate of Approval – Water Supply >4,500 L/day	
Government Services	Certificate of Approval – Storage and Handling of Gasoline and associated products.	
Government Services	Permit for Flammable and Combustible Liquid Storing and Dispensing (Above or Below Ground) and for Bulk Storage (above ground only)	
Government Services	Storage Tank System Application	All Storage Tanks on Site Including Waste Oil Tanks.

Government Agency	Permit, Authorization, Approval	Activity Requiring Compliance
Government Services	Compliance Standards – National Fire Code, National Building Code and Life Safety Code	All Buildings on Site.
Government Services	Building Accessibility Exemption	All Building on Site
Government Services	Statutory Declaration for Registration of Boiler and Pressure Vessel Fittings Fabricated in Newfoundland and Labrador	
Government Services	**Certificate of Plant Registration** for Power, Heat, Refrigeration, Compressed Gas or Combined Plant	
Government Services	Contractor's Licence – Pressure Piping System	
Government Services	Examination and Certification of Welders and Blazers	
Government Services	Examination and Certification of Propane System Installers	
Government Services	Food Establishment Licence	If a cafeteria is located on site.
Government Services	Waste Management Plan	General
Department of Transportation and Works		
Transportation and Works	Compliance Standard – Storing, handling and transporting dangerous goods	General
Department of Human Resources Labour and Employment		
Human Resources Labour and Employment	Compliance Standard – Occupational Health and Safety	Project-related employment
Department of Tourism, Culture and Recreation		
Tourism, Culture and Recreation	Compliance Standard – Historic Resources Act	Construction and operation.
Tourism, Culture and Recreation	Archaeological Investigation Permit	
Department of Human Resources, Labour and Employment		
Human Resources, Labour and Employment	Occupational Health and Safety Manual	General
Town of Come By Chance		
Town of Come By Chance	Compliance Standard/ Development Plan	Project Construction and Operation

Potentially Applicable Federal Authorizations

Government Agency	Permit, Authorization, Approval	Activity Requiring Compliance
Transport Canada		
Transport Canada	Permit to Store, Handle and Transport Dangerous Goods	
Department of Fisheries and Oceans		
Marine Environment and Habitat Management Division	Authorization for Harmful Alteration, Disruption of Destruction (HADD) of Aquatic Habitat	Marine - Wharf construction and marine infilling. Freshwater - any in-stream work that will impact fish habitat.
Marine Environment and Habitat Management Division	Letter of Advice	
Marine Environment and Habitat Management Division	Project Referral	
Canadian Coast Guard	Navigable Waters Protection Act (NWPA)	Wharf Construction or any activity affecting navigable waters.
Canadian Coast Guard	Letter of Assessment for Stream Crossings (NWPA)	(any stream crossings)
DFO	Environmental Effects Monitoring Plan	Also has to be submitted to Department of Environment and Conservation.
Environment Canada		
Environment Canada	Compliance Standard – *Fisheries Act*, Section 36(3), Deleterious Substances	Any project-related water run-off
Environment Canada	Scientific Research Permit (Wildlife Permit)	
Canadian Wildlife Service	Compliance Standard, Migratory Birds Convention Act and Regulations	Any activities which could result in the mortality of migratory birds and endangered species and any species under federal authority.
Industry Canada		
Industry Canada	Communications Licence	General
Industry Canada	Radio Station Licence	Use of radios on site
Canadian Nuclear Safety Commission		
Canadian Nuclear Safety Commission	Nuclear Substances and Radiation Devices	General

Appendix 'B'
Refining Process

PROCESSING EQUIPMENT

PROCESS UNITS

Crude Blending Unit

A blending facility will be incorporated at the beginning of the process stream to provide the means to physically mix two or more different crude feedstocks to produce a feedstock with desired characteristics to produce the most efficient operation of the plant. Crude will be blended with either in-line through a manifold system, or batch blended in tanks depending to the type, quality and volumes of crudes to be blended.

Atmospheric and Vacuum Distillation Unit

This primary refinery unit will process the crude oil feed stock using desalting and fractional distillation equipment under both atmospheric and vacuum conditions to:

- Remove potentially corrosive salts to protect downstream process units;
- Recover pentanes and lighter materials for further processing;
- Separate the crude oil into naphtha, distillate, gas oil, and residual streams for further processing.

Distillation separates the various hydrocarbon constituents of the crude oil based on their boiling points. Light hydrocarbons can be vapourized (boiled) at relatively low temperatures. Higher temperatures are required to vapourize heavier materials and vacuum conditions are often used to prevent thermal decomposition of heavy stocks at high temperature. Desalting, atmospheric, and vacuum distillation are proven processes, widely used throughout the hydrocarbon processing industry.

The pentane and lighter material will be sent to the Saturate Gas Recovery Unit for separation.

Saturate Gas Recovery Unit

The Saturate Gas Recovery Unit receives pentane and lighter streams from the Atmospheric Distillation Unit, the hydrotreating units, and the hydrocrackers and separates the components for further processing, sales, or other uses within the refinery.

The pentanes (C5) will be sent to the Isomerization Unit for upgrading to gasoline. Propane (C3) and butane (C4) will be separated for from the ethane (C2) and lighter material. The C2 and lighter will be used for refinery fuel. Propane will be produced to LPG specification for domestic sales. Butane will be separated for gasoline blending.

Surplus volumes of C3 and C4 my be used to supplement the feedstock requirements of the Hydrogen Generation Unit.

Hydrotreating Units

In the hydrotreating units, contaminants, principally sulphur and nitrogen, are removed from the specific feedstock to produce high quality hydrocarbon products for product blending or downstream processing. In hydrotreating, the feedstock is mixed with hydrogen, heated, and passed through a catalyst bed where the contaminants are removed and the product quality is improved. These units operate at moderate temperatures and moderate to high pressure. The refinery will have five (5) hydrotreating units:

1) The Light Straight Run Naphtha Hydrotreater (LSR HTU) removes sulphur from the Atmospheric Distillation Unit Light Naphtha to make it suitable for gasoline blending.

2) The Naphtha Hydrotreater (Naphtha HTU) removes sulphur from the heavy naphtha streams from the Atmospheric Distillation Unit and the Kerosene and Diesel Hydrotreaters to prevent the poisoning of the catalyst in the Reformer.

3) The Kerosene Hydrotreater (Kerosene HTU) removes sulphur and nitrogen from the Atmospheric Distillation kerosene and produces a product for blending into Jet A1 or product kerosene.

4) The Diesel Hydrotreater (Diesel (HTU) operates under high pressure to improve the cetane quality of the Atmospheric Distillation Unit diesel stream and to reduce its sulphur content to a level that will allow its sale as Ultra-Low Sulphur diesel (ULSD).

5) The Coker Naphtha Hydrotreater removes sulphur from the naphtha streams produced by the Delayed Coker and saturates the olefinic and di-olefinic components to levels that allow the to be processed in downstream refinery units or blended to directly to gasoline.

Isomerization Unit

The Isomerization Unit, using a catalyst and hydrogen, combines the C5 and C6 material from the Saturate Gas Recovery Unit into a low volatility, high octane stock for gasoline blending.

Hydrocracker

The Hydrocracker, operating at high pressure and moderate temperature, uses hydrogen and catalyst remove the sulphur and nitrogen from the heavy gas oil streams from the Atmospheric and Vacuum Distillation Unit and the Delayed Coker. It also breaks these heavier materials into lighter components for use in commercial fuels. The quality of the Kerosene and Diesel produced will allow them to be used directly for product blending. The naphtha stream will be sent to the Reformer for octane improvement.

Delayed Coker

In the Delayed Coker, the heavy residual oil from the bottom of the Vacuum Distillation Unit is heated and charged to a coke drum where time and the heat from the feed cause the heavy oil to break down. The vapours from this thermal

decomposition are condensed and separated into fractions for further processing. The light gases are recovered primarily for refinery fuel. The naphtha fraction is treated in the Coker Naphtha Hydrotreater. The light gas oil is sent to the Diesel Hydrotreater and the heavy gas oil to the Hydrocracker. The solid coke remaining in the drum is periodically cooled and mechanically removed.

Reformer

Operating with a noble metal catalyst and at high temperature, the Reformer rearranges the molecular structure of components of the various naphtha streams to generate a stream that provides high octane for gasoline blending. As a result of the molecular rearrangement, the Reformer also produces hydrogen which supplements the volumes required by the various hydroprocessing units.

Integral to the operation of the Reformer are the Reformate Splitter and the Benzene Saturation Unit. The Splitter separates the Reformer product stream into a light fraction high in benzene and a heavier fraction. The light fraction is sent to the Benzene Saturation Unit where hydrogen is catalytically added to reduce the benzene content to safe levels. The heavy fraction is sent directly to gasoline blending.

Hydrogen Plant

High purity hydrogen (95%-99%) is produced beginning with the Hydrogen Generation Unit (HGU). First hydrogen is produced by the catalytic reforming of natural gas in the presence of steam. The raw hydrogen produced is purified using Pressure Swing Absorption (PSA) technology. Consideration will be given to recovering additional hydrogen from purge gas and fuel gas streams to minimize the investment required in the HGU. The HGU will be designed to produce hydrogen from feedstock other than natural gas.

Sulphur Recovery Facilities

The Sulphur Recovery Unit (SRU) will use the following three (3) processes:

1) Gas Treating

2) Sour Water Stripping

3) Sulphur Recovery

Sour gases, those containing H2S, NH3 and CO2, from the process units will be treated in an amine system to remove the contaminants. A lean amine solution will be circulated to the various process units where it will be contacted with the sour gases. The resulting rich amine solution, containing the contaminants, will be returned to a central regeneration system where the contaminants, principally H2S will be stripped out and sent for sulphur recovery. The stripped lean amine will be recirculated.

Process waters that have potentially come in contact with H2S and NH3 will be collected and sent to a sour water stripper where the contaminant gases will be thermally stripped from the water. The stripped water will be sent to the waste water treating facility to be processed for recycle to the process units. The H2S rich gas will be sent for sulphur recovery.

The H2S rich streams from the amine unit and sour water stripper will sent to a Claus type recovery plant where the H2S will be converted to elemental sulphur, degassed, and sent to storage. Any unconverted H2S will be oxidized to SO2 before being discharged to atmosphere through a stack.

Gasoline/ Distillate Blending Unit

A blending facility will be incorporated at the end of the process steam to provide a physical mixture of a number of different liquid hydrocarbons to produce a finished product with certain desired characteristics. Products will be blended in-line through a manifold system. In-line blending of gasoline, distillates, jet fuel, and kerosene is accomplished by injecting proportionate amounts of each component into the main stream where turbulence promotes thorough mixing. Additives including octane enhancers, metal deactivators, anti-oxidants, anti-knock agents, gum and rust

inhibitors, detergents, etc. are added during and/or after blending to provide specific properties not inherent in hydrocarbons.

HEAT EXCHANGERS, COOLERS, AND PROCESS HEATERS

Heaters

Process heaters and heat exchangers preheat feedstock in distillation towers and in refinery processes to reaction temperatures. Heat exchangers use either steam or hot hydrocarbon transferred from some other section of the process for heat input. The heaters are usually designed for specific process operations, and most are of cylindrical vertical or box-type designs. The major portion of heat provided to process units comes from fired heaters fuelled by refinery and/or natural gas, distillate, and residual oils. Fired heaters are found on crude and reformer preheaters, coker heaters, and large-column reboilers.

Coolers

Heat also needs to be removed from some processes by air and water exchangers, fin fans, gas and liquid coolers, and overhead condensers, or by transferring heat to other systems. The basic mechanical vapor-compression refrigeration system, which may serve one or more process units, includes an evaporator, compressor, condenser, controls, and piping. Common coolants are water, alcohol/water mixtures, or various glycol solutions.

PRESSURE-RELIEF AND FLARE SYSTEMS

Pressure-relief systems will control vapors and liquids that are released by pressure-relieving devices and blow-downs. Pressure relief is an automatic, planned release when operating pressure reaches a predetermined level. Blowdown normally refers to the intentional release of material, such as blowdowns from process unit startups, furnace blowdowns, shutdowns, and emergencies.

Safety relief valves, used for air, steam, and gas as well as for vapor and liquid, will allow valves to open in proportion to the increase in pressure over the normal operating pressure.

The pressure release and flare system will include relief valves and lines from process units for collection of discharges, knockout drums to separate vapors and liquids, seals, and/or purge gas for flashback protection, and a flare and igniter system which combusts vapors. Discharging directly to the atmosphere is not permitted.

The new facility is expected to have 3 flares; HP Flare, LP Flare and Acid Gas flare. While the acid gas flare will be an integral part of the sulphur recovery unit, the HP & LP Flares will be installed in offsite area. It is envisaged that relief discharges from the high pressure systems in the hydroprocessing units will be routed to the HP Flare while relief discharges from the rest of the facility will be routed to the LP flare. Each flare will be equipped with its own knock-out vessel, pumps, pilots and seal system. Hydrocarbon from the knock-out vessel will be returned to the slop tank. Emergency power will be made available for Flare K.O. Drum pump.

Appendix 'C'
Commercial Fishery & The Aquaculture Industry

NL Refinery Registration Document: Overview of Placentia Bay Commercial Fisheries and Aquaculture Activities

Prepared by Canning and Pitt Associates, Inc., 15 August 2006

1. Study Purpose and Scope

This report provides an overview and description of commercial fisheries and aquaculture activities in Placentia Bay. Its purpose is to provide background information for the Registration stage of the proposed NL Refinery facility (the Project) and the context for a more detailed assessment of potential impacts on project-area fisheries activities and aquaculture to be undertaken in later stages of the project assessment process.

For the purpose of this analysis, the study area is all of Placentia Bay encompassed by NAFO Unit Area 3PSc.

Discussion of Placentia Bay's commercial fisheries includes a historical overview of those activities, recent changes in the area's fisheries management regime and a description of key species and harvesting patterns and locations. Current aquaculture operations and sites are also described, including a brief summary of development trends within this sector during the past decade.

As further discussed in the next section, in addition to relevant historical data, the commercial fisheries analysis relies on existing (2003- 2005) DFO data on study area fisheries resources and catches. The overview of past and current aquaculture activities is based on information obtained from the Provincial Department of Fisheries and Aquaculture (DFA). The report also draws on background information from existing agency reports, other research studies and the consultant's files.

2. Data Sources

2.1. Fisheries Data

The statistical data and analysis in this report are based primarily on time-series data from the Department of Fisheries and Oceans, Newfoundland and Labrador Region and Maritimes Region[1] describing the quantity, month and location (fisheries management Unit Area) of fish harvesting. The datasets also include information on fishing gear, vessels and other information. They have been acquired from DFO in digital form, for the period from 1984 to 2005. The analysis for this registration document presents historical information about the Placentia Bay fisheries and then focuses on the current fisheries environment, i.e. the 2003-2005 period, which has the most recently-available data.

[1] Although only a very small proportion of the harvest from within 3PSc is landed in Maritimes (Nova Scotia) Region (less than 15 tonnes in 2005); these datasets are included within the Newfoundland Region data and are used in this analysis.

About 2% of the harvest by quantity from 3PSc was specifically georeferenced in 2005 and 15% in 2004. Though this represents quite a small portion of the harvest overall, this section also provides maps of the georeferenced data that are available to indicate some part of the harvesting locations[2] in Placentia Bay.

The main analysis of harvesting activities describes fish caught within the waters of fisheries management (NAFO) Unit Area 3PSc (see Figure 1). This management and data area encompasses all of Placentia Bay, and captures species harvested from 3PSc wherever they were landed or processed. Thus catches by fishers who are not based in Placentia Bay are included while catches made by Placentia Bay-based vessels are excluded if they were harvested beyond the 3PSc area. For example, some of the larger (>35') vessels based in the area take a portion of their annual catch on fishing grounds farther offshore, such as St. Pierre Bank, whereas catches by fishers based in other areas of the province, e.g. in Fortune Bay, are included in the analysis if taken within 3PSc.

Figure 1: Study Area

The calculation of the value of the fisheries is much more complex. In addition to variability that results from changes in the quantity of harvest from year to year (whether

[2] The location given is that recorded in the vessel's fishing log, and is reported in the database by degree and minute of latitude and longitude; thus the position is accurate within approximately 0.5 nautical mile of the reported co-ordinates. It should be noted that for some gear, such as mobile gear towed over an extensive area, or for extended gear, such as longlines which may be several miles long, the reference point does not represent the full distribution of the gear or activity on the water. However, over many data entries, the reported locations create a fairly accurate indication of where such fishing activities occur.

due to natural variability or changing quotas), prices also vary from year to year, and even within the fishing season, driven primarily by market conditions, which in turn are determined by supply and demand, currency exchange rates and other market factors. Quality issues also affect the prices paid for many species. Consequently, most of the analysis provided in this section involves quantity of harvests (tonnes of fish landed), which is directly comparable from year to year.

Other data sources include fisheries management plans and data tables (e.g. fishing enterprises) provided by DFO. Information on Aquaculture was provided by the provincial Department of Fisheries and Aquaculture, including its **AguaGIS.com** database.

2.2. Consultations

The terms of reference did not require the consultants to undertake any new consultations with commercial fisheries participants or aquaculture operators in the study area. However, where required, relevant DFO and DFA managers were contacted to obtain current information on the area's fisheries and aquaculture sector activities.

Annex 1 provides a list of all persons consulted for this report, and references and information sources are listed in Appendix *.

3. Commercial Fisheries

This section presents a detailed review of the commercial fisheries harvesting environment in the Placentia Bay study area. Topics addressed include the historical context, species harvested, the monthly distribution of fishing activities, fishing gears used and geographic location of fishing activities where that information is available.

3.1. Historical Context, 1980s to the Present

Drastic changes occurred in the Placentia Bay commercial fisheries in the early 1990s when fisheries moratoria were imposed because of declining groundfish stocks. For example, within 3PSc for the period 1984-1990, 74% of the catch by quantity was cod while snow crab made up just 3%; during 1994-1995, immediately after the moratoria were imposed, cod made up only 6% of the harvest and snow crab catches had increased to 24%. In terms of value, cod accounted for nearly 60% of the value of the 3PSc harvest (1984-1992), but only a negligible amount in 1994-1995 (see Figure 2).

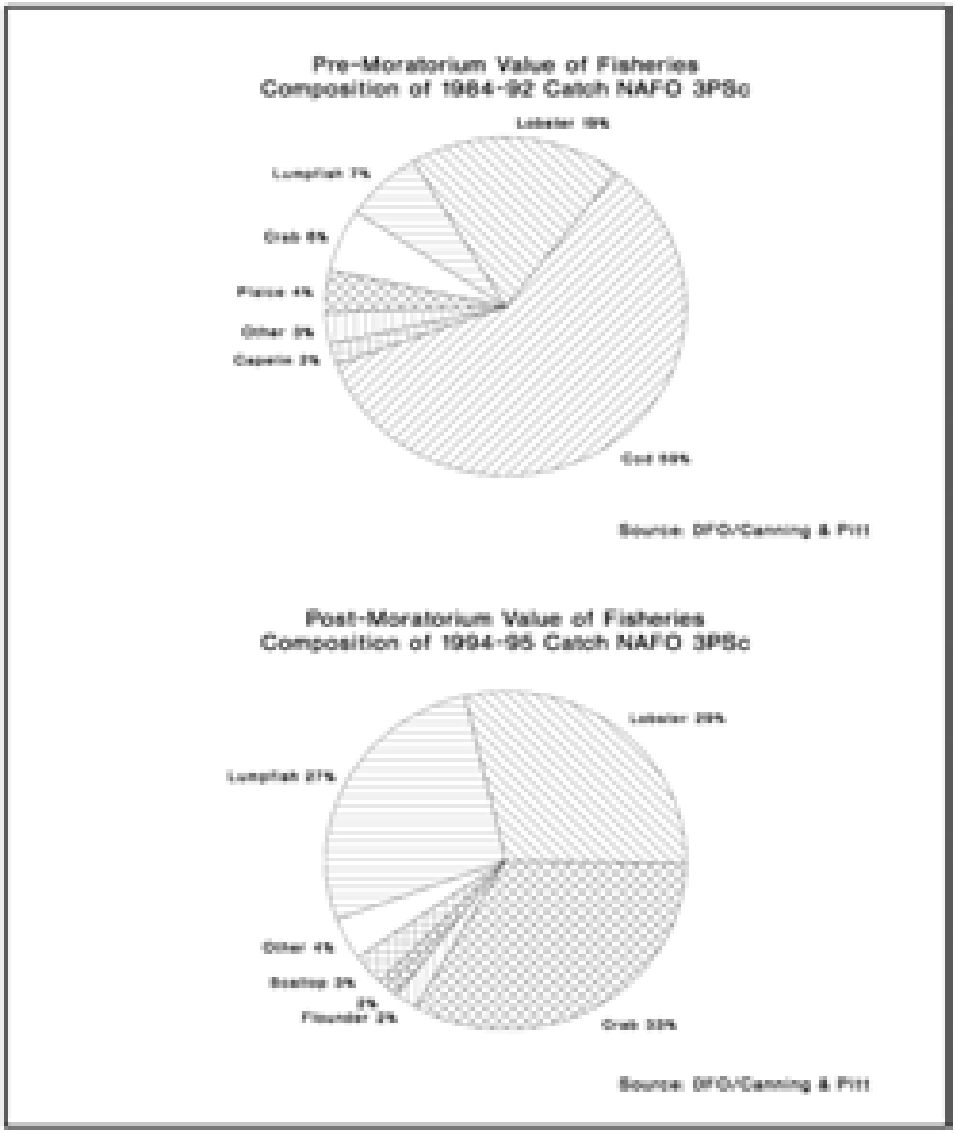

Figure 2

Between the landings highpoint in 1986 and the 1995 harvest, the quantity of biomass taken from Placentia Bay declined from more than 19,000 tonnes to under 3,000 tonnes, a drop of 85%. However, the landed value of the 3PSc fishery did not experience a similar decline, owing to the changed composition of the catch, made up - in 1995 - primarily of high-priced species such as lobster, snow crab and lumpfish roe. In that year, the value of the fishery was only 8% lower than in 1986 ($9,740,000 vs. $10,634,000). Total value continued to rise after 1995 and, by 2002, the harvest from 3PSc was worth more than $18 million; this was nearly 180% of the value of the harvest in 1986 - the peak harvesting year within the 1986-2005 timeframe. Even with weaker prices in recent years, snow crab is still a very valuable species in this area.

A limited cod fishery was reinstated in 3PSc in 1997 under a strict management regime, and during 2000-2002 cod again accounted for nearly 60% of the harvest by quantity,

though in recent years quotas have been reduced once more. The following graphs show the changes in the quantity of the harvest from 3PSc over the last 20 years (1986 – 2005). Figure 3 shows the overall quantity harvested (all species), and Figure 4 contrasts groundfish and shellfish harvests (mainly snow crab, scallops and lobster) over this period.

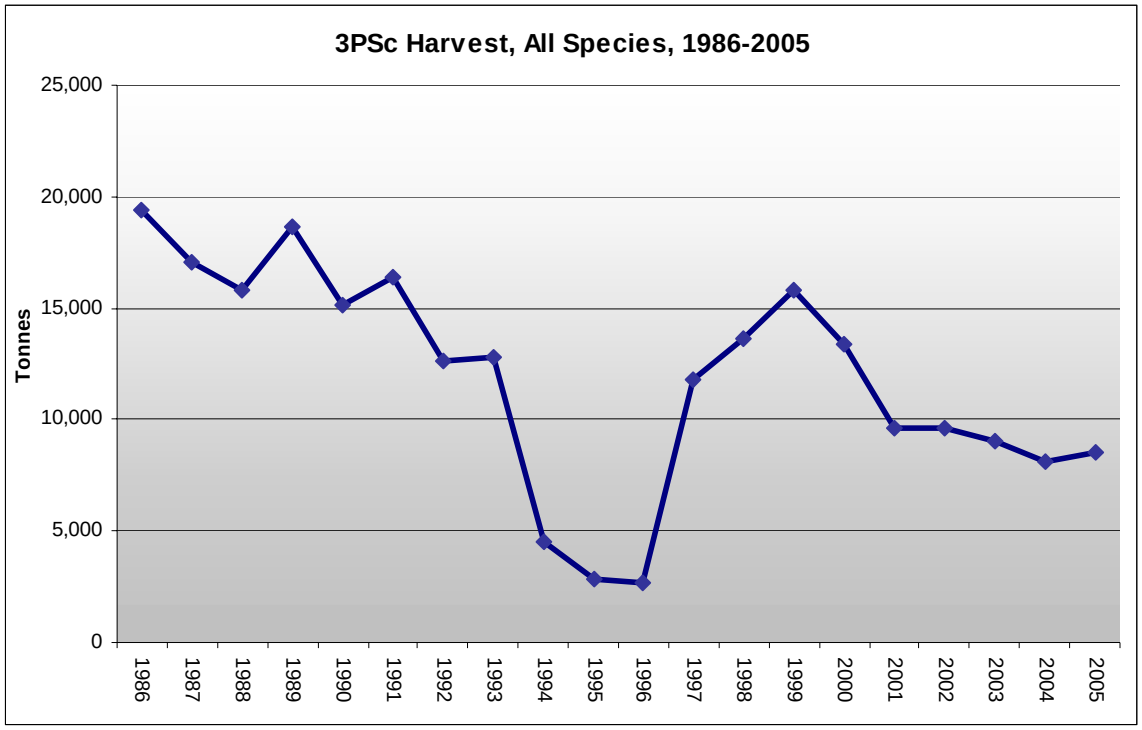

Figure 3

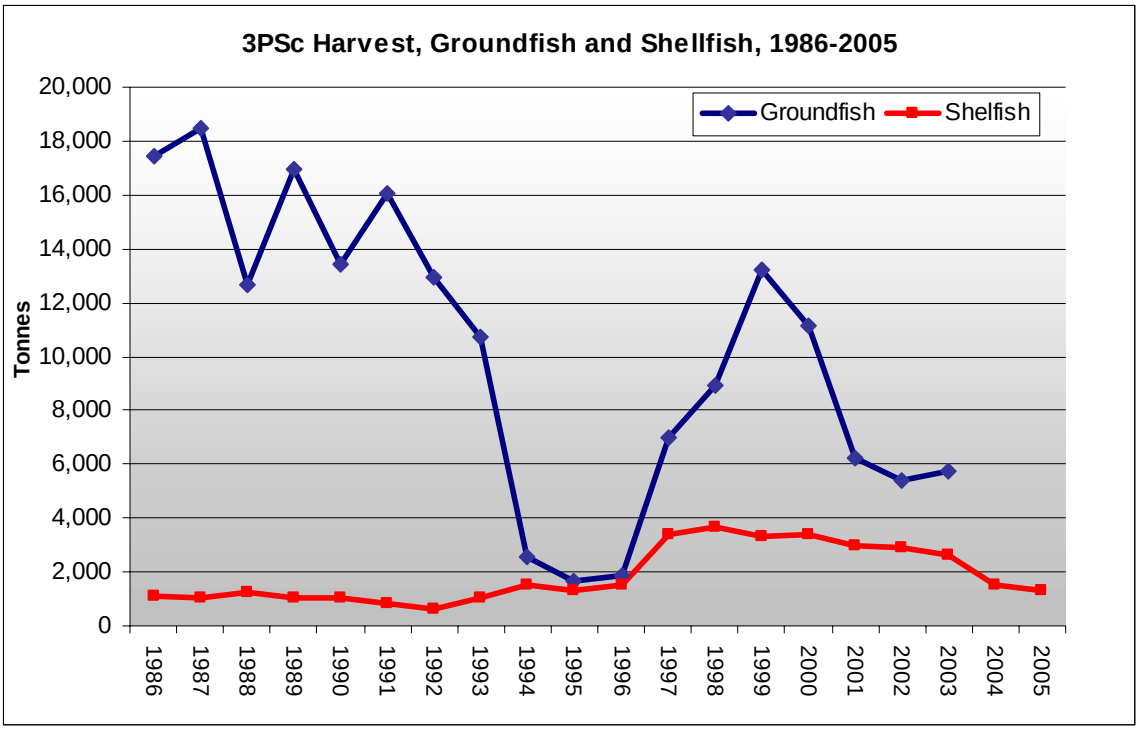

Figure 4

Since the mid-1990s, the fisheries and fisheries management and licencing regimes in Placentia Bay have continued to evolve. Most significantly, a fish harvesting rationalization strategy was implemented in the province that reduced the number of participants in the harvesting sector, and a professionalization process was introduced which prescribed specific levels of experience and training required to be a professional fish harvester. Along with this system, DFO introduced the "core" harvesting enterprise designation, with restrictions on harvesting by those who are not part of such an enterprise.

3.2. Current Commercial Fisheries

The following sections provide more information on key aspects of present-day Placentia Bay fisheries.

3.2.1. Harvesting

The following Table shows the composition of the harvest in 3PSc in recent years, based on 2003-2005 landings (averaged). As these data show, cod is still by far the most important species harvested in the area, with snow crab, herring and lumpfish (roe fishery), scallops and a few other groundfish species making up most of the remainder.

Table 1: 3PSc Harvest, 2003-2005 (Annual Average)

Species	Tonnes	% of Total
Atlantic Cod	4,805.2	56.3%
Haddock	16.1	0.2%
Redfish	5.1	0.1%
Halibut	4.4	0.1%
American Plaice	198.0	2.3%
Yellowtail Flounder	6.5	0.1%
Winter Flounder	86.1	1.0%
Skate	56.8	0.7%
Pollock	48.8	0.6%
White hake	198.9	2.3%
Monkfish	55.6	0.7%
Hagfish	60.2	0.7%
Lumpfish (roe weight only)	379.9	4.5%
Herring	754.6	8.8%
Mackerel	12.3	0.1%
Capelin	25.1	0.3%
Scallops	17.9	0.2%
Icelandic Scallops	100.6	1.2%
Sea Cucumbers	192.54	2.3%
Whelks	28.4	0.3%
Sea Urchins	31.5	0.4%
Lobster	71.9	0.8%
Snow Crab	1,367.6	16.0%
All others	7.9	0.1%
Total	8,532.1	100.0%

[1] Although the DFO data identify this harvest as "sea cucumbers" (*Cucumaria frondosa*), DFO managers consulted believe this is an error in the dataset, either associated with the incorrect Unit Area designation (sea cucumbers are harvested off St. Pierre Bank in 3PS), or the incorrect species code was used when the data were entered. If the latter, these may be scallops (code 618 vs. code 619).

Currently, some harvesting is conducted year-round, as it was in the pre-moratorium (1984-1992) period, though in recent years it has been much less evenly distributed throughout the months as it once was (see Figure 5). Since 1996, the peak harvesting months have been June and July, but there has also been a fairly strong fishery in the late fall (primarily for cod), as indicated in the graph.

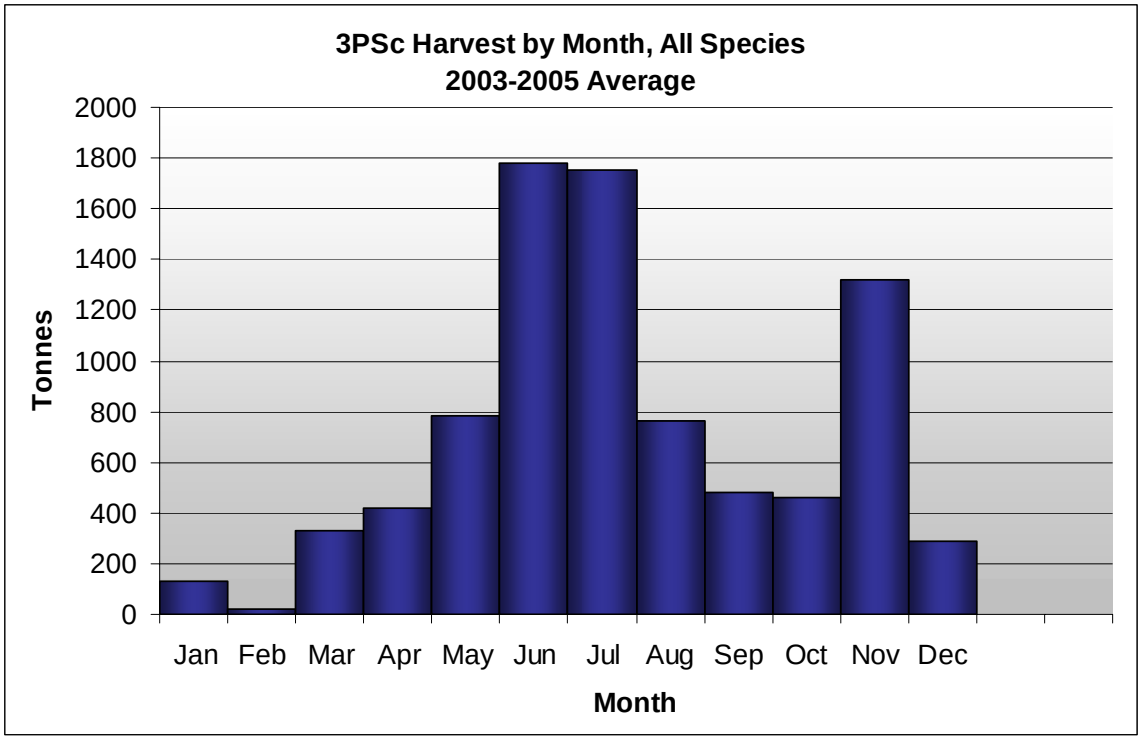

Figure 5

The following graphs show the timing of the 2003-2005 cod and snow crab harvests separately.

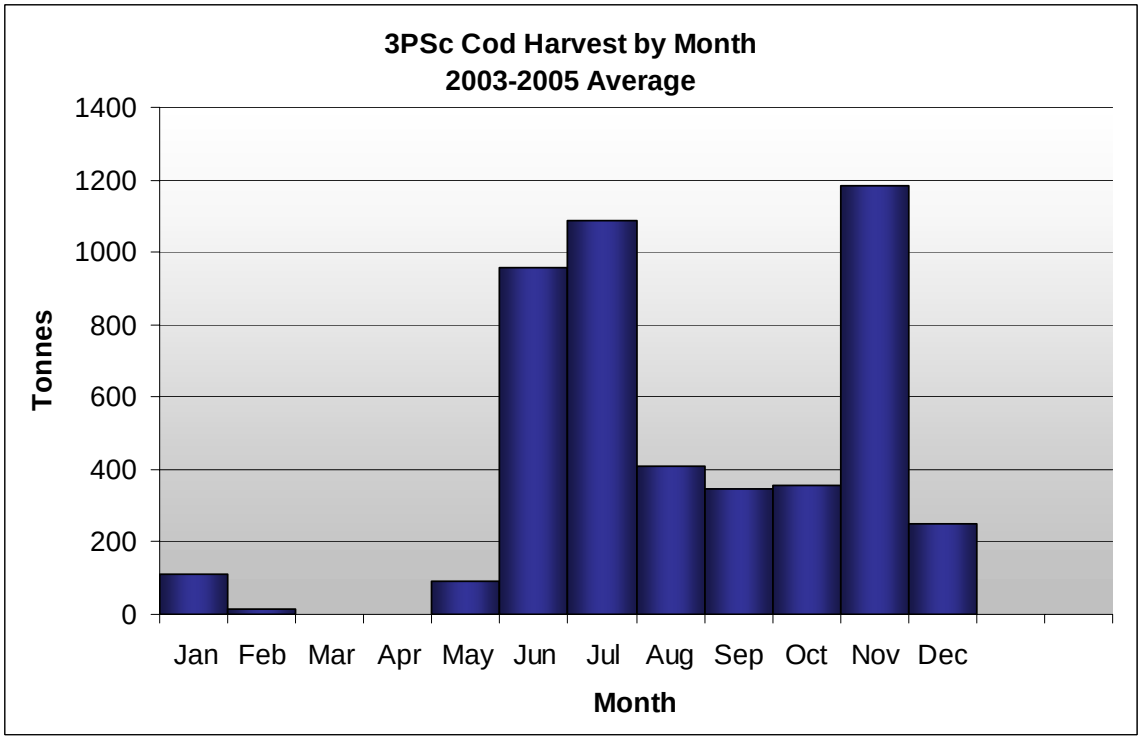

Figure 6

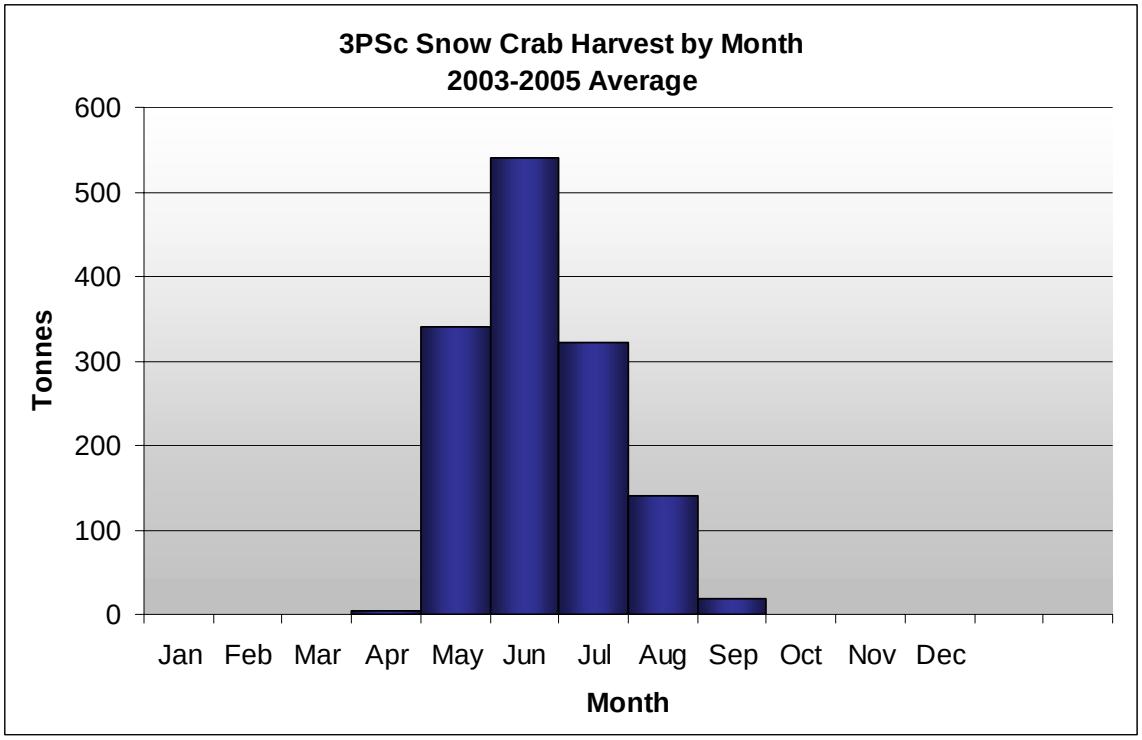

Figure 7

In terms of economic value, the area's commercial fishers currently depend on three, high-value species - lobster, snow crab and cod - for the bulk of their annual fishing income. While lobster accounts for only a small percentage by weight of the annual catch, given its high value this species remains very important to many study area fishers. Although the herring fishery is important (especially as bait), it does not have the direct economic value of the other three fisheries.

In many cases the fishing gear used is specific to the species harvested: pots for snow crab, scallop drags for scallops, diving for sea urchins. Cod is harvested using several gear types, but primarily (87% , 2003-2005) it is harvested with gillnets in this area. Table 2 shows the quantity of the harvest by each gear type for the 2003-2005 period.

Table 2: 3PS Harvest by Gear Type, 2003-2005 Average

Gear	Tonnes	% of Total
Stern Otter Trawl	58.8	0.7%
Danish Seine	1.2	0.0%
Beach/Drag/Bar Seine	37.5	0.4%
Purse Seine	644.7	7.6%
Gillnet	5,266.7	61.7%
Longline	329.2	3.9%
Hand Line	267.4	3.1%

Gear	Tonnes	% of Total
Trap Net	56.5	0.7%
Trap/Pot	1,465.5	17.2%
Drag/Dredge	311.1	3.6%
Diving	31.5	0.4%
Hagfish Barrel	60.2	0.7%
All Other	1.9	0.0%
Total	8,532.0	100.0%

The following maps show the locations recorded in the DFO georeferenced dataset for all species, 2003 - 2005. As noted, however, this represents a small sub-set of the 3PSc harvest. Some species (e.g. lobster) are not represented at all in these data.

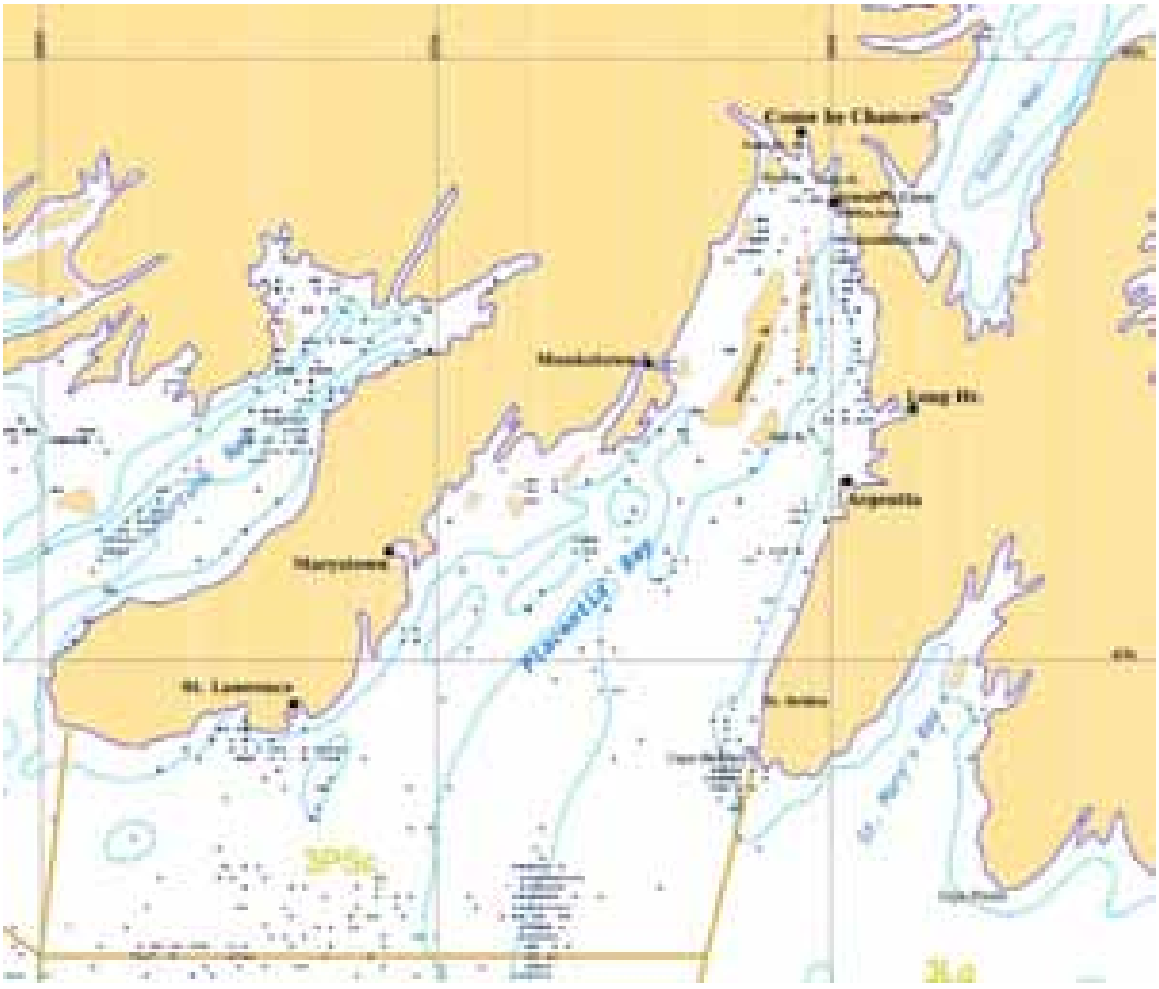

Figure 8: 3PSc Harvesting Locations, January - December 2003 (All Species in Geo-Referenced Sub-Set)

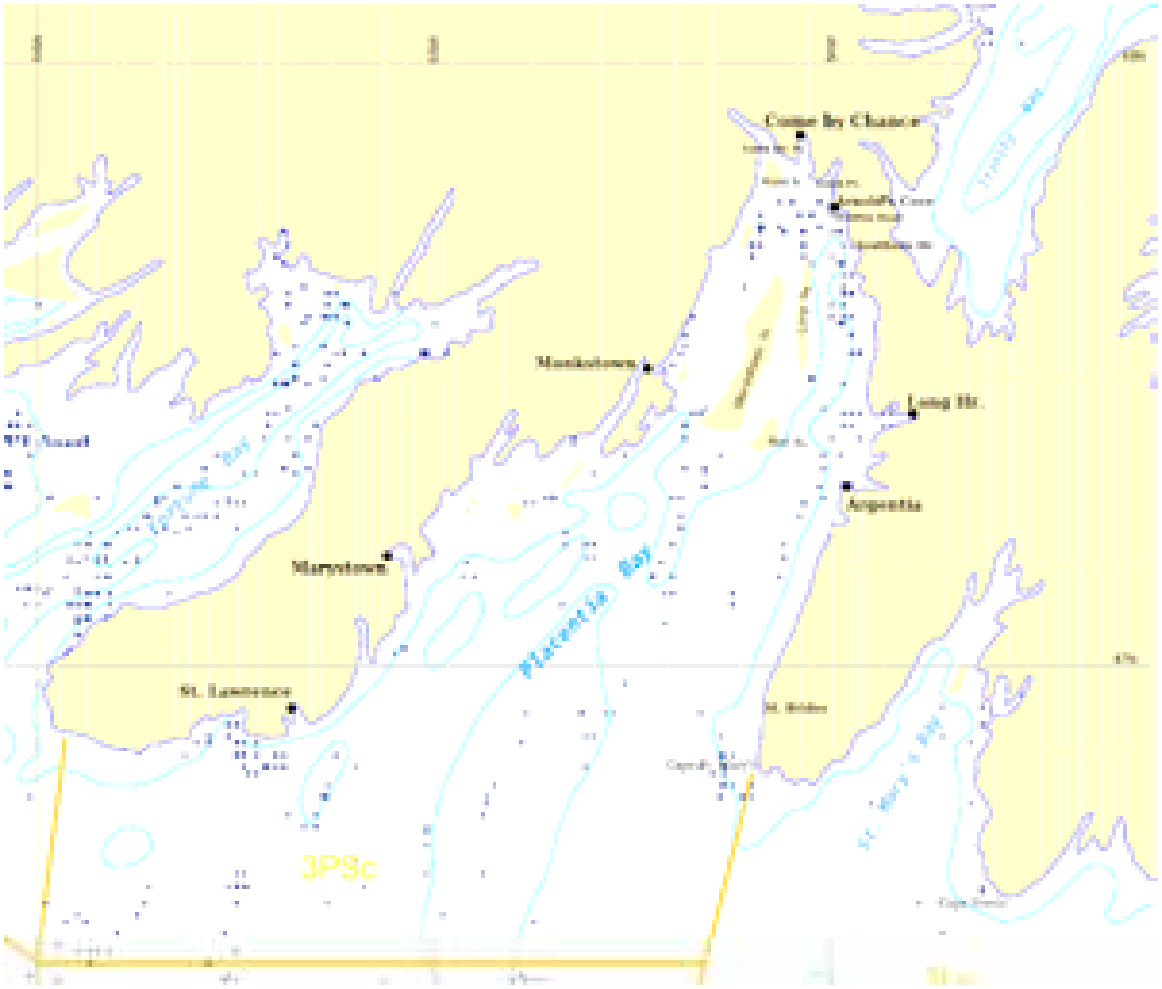

Figure 9: 3PSc Harvesting Locations, January - December 2004 (All Species in Geo-Referenced Sub-Set)

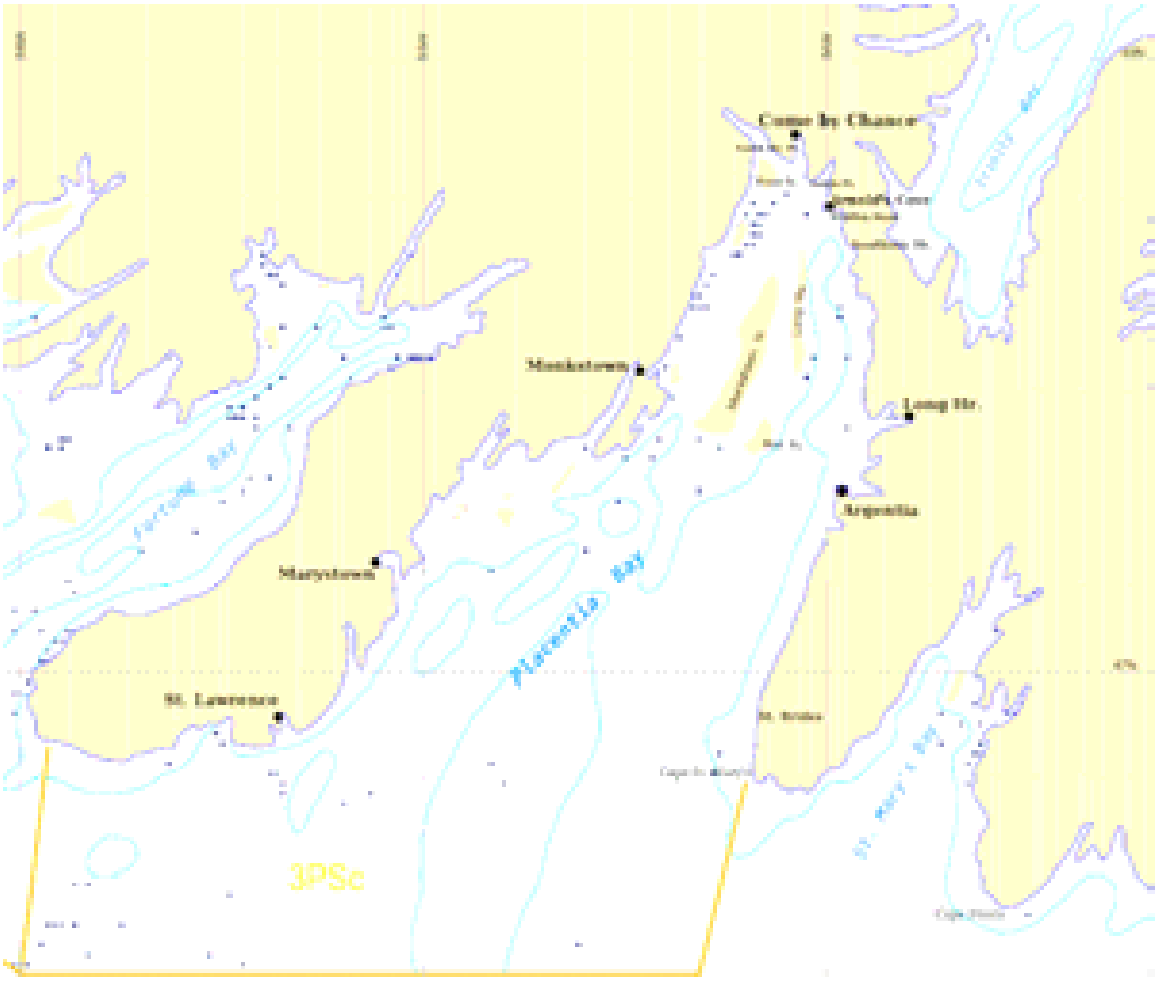

Figure 10: 3PSc Harvesting Locations, January - December 2005 (All Species in Geo-Referenced Sub-Set)

3.2.2 Fishing Enterprises, Fishers and Fishing Licences

Data on the number or core and non-core fishing enterprises in the study area, as well as information on the distribution of species licences, were provided by DFO's Licensing Branch in St. John's. The latest data readily available for the purpose of this background report was for the year 2003. It is likely that these data adequately reflect the current (2005-2006) situation in the study area.

Tables 3(a), 3(b) and 3(c) show the number of core and non-core enterprises by community and vessel length for Placentia Bay (Fishing Area 10) in 2003.[3] Table 4 lists the numbers of licences.

[3] A "core" fishing enterprise is a commercial fishing enterprise holding key species licences, under a system established by DFO in 1996. New core enterprises are not normally created, though existing enterprises may be transferred to a new eligible harvester. DFO requires that the transfer go to a Level II

Table 3(a): Number of Core Enterprises and Vessel Size, Placentia Bay (2003 Data)

Home Port	<35 ft	35-64 ft	Total
St. Bride's	30	10	40
Patrick's Cove	1		1
Placentia (Incl Southeast)	10	11	21
Dunville	5		5
Jerseyside	2	1	3
Freshwater, P. Bay	1		1
Fox Harbour	5	3	8
Ship Harbour	6	1	7
Long Harbour	2	1	3
Mt. Arlington Heights	2		2
Fair Haven	13	1	14
Little Harbour East P.B.	12	5	17
Southern Harbour	28	16	44
Arnold's Cove	21	3	24
Come By Chance	4		4
North Harbour, P.B.	13	1	14
Garden Cove	6		6
Swift Current	2	1	3
Prowseton & Sand Hr. (Vacated)	4	1	5
Davis Cove (Vacated)	6	1	7
Old Cove-Woody Island (Vacated)	1		1
Bar Haven (Vacated)	2		2
Haystack (Vacated)	1		1
Red Island (Vacated)	4		4
Brewley (Vacated)	1		1
Merasheen (Vacated)	5		5
Tack's Beach (Vacated)	2		2

professional fish harvester as certified by the Professional Fish Harvesters Certification Board (PFHCB) of Newfoundland and Labrador. A non-core enterprise is one holding other (perhaps single) species licences.

Home Port	**<35 ft**	**35-64 ft**	**Total**
Isle Au Valen (Vacated)	3		3
Little Paradise (Vacated)	2	2	4
Great Paradise (Vacated)	2		2
South East Bight	23	2	25
Monkstown	5	1	6
Petite Forte	17	3	20
Port Ann (Vacated)	1		1
Boat Hr (Inc. Brookside)	8		8
Parkers Cove	11		11
Baine Harbour	8	3	11
Rushoon	2	1	3
Oderin (Vacated)	2		2
Red Harbour	16	1	17
Jean De Baie	1		1
Rock Harbour	1		1
Little Bay, P.B.		1	1
Beau Bois	1		1
Fox Cove (Near Burin)	1		1
Port Au Bras	1	1	2
Burin	17	7	24
Little St. Lawrence	1		1
St. Lawrence	9	7	16
Lawn	10	11	21
Lord's Cove	13	1	14
Point Au Gal	10		10
Lamaline	17	1	18
Point May	8		8
Total	**379**	**98**	**477**

Table 3 (b): Number of Non-core Enterprises and Vessel Size, Placentia Bay (2003 Data)

Home Port	**<35 ft**	**35-64 ft**	**Total**
Placentia (Incl Southeast)	3		3
Jerseyside	1		1
Freshwater, P. Bay	2		2
Fox Harbour	2		2
Ship Harbour	1		1
Long Harbour	1		1
Mt. Arlington Heights	1		1
Fair Haven	3		3
Little Harbour East P.B.	4		4
Southern Harbour	6		6
North Harbour, P.B.	2		2
Garden Cove	2		2
Swift Current	1		1
Red Island (Vacated)	1		1
Merasheen (Vacated)	1		1
South East Bight	1		1
Monkstown	1		1
Boat Hr (Inc. Brookside)	2		2
Parkers Cove	1		1
Burin	2		2
Little St. Lawrence	2		2
St. Lawrence	4		4
Lawn	4		4
Lord's Cove	2		2
Lamaline	1		1
Total	**51**		**51**

*Key Licence Holders Only

Table 3(c): Number of Core and *Non-core Enterprises and Vessel Size, Placentia Bay (2003)

Home Port	<35 ft	35-64 ft	Total
St. Bride's	30	10	40
Patrick's Cove	1		1
Placentia (Incl Southeast)	13	11	24
Dunville	5		5
Jerseyside	3	1	4
Freshwater, P. Bay	3		3
Fox Harbour	7	3	10
Ship Harbour	7	1	8
Long Harbour	3	1	4
Mt. Arlington Heights	3		3
Fair Haven	16	1	17
Little Harbour East P.B.	16	5	21
Southern Harbour	34	16	50
Arnold's Cove	21	3	24
Come By Chance	4		4
North Harbour, P.B.	15	1	16
Garden Cove	8		8
Swift Current	3	1	4
Prowseton & Sand Hr. (Vacated)	4	1	5
Davis Cove (Vacated)	6	1	7
Old Cove-Woody Island (Vacated	1		1
Bar Haven (Vacated)	2		2
Haystack (Vacated)	1		1
Red Island (Vacated)	5		5
Brewley (Vacated)	1		1
Merasheen (Vacated)	6		6
Tack's Beach (Vacated)	2		2
Isle Au Valen (Vacated)	3		3
Little Paradise (Vacated)	2	2	4

Home Port	**<35 ft**	**35-64 ft**	**Total**
Great Paradise (Vacated)	2		2
South East Bight	24	2	26
Monkstown	6	1	7
Petite Forte	17	3	20
Port Ann (Vacated)	1		1
Boat Hr (Inc. Brookside)	10		10
Parkers Cove	12		12
Baine Harbour	8	3	11
Rushoon	2	1	3
Oderin (Vacated)	2		2
Red Harbour	16	1	17
Jean De Baie	1		1
Rock Harbour	1		1
Little Bay, P.B.		1	1
Beau Bois	1		1
Fox Cove (Near Burin)	1		1
Port Au Bras	1	1	2
Burin	19	7	26
Little St. Lawrence	3		3
St. Lawrence	13	7	20
Lawn	14	11	25
Lord's Cove	15	1	16
Point Au Gal	10		10
Lamaline	18	1	19
Point May	8		8
Total	**430**	**98**	**528**

*Key Licence Holders Only

Table 4 : Core, Non-core and Recreational Licences (832 Fishers), Placentia Bay (2003)

Species	**Total Licences**
Bait	371
Capelin Fg	100
Capelin Ps	1
Eel	6
Groundfish Fg	518
Herring Fg	124
Herring Ps	10
Lobster	345
Mackerel Fg	105
Mackerel Ps	8
Salmon Atlantic	5
Scallop	225
Scallop Recreational	265
Seal	53
Seal Personal Use	42
Snow Crab Inshore	401
Snow Crab Supplementary	68
Squid	245
Tuna Bluefin	4
Whelk	86
Total	2,982

4. Overview of Placentia Bay Aquaculture Sector

4.1 Aquaculture Development and Current Activities

To date, the majority of the aquaculture development and investment activities in southern Newfoundland have been concentrated in the Bay d'Espoir and Fortune Bay areas. The province's aquaculture Strategic Plan notes "The Newfoundland salmonid industry is located in Bay d'Espoir, the only area of the province that is suitable for the growing of steelhead trout and salmon."[4] However, DFA aquaculture managers believe that Placentia Bay has many of the desirable characteristics of Bay d'Espoir. As such, they are confident that Placentia Bay has significant growth opportunities, including possibilities for the development of salmon and rainbow trout farming, as well as further expansion of existing cod and mussel operations.

The development of aquaculture resources in Placentia Bay has been underway since about the mid-1990s. In 1997 there were about seven licenced aquaculture operations, and several applications pending to investigate and/or develop additional sites. (Two sea urchin sites were later approved but by 2003 these were no longer active. A cod hatchery was also established in Placentia Bay in the early 1990s, but this was subsequently destroyed by fire.)

DFA reports that, during 2000-2003, there was significant level of expansion in the Placentia Bay aquaculture sector, and a considerable interest in the development of new sites - particularly on the Burin Peninsula side of the bay, and around Merasheen Island. During this period, DFA deployed thermographs in numerous locations to monitor water temperatures in order to assess whether such areas might be suitable for aquaculture.

By 2003 there were 15 approved aquaculture operations, including six blue mussel sites and nine cod grow-out facilities.[5] At that point, most of these aquaculture sites were still at a "developmental" stage, i.e. they had product in the water, but no significant amount of commercial sales. In 2004, DFA reported that only four operators were selling their product on a commercial basis.[6] Nevertheless, based on discussions with DFA experts and 2004 production and sales data obtained from selected aquaculture enterprises, the annual value of aquaculture production (after primary processing) in Placentia Bay was estimated at $500,000.[7]

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[4] Burke Consulting. 2000. Strategic Plan: Newfoundland and Labrador Aquaculture. Prepared in collaboration with Resource Development Associates.

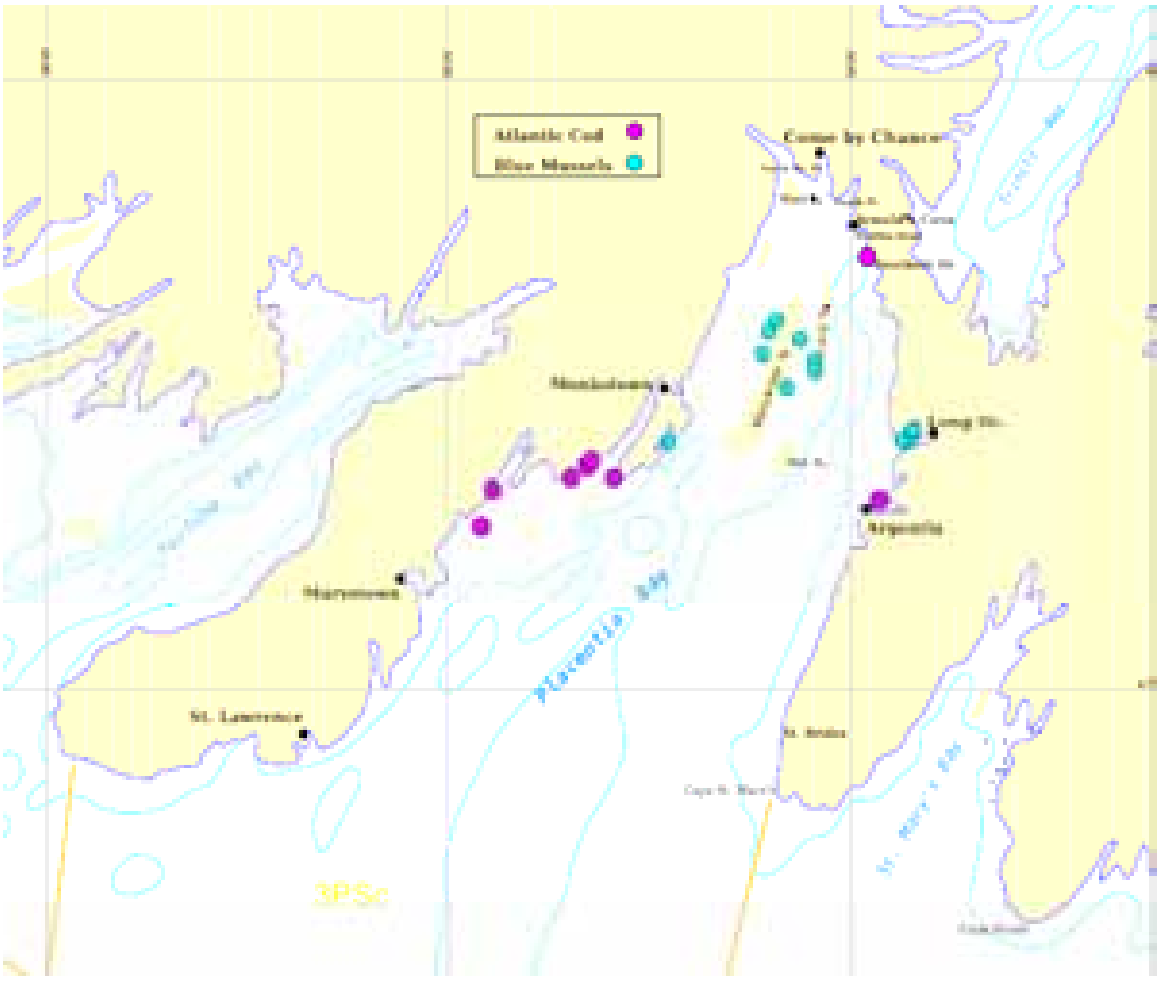
[5] As of 2004, there were still no full-cycle ("egg to plate") cod aquaculture operations in the province, and all cod enterprises are thus "grow-out" facilities. However, current production of farmed cod is limited because of restrictions on taking wild cod for any purpose (DFA managers, pers comms., 2004)

[6] These included a cod farming facility on Jerseyman Island, two blue mussel farms at Crawley Island/St. Croix Bay and another mussel operation on Merasheen Island.

[7] Canning and Pitt Associates. 2005. Placentia Bay Project Benefits Study: Marine Institute Canadian Centre for Marine Communications.

At present, there are 19 “active” (commercial or “developmental”) aquaculture operations in the Placentia Bay area.[8] However, DFA managers note that several 2006 sites are still awaiting final approval.[9] Figure 11 shows the geographic location of existing aquacultural activities in Placentia Bay, and Table 5 provides relevant, more detailed information on these 11 blue mussel farms and 8 Atlantic cod grow-out operations.

Figure 11 – Existing Aquaculture Sites in Placentia Bay (2006)



Source. DFA site location data in Table 1.1 (from T. Budgell, August 2006)

[8] DFA managers report that, if an aquaculture site is licenced, it is deemed to be "active", even though it may not be at the commercial production stage, i.e. currently selling its product. It was also noted that, although their licences have been renewed annually, most of the Atlantic cod operations have had little or no activity over the past several years due to moratoria. Further, most of the area’s cod sites are classed as “developmental” licences (for reasons related to the original intent of the cod grow-out sector and associated land tenure issues). Managers also note that even “developmental” mussel licences are considered active since these operations have gear deployed in the water, and hence “aquaculture” is being conducted (T. Budgell, pers comm., August 2006).

[9] DFA notes that there is no guarantee that all of these applications will receive final approval.

Table 5. Placentia Bay Aquaculture Sites (2006): Enterprise Name, Location and Species

Company	Site Location	Lat Deg	Lat Min	Lng Deg	Lng Min	Species
Hollett, Mervin *	Port Royal Arm	47	32.5	54	5.62	Blue Mussels
Jones, Ambrose	Petite Forte	47	23.4	54	39.99	Atlantic Cod
Keating, Joseph (Baie Sea Farms)	Crawley Island, Long Harbour	47	25.5	53	51.33	Blue Mussels
Keating, Joseph (Baie Sea Farms)	Crawley Island	47	25.5	53	52.43	Blue Mussels
Keating, Joseph (Baie Sea Farms)	St. Croix Bay	47	26.8	53	51.57	Blue Mussels
Leonard, Peter W.	Southern Harbour	47	42.8	53	57.6	Atlantic Cod
Merasheen Mussel Farms Inc. *	Barren Island	47	31.2	54	6.36	Blue Mussels
Merasheen Mussel Farms Inc. *	Jean de Gaunt Island	47	32.9	54	13.09	Blue Mussels
Merasheen Mussel Farms Inc. *	Presque Harbour	47	24.8	54	29.7	Blue Mussels
Merasheen Mussel Farms Inc. *	Rose au Rue	47	30.1	54	10.86	Blue Mussels
Merasheen Mussel Farms Inc. *	Dog Harbour	47	34.7	54	8.6	Blue Mussels
Moulton, Clayton	Flat Island Harbour	47	16.12	54	55.15	Atlantic Cod
Norman, Bernard	Jerseyman Island	47	20.09	54	53.24	Atlantic Cod
Pevie, Joseph and Pearson, Christopher	Woody Island	47	22.38	54	42.34	Atlantic Cod
Pomeroy, Donald A. & Barry, John Jr.	Petite Forte Harbour	47	24.06	54	39.49	Atlantic Cod
Pomeroy, Donald A. & Barry, John Jr.	Gaultoin's Cove (near Great Paradise)	47	20.9	54	35.4	Atlantic Cod
Sapphire Sea Farms Ltd.	Dunville	47	15.9	53	55.11	Atlantic Cod
Warren, Christopher J.	Big South West Cove, Merasheen	47	34.43	54	10.35	Blue Mussels
Warren, Christopher J.	Merasheen Island	47	36.22	54	9.85	Blue Mussels

Source: DFA, Newfoundland and Labrador (T. Budgell, DFA Grand Falls, August 2006)
* DFA indicates that applications for these operations are still under review/licence not yet approved

In addition to the above, information available from DFA indicates that, during the past decade or so, aquacultural activities have been approved, developed or proposed at additional sites within Placentia Bay. However, the department currently considers all of these sites as "inactive" and "abandoned"; these files are now closed, and the sites have reverted to the Crown. In future, however, some of these sites may be re-activated, and thus it may be useful to list these locations, if only to indicate the potential for a more widespread development of the area's aquaculture sector in future. Table 6 indicates the location and species of these previously licenced, or proposed, aquaculture sites.

Table 6. Other "Potential" Placentia Bay Aquaculture Sites (ca. 1997-2005)

Site Location	Species	Previous Status (if known)
Bar Haven	Blue Mussels	Developmental
Bar Haven (north of Haddock Head)	Blue Mussels	Commercial
Gulch Head	Blue Mussels	Unknown
Bar Haven	Blue Mussels	Commercial
Cooper Island	Sea Urchins	Developmental
Fox Cove	Atlantic Cod	unknown
Jigging Cove (near Monkstown)	Atlantic Cod	unknown
Southern Harbour	Atlantic Cod	Developmental
Monkstown	Atlantic Cod	Developmental
Spanish Room Point	Atlantic Cod	unknown
Cross Island	Blue Mussels	Developmental
Petite Forte Harbour	Atlantic Cod	unknown
Petite Forte Harbour	Atlantic Cod	unknown
Muddy Hole, Sound Island	Atlantic Cod	Developmental
Jerseyman Island	Steelhead Trout	Research
West of Chambers Island	Atlantic Cod	unknown
North of Little Chambers Island	Atlantic Cod	unknown
Southwest of Isle Valen	Atlantic Cod	unknown
South of Isle Valen	Atlantic Cod	unknown
North of Little Isle Valen	Atlantic Cod	unknown

Site Location	Species	Previous Status (if known)
Southwest of Chambers Island	Atlantic Cod	unknown
Northeast Nonsuch Arm	Atlantic salmon	unknown
Boat Harbour	Atlantic Salmon	unknown

Source: DFA licence files (2003/2004); AquaGIS.com data; and Todd Budgell, pers comm., August 2006

Annex 1. Agencies and Persons Consulted

Department of Fisheries and Aquaculture (2004* and 2006 Consultations)

Mike Warren, Executive Director, Policy and Planning

Todd Budgell, Manager of Aquaculture Licencing and Inspections

Shawn Robinson*, Director of Aquaculture

Brent Tompkins*, Aquaculture Development Officer

Elizabeth Barlow*, Salmonid Aquaculturalist

Steve Moyse*, Aquaculture Planning Analyst

Paul James*, Aquaculture Development Officer

Annex 2. References and Information Sources

Burke Consulting. 2000. Strategic Plan: Newfoundland and Labrador Aquaculture. Prepared in collaboration with Resource Development Associates.

Canning and Pitt Associates. 2005. Placentia Bay Project Benefits Study: Marine Institute Canadian Centre for Marine Communications.

Canning and Pitt Associates. 2004. Placentia Bay Commercial Fisheries 1996-2003: Newfoundland Transshipment Limited.

Canning & Pitt Associates. 1997. Whiffen Head and Placentia Bay: Commercial Fisheries Environment, in TERMPOL Review Process for Newfoundland Transshipment Limited.

Canning & Pitt Associates. 1996. Newfoundland Transshipment Terminal Environmental Assessment: Section 4.8 Commercial Fisheries.

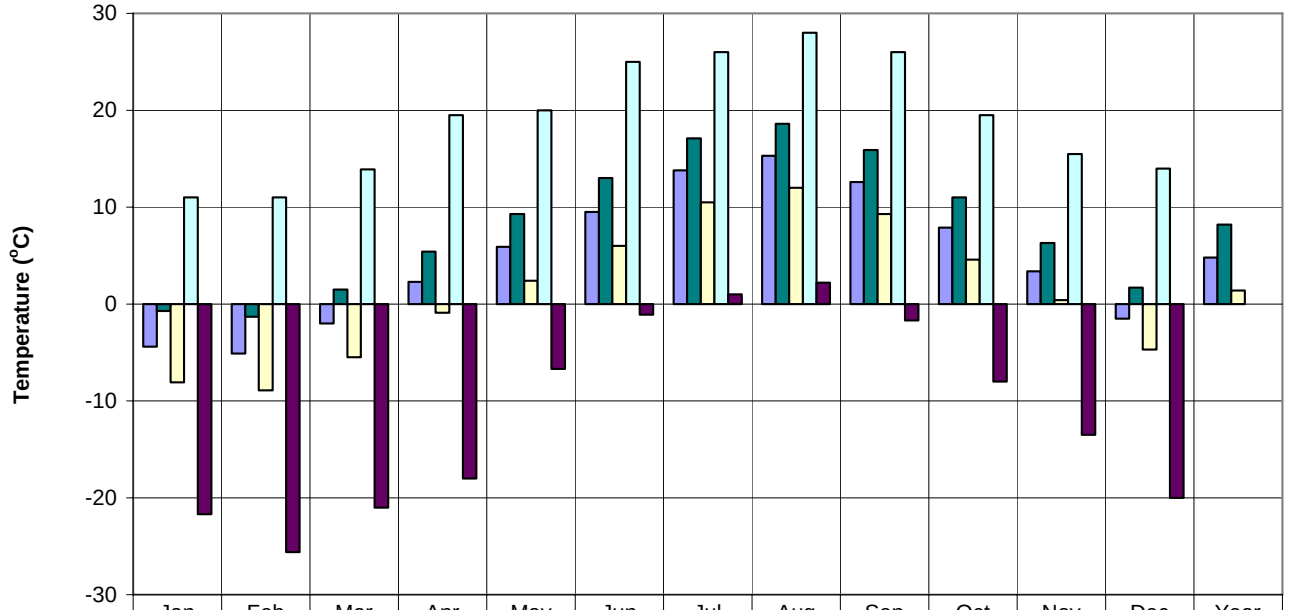
Department of Fisheries and Aquaculture Newfoundland and Labrador (DFA). 2004. Aquaculture Geographic Information System, www.AquaGIS.com

DFO. Catch and Effort Data,1980 - 2006

Appendix 'D'
Climatology Summaries

Station Active From 1971-1994

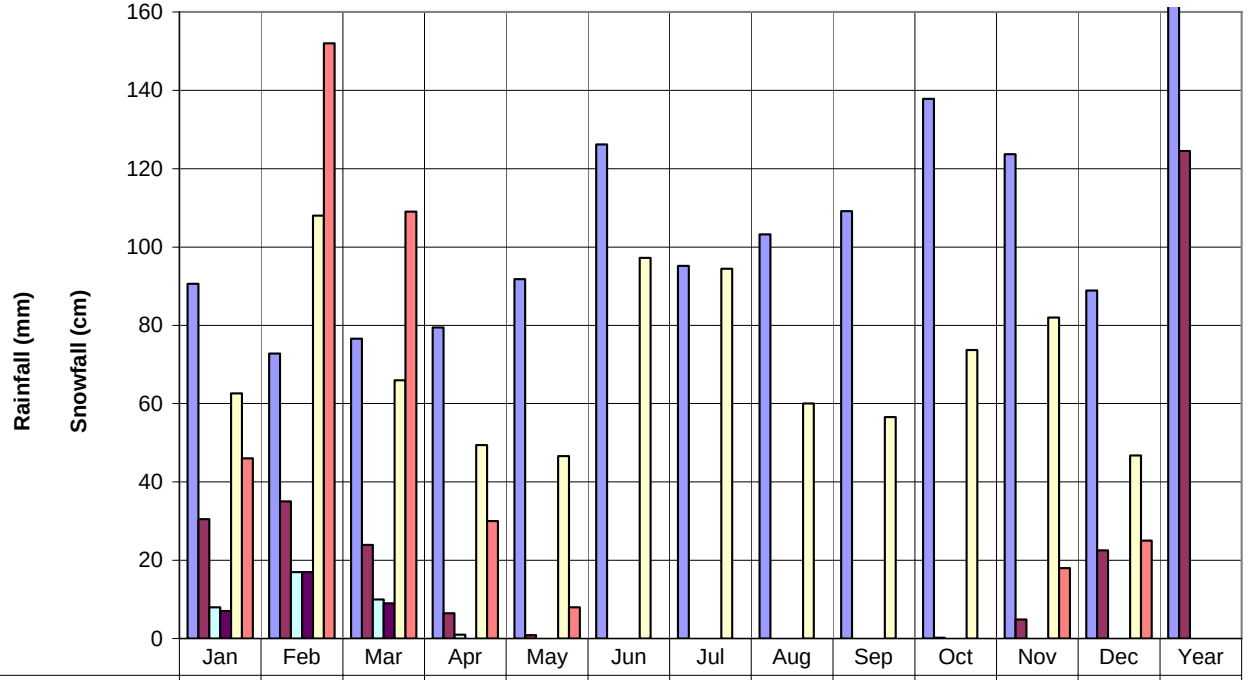
Air Temperature
Arnolds Cove



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average (°C)	-4.4	-5.1	-2	2.3	5.9	9.5	13.8	15.3	12.6	7.9	3.4	-1.5	4.8
Daily Maximum (°C)	-0.7	-1.3	1.5	5.4	9.3	13	17.1	18.6	15.9	11	6.3	1.7	8.2
Daily Minimum (°C)	-8.1	-8.9	-5.5	-0.9	2.4	6	10.5	12	9.3	4.6	0.4	-4.7	1.4
Extreme Maximum (°C)	11	11	13.9	19.5	20	25	26	28	26	19.5	15.5	14	
Extreme Minimum (°C)	-21.7	-25.6	-21	-18	-6.7	-1.1	1	2.2	-1.7	-8	-13.5	-20	

Station Active From 1971-1994

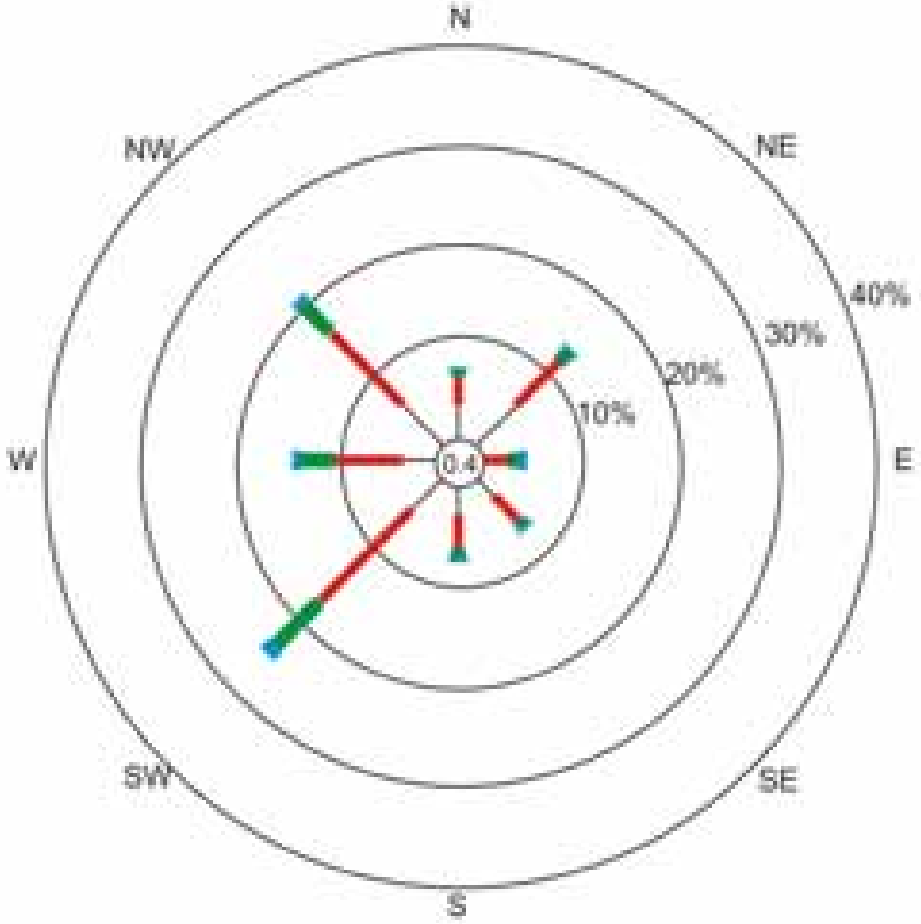
Precipitation
Arnolds Cove



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average Rainfall (mm)	90.6	72.8	76.6	79.4	91.8	126.2	95.2	103.2	109.2	137.8	123.7	88.9	1195.5
Average Snowfall (cm)	30.5	35	23.9	6.5	0.9	0	0	0	0	0.2	4.9	22.5	124.5
Average Snow Depth (cm)	8	17	10	1	0	0	0	0	0	0	0		
Median Snow Depth (cm)	7	17	9	0	0	0	0	0	0	0	0		
Extreme Daily Precipitation (mm)	62.6	108	66	49.4	46.6	97.2	94.4	60	56.6	73.7	82	46.8	
Extreme Snow Depth (cm)	46	152	109	30	8	0	0	0	0	0	18	25	

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: January

Prepared by amec
September 7, 2006



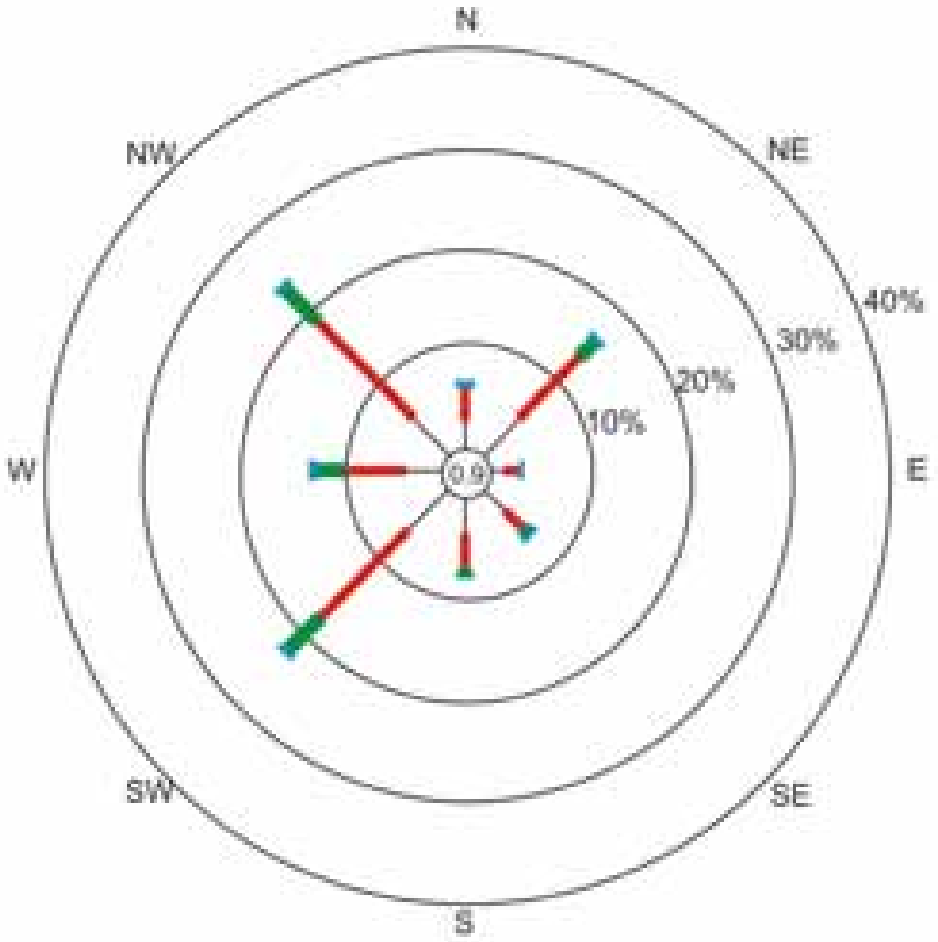
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	1774	13.6
E	555	4.3
SE	868	6.7
S	919	7.1
SW	3240	24.9
W	1921	14.8
NW	2763	21.2
N	931	7.1
Calm	50	.4
Missing	3347	20.4

Total # of Obs. = 13021

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: February

Prepared by amec
September 7, 2006



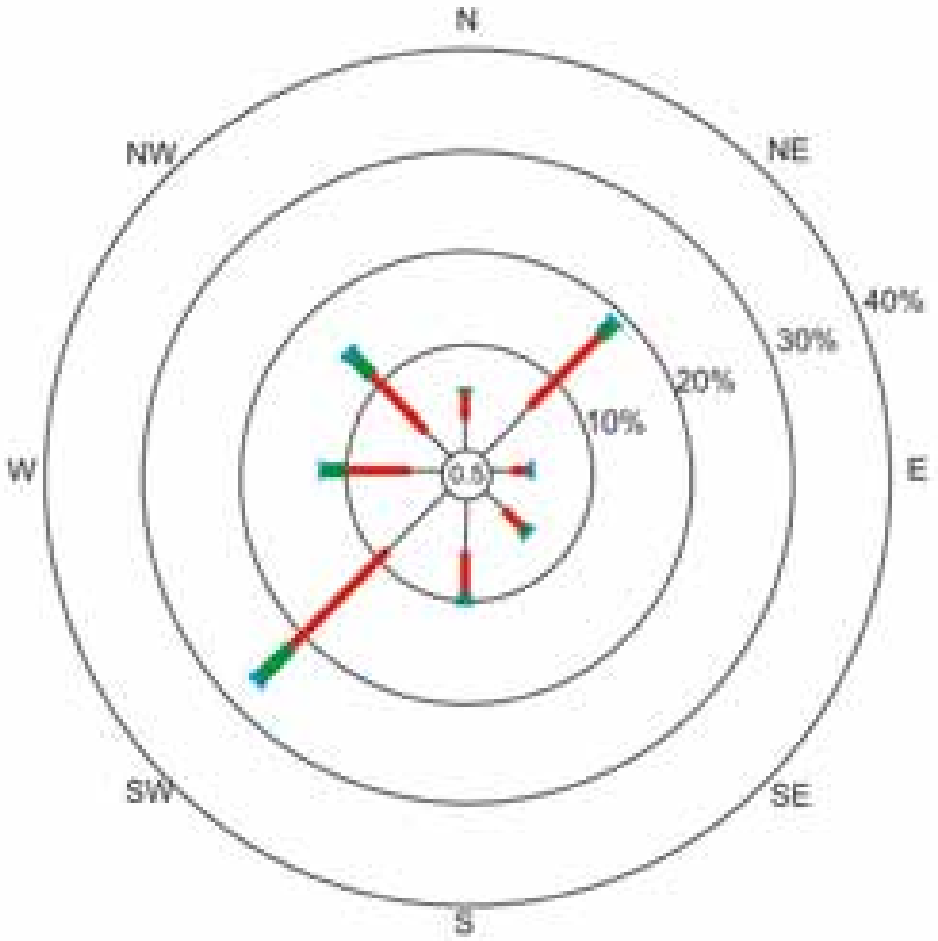
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	1954	16.8
E	410	3.5
SE	743	6.4
S	874	7.5
SW	2606	22.3
W	1479	12.7
NW	2731	23.4
N	763	6.5
Calm	100	.9
Missing	3268	21.9

Total # of Obs. = 11660

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: March

Prepared by amec
September 7, 2006



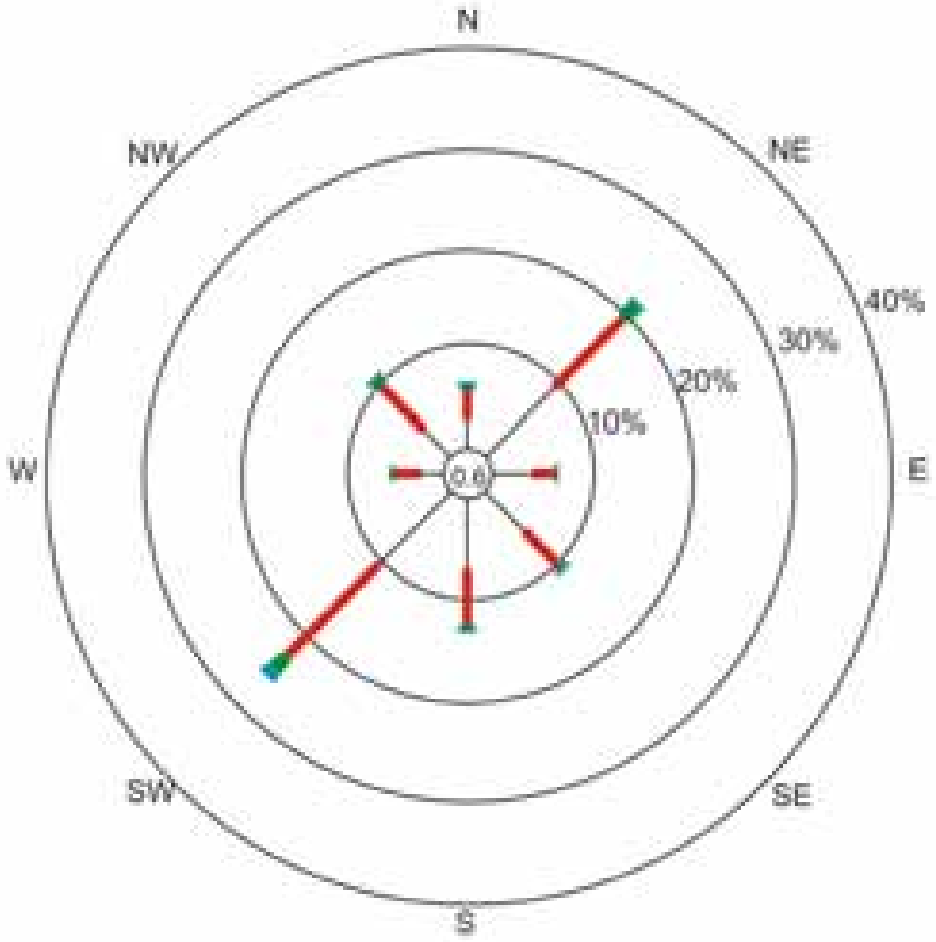
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	2775	19.2
E	638	4.4
SE	928	6.4
S	1514	10.5
SW	3893	26.9
W	1740	12.0
NW	2051	14.2
N	850	5.9
Calm	79	.5
Missing	1900	11.6

Total # of Obs. = 14468

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: April

Prepared by amec
September 7, 2006



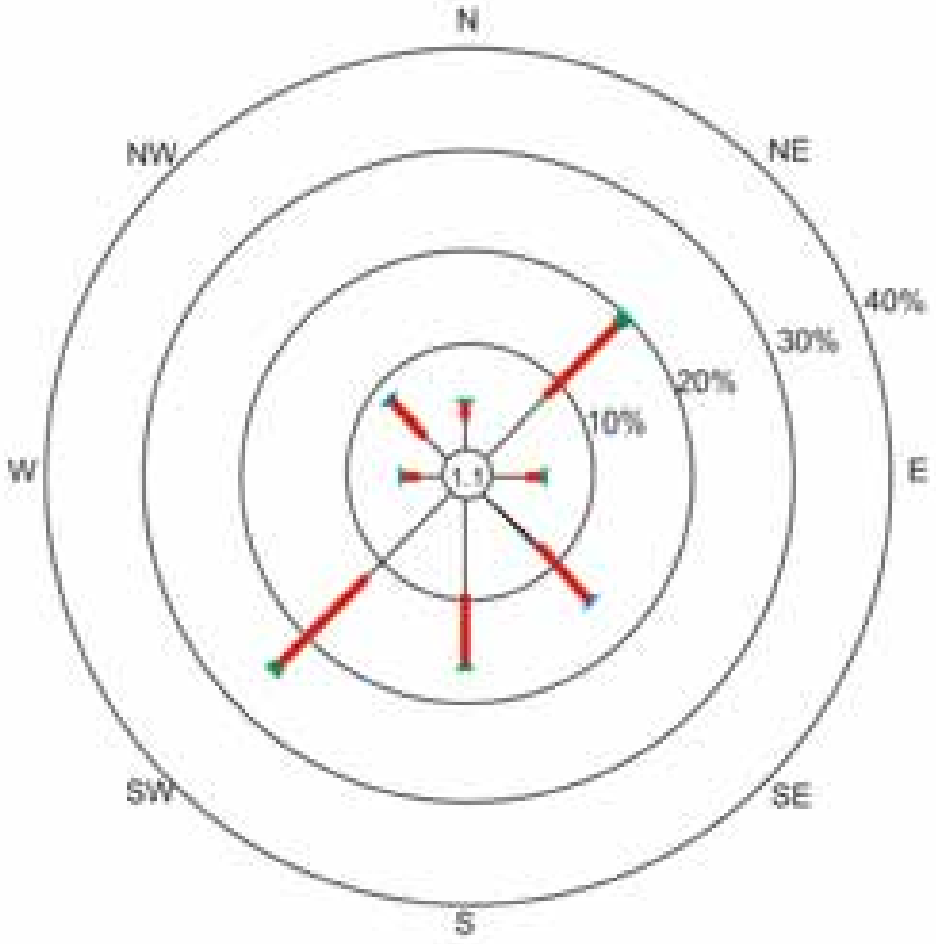
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	2932	20.8
E	839	6.0
SE	1524	10.8
S	1867	13.3
SW	3661	26.0
W	802	5.7
NW	1516	10.8
N	861	6.1
Calm	84	.6
Missing	1754	11.1

Total # of Obs. = 14086

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: May

Prepared by amec
September 7, 2006



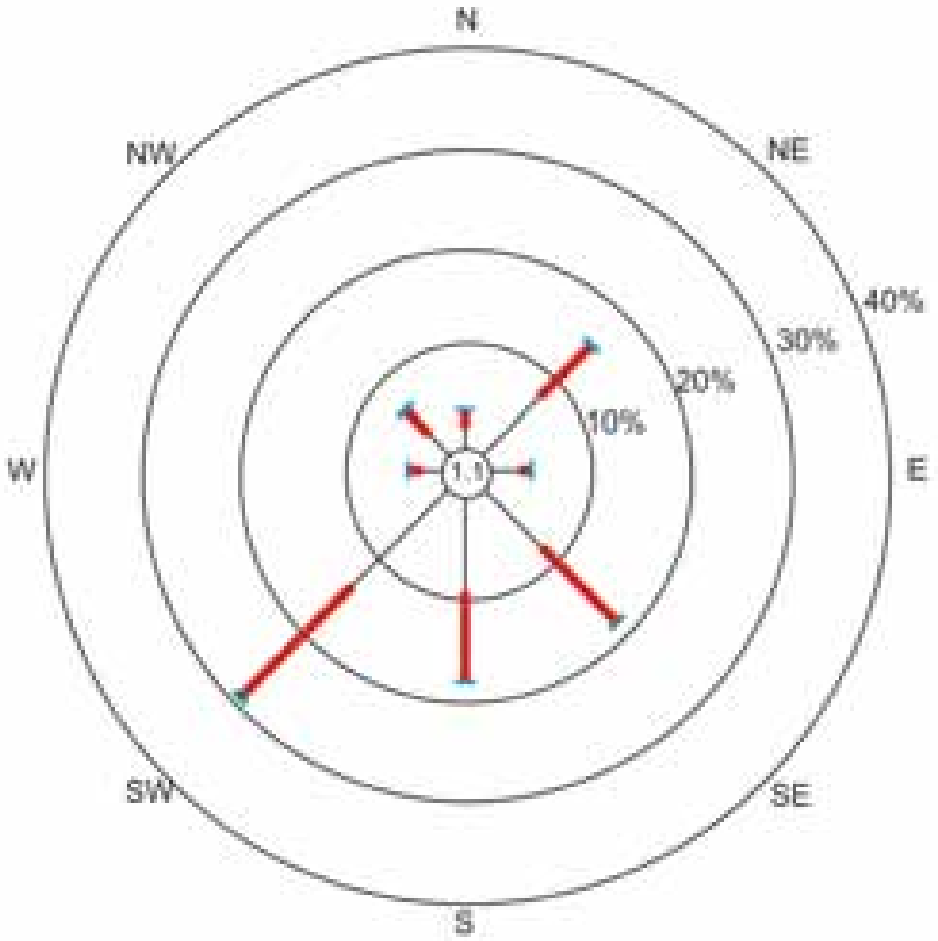
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	2713	19.6
E	732	5.3
SE	2102	15.2
S	2329	16.8
SW	3471	25.0
W	592	4.3
NW	1150	8.3
N	621	4.5
Calm	147	1.1
Missing	2511	15.3

Total # of Obs. = 13857

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: June

Prepared by amec
September 7, 2006



Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	2098	15.5
E	565	4.2
SE	2562	18.9
S	2470	18.3
SW	3932	29.1
W	443	3.3
NW	817	6.0
N	468	3.6
Calm	149	1.1
Missing	2316	14.6

Total # of Obs. = 1352

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: July

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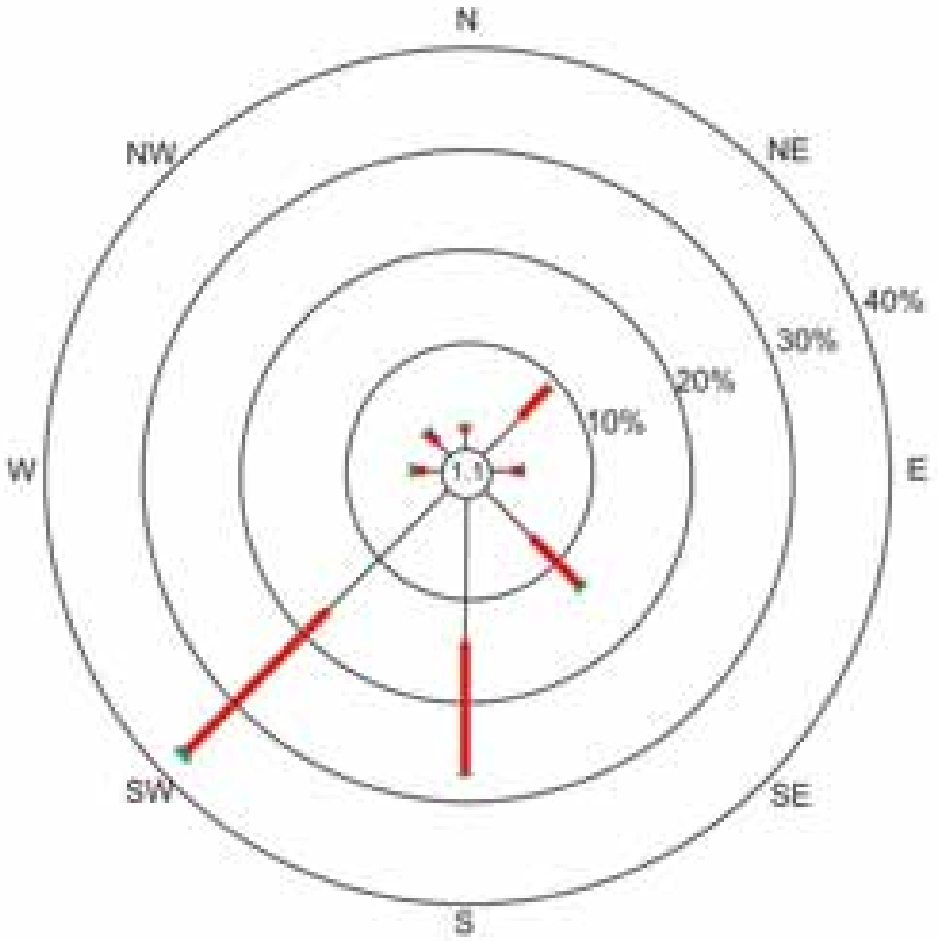


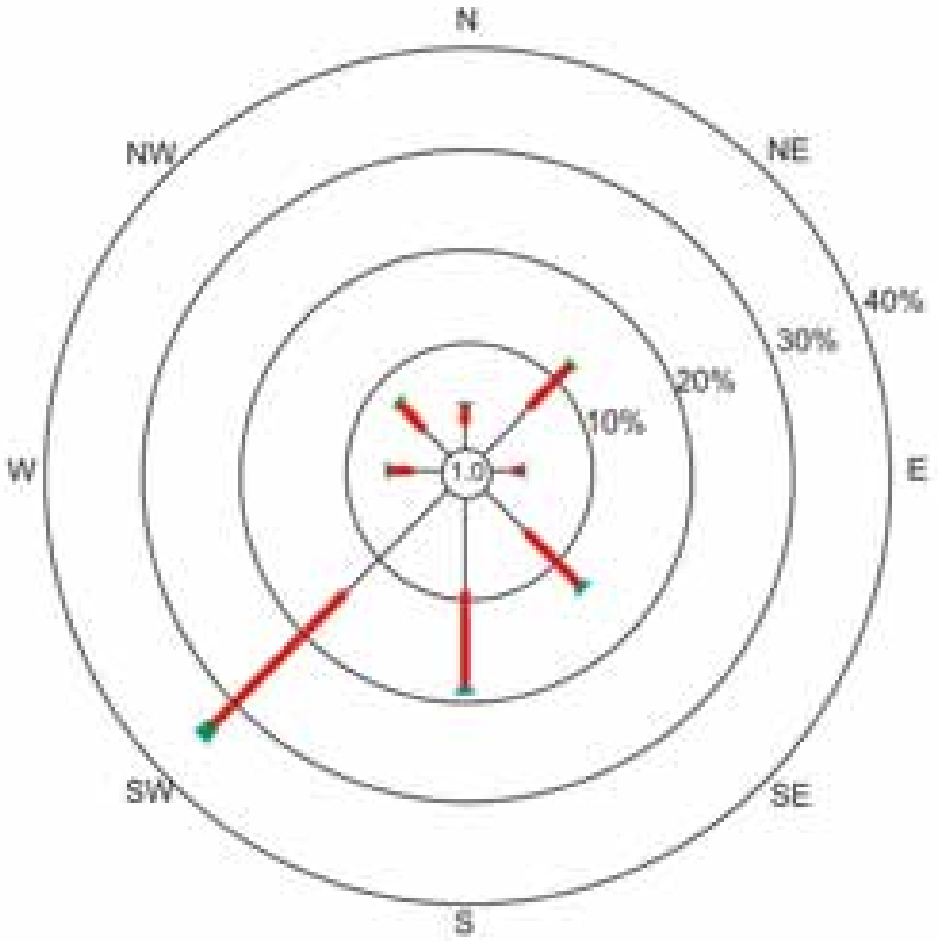
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	1235	9.3
E	439	3.3
SE	1753	13.2
S	3625	27.2
SW	4981	37.4
W	405	3.0
NW	439	3.3
N	306	2.3
Calm	147	1.1
Missing	3062	18.7

Total # of Obs. = 13330

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: August

Prepared by amec
September 7, 2006



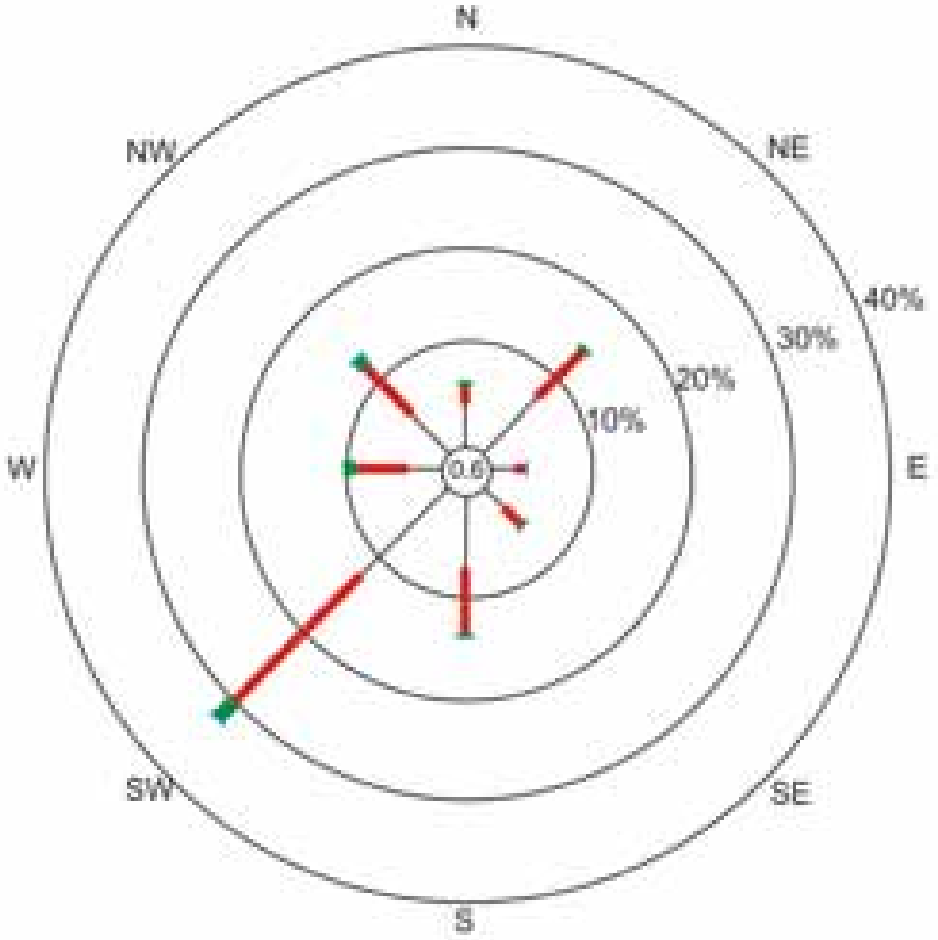
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	1596	12.4
E	448	3.5
SE	1770	13.7
S	2441	18.9
SW	4398	34.1
W	696	5.4
NW	902	7.0
N	517	4.0
Calm	133	1.0
Missing	3467	21.2

Total # of Obs. = 12901

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: September

Prepared by amec
September 7, 2006



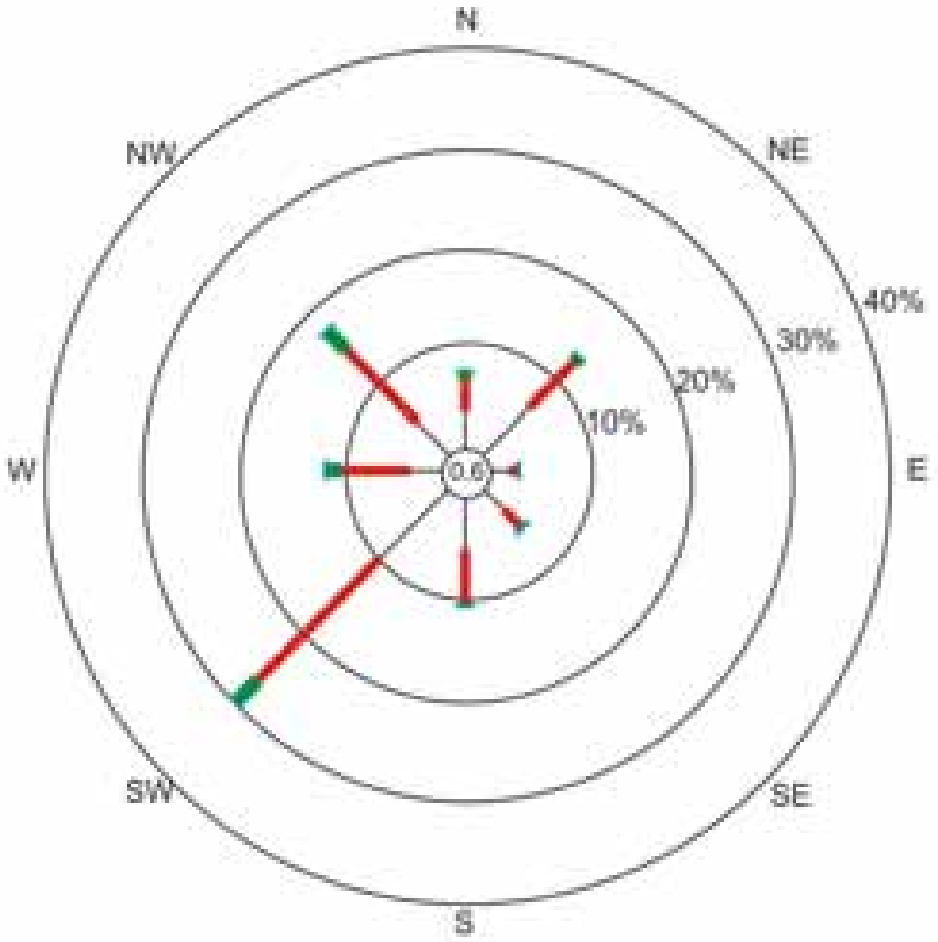
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	1772	14.4
E	435	3.5
SE	673	5.5
S	1768	14.4
SW	4027	32.7
W	1226	10.0
NW	1593	13.0
N	731	5.9
Calm	75	.6
Missing	3540	22.3

Total # of Obs. = 12300

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: October

Prepared by amec
September 7, 2006



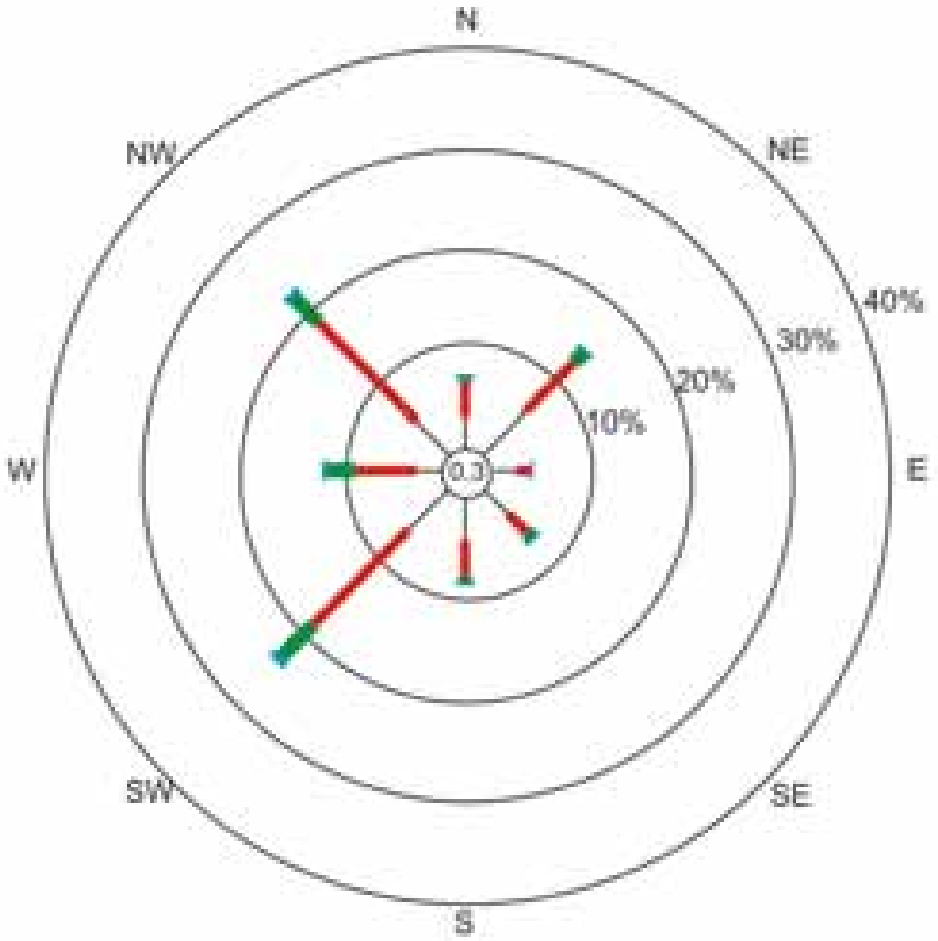
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	1713	13.8
E	358	2.9
SE	699	5.6
S	1342	10.8
SW	3727	30.1
W	1449	11.7
NW	2122	17.0
N	911	7.3
Calm	75	.6
Missing	3972	24.3

Total # of Obs. = 12396

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: November

Prepared by amec
September 7, 2006



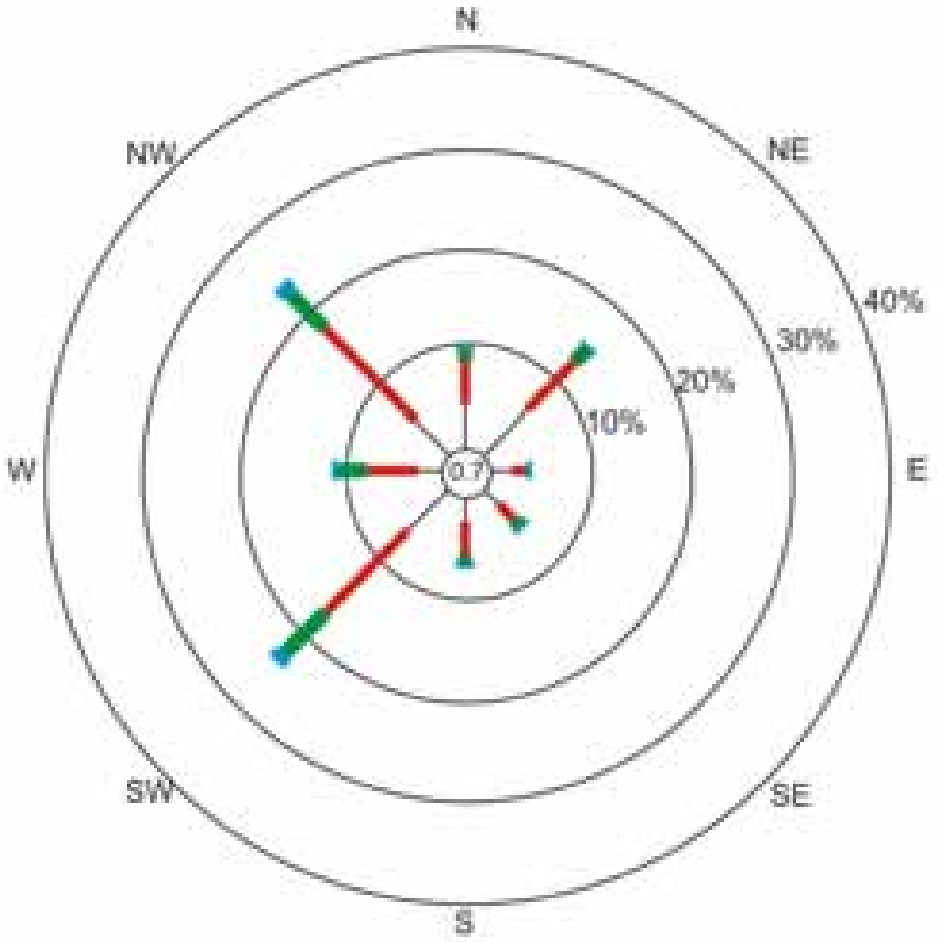
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	1839	14.3
E	494	3.8
SE	840	6.5
S	1112	8.6
SW	3150	24.4
W	1570	12.2
NW	2948	22.8
N	911	7.1
Calm	39	.3
Missing	2937	18.5

Total # of Obs. = 12903

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: December

Prepared by amec
September 7, 2006



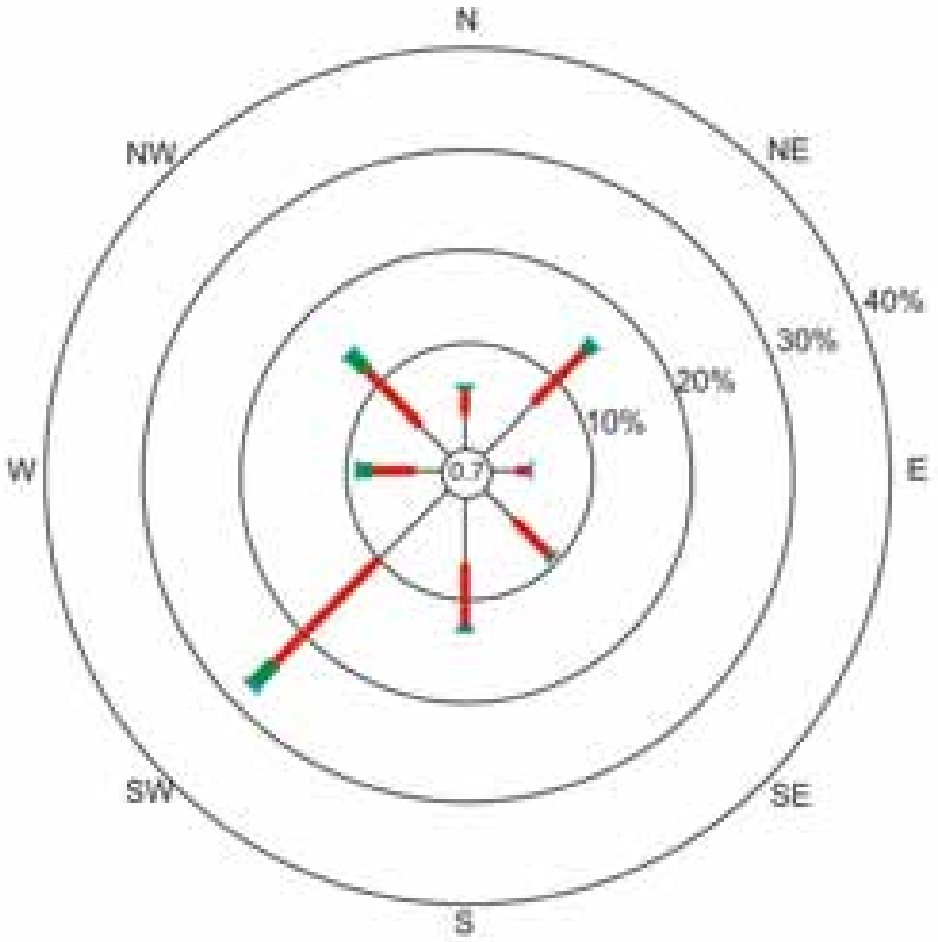
Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	1905	14.7
E	500	3.9
SE	685	5.3
S	878	6.8
SW	3133	24.2
W	1443	11.2
NW	3051	23.6
N	1253	9.7
Calm	93	.7
Missing	3427	20.9

Total # of Obs. = 12941

Site: Arnold's Cove, 1971 - 1993 (MSC measured)
Sampling Interval (DT): 1 hour
Observation Period: July 1, 1971 to July 1, 1993

Prepared by amec
September 7, 2006



Graph Binning: 18 km/h (5 m/s)

Direction (from)	# of Obs.	% TOTAL
NE	24306	15.4
E	6413	4.1
SE	15147	9.6
S	21139	13.4
SW	44219	28.1
W	13766	8.7
NW	22083	14.0
N	9143	5.8
Calm	1171	.7
Missing	35501	18.4

Total # of Obs. = 157387

Waves

Wave roses are based on AES40 node 5616 at coordinates Lat 46.875N, Long 55.0W. Directional statistics on wave climate were calculated using wind data from AES40, a 49-year hindcast of 6 hourly data provided by Meteorological Services Canada (AES, 1999, Swail et al., 2000). The grid point used was 5616 (46.875N, 55.0W.), which lies in the mouth of Placentia Bay, Newfoundland and Labrador.

Predominate wave direction (based on yearly analysis) is from south and southwest. Maximum wave heights in these directions are 6m. As with the wind regime the majority of the winds are from the southwest and south annually with the greatest magnitude winds occurring in winter. The wave roses confirm this with the majority of the waves coming from the southwest and south with the largest magnitude waves occurring in the winter months.

Maximum wave directions heights are 6m, which occur during winter months (Nov-March). Wave directions for all months come from the south-southwest direction. During summer months (Jun, July, Aug), maximum wave heights are on the order of 3m.

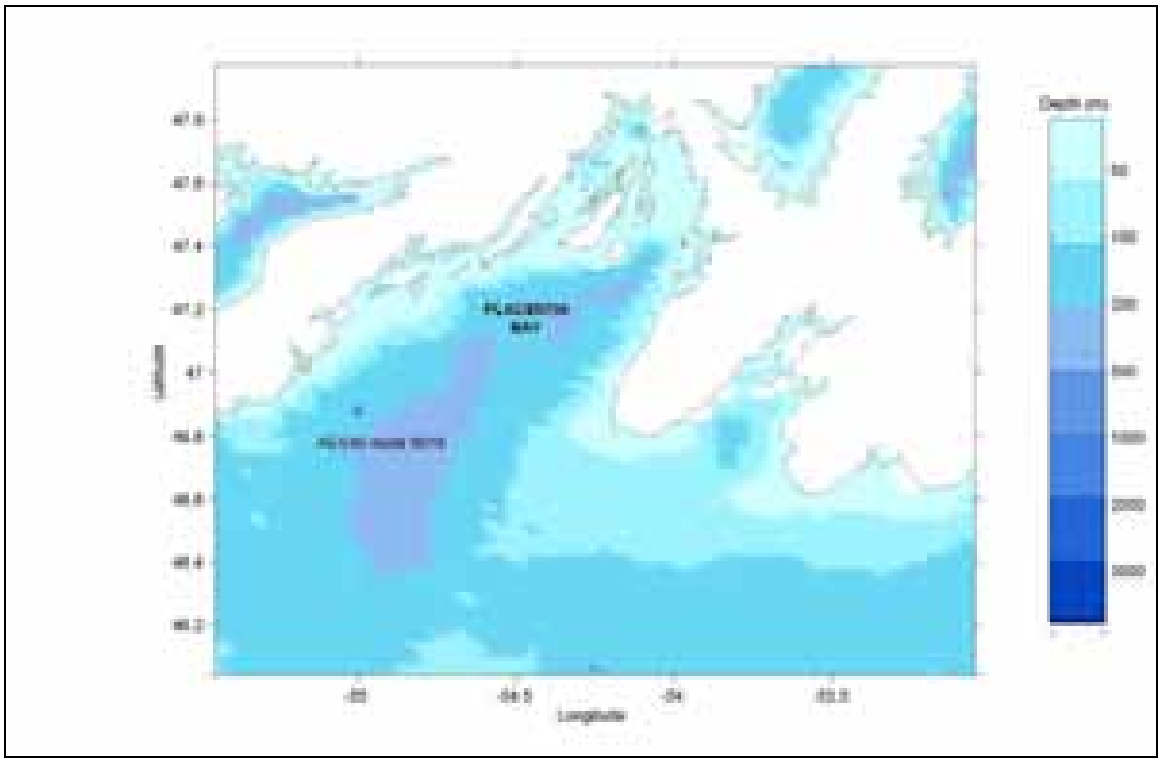


Figure 1, AES40 Grid Point Location.

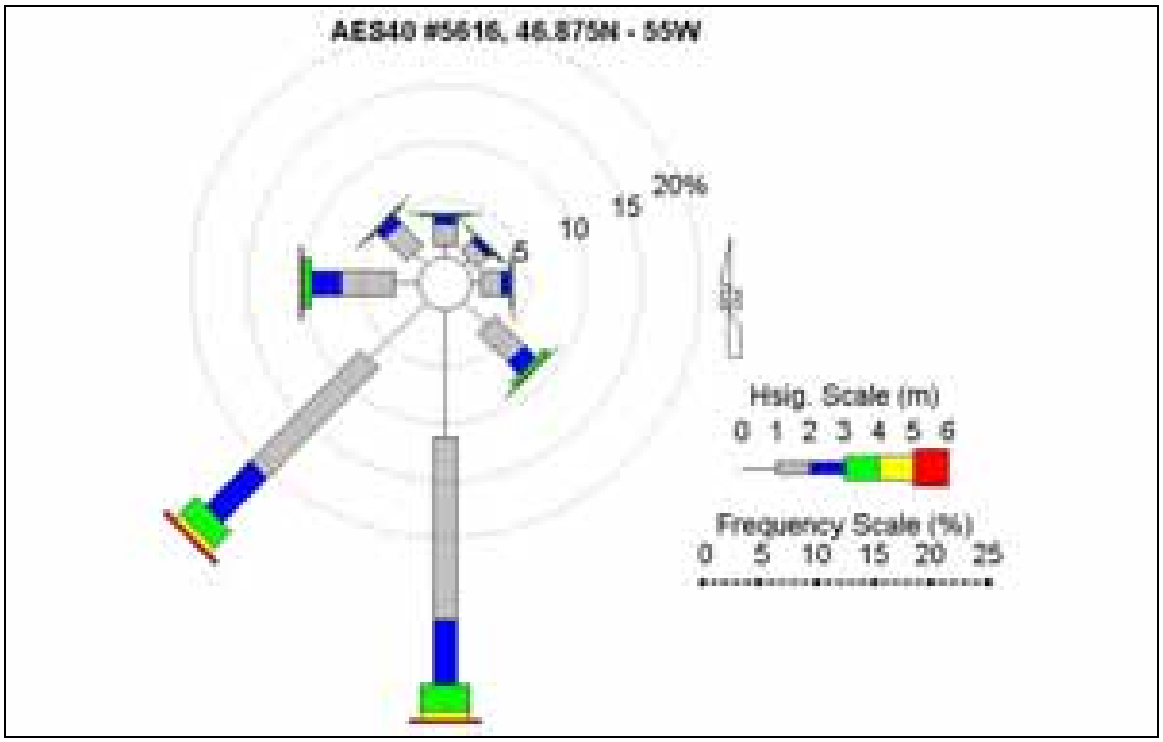


Figure 2, AES 40 Annual Wave Rose.

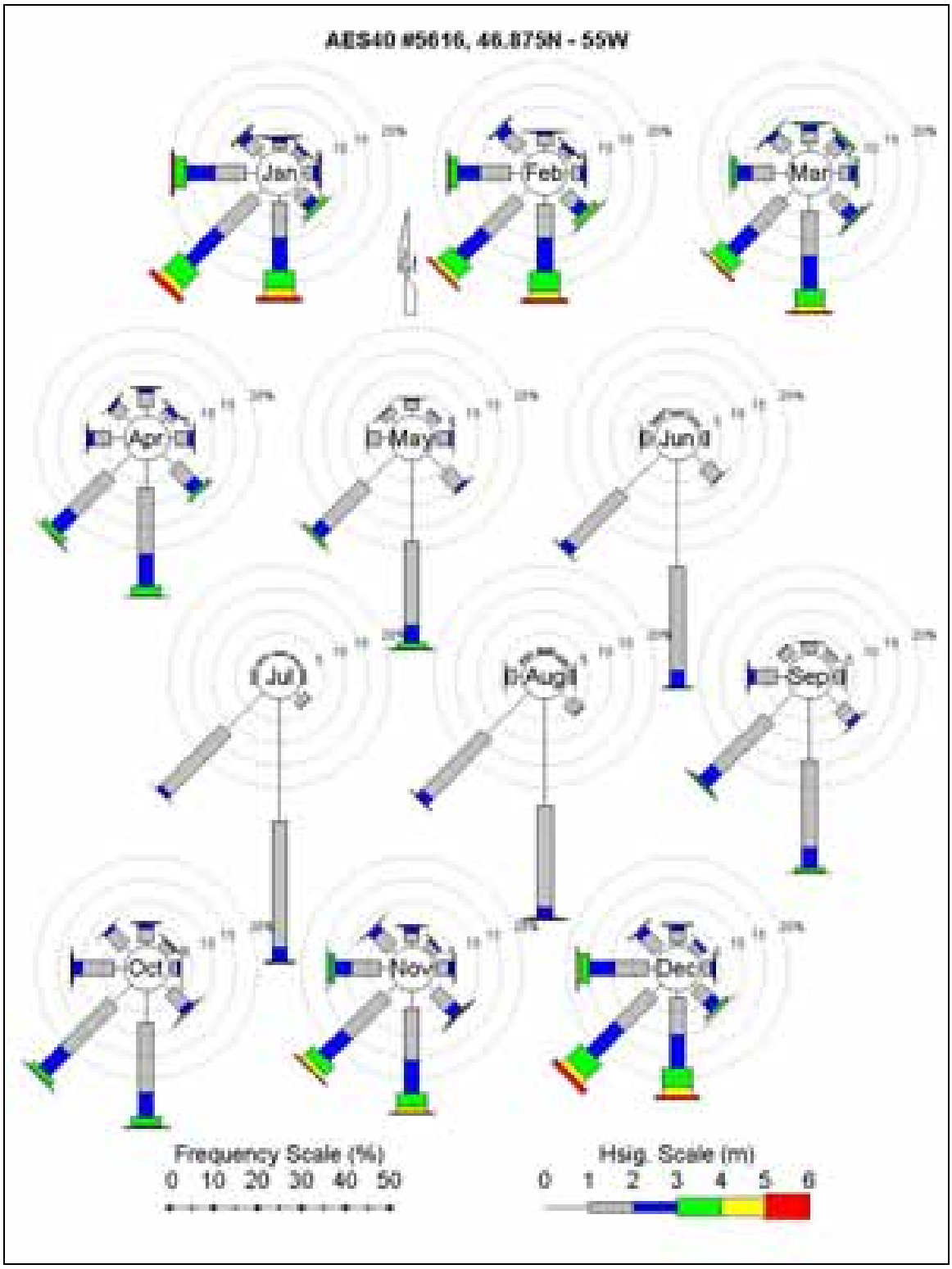


Figure 3, AES 40, Monthly Wave Roses.