Social and Economic Considerations for the Arctic Marine Shipping Assessment

Submitted by:

Integrated Environments Ltd.

Ste.110, 2509 Dieppe Ave SW

Calgary, AB T3E 7J9

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1 RESEARCH FOCUS

1.1 Project Purpose:

The Arctic Climate Impact Assessment (ACIA) identified conclusions forwarded to the Arctic Council in 2004. Key Finding #6 addressed future implications of climate change on shipping: "Reduced sea ice is likely to increase marine transport and access to resources."

In response to the ACIA finding, the 4th Arctic Council Ministerial Meeting (Reykjavik Declaration): "Request(ed) PAME to conduct a comprehensive Arctic marine shipping assessment as outlined in the AMSP under the guidance of Canada, Finland, and the United States as lead countries and in collaboration with the EPPR working group and other working groups of the Arctic Council and Permanent Participants as relevant."

The Arctic Marine Shipping Assessment (AMSA) was to focus on the following:

- The assessment should cover all ship based activities and all ship types;
- The geographical area will be as defined by the member states;
- The LME approach will be used in the assessment;
- The projects will extend to 2020 for economic development and to 2050 for the Arctic Climate Change;

Canada, as a participant in the AMSA, agreed to contribute to a domestic study and report on the social, economic, and environmental effects and consequences to northern and Aboriginal communities from current and future marine shipping activities in the Canadian Arctic. This study will follow Transport Canada's Canadian Arctic Shipping Assessment Scoping Study in defining the Canadian Arctic as: "Canada's continental coastline between Alaska and Cape Chidley in northern Labrador (including its immediate hinterland and the Mackenzie Delta); borders with the USA and Denmark (Greenland); and their meridian extensions to the North Pole." This domestic study will form part of the Canadian contribution in support of the Arctic Council's Arctic Marine Shipping Assessment (AMSA).

1.2 Research Questions:

Increased Arctic marine access and expanded Arctic shipping activities are likely to present both opportunities and challenges for governments and Arctic communities. This project aims to conduct a background literature review and report on primarily social, economic, and related environmental impacts to northern and Aboriginal communities from current and future Arctic marine shipping activities. The main research objectives are to ascertain how current and future Arctic shipping activity will affect people living in the Canadian Arctic including socio-economic effects of current and future

marine shipping activities, and associated effects on the human use of the environment. Our main research questions include:

1) What are the larger factors of social and economic change related to increased Arctic marine shipping in Canada?

2) What are the social and economic consequences of changes in future Arctic marine shipping activity in Canada?

1.3 Methods:

Research is based upon a detailed review of secondary literature surrounding current and projected Arctic marine shipping activities. This includes a review of literature on the social and economic effects of past and current marine shipping activities, and literature pertaining to anticipated future trends in Arctic marine shipping in Canada. In order to gain an understanding of general social and economic effects of Canadian Arctic marine shipping, case studies are reviewed including an examination of past reported impacts of past Arctic marine shipping in Canada, and assessments of projects currently proposed. Proxy transportation literature is also reviewed to allow for a comparison between what is known about the social and economic effects of Arctic marine shipping and those lessons learned (or anticipated) from changes in other Arctic transportation systems, such as new road or air access. Finally, common findings from the case studies will be synthesized to present a general overview of social and economic effects of current and future Arctic Marine activities in Canada.

1.4 Links:

The information generated in this report will form part of Canada's contribution to Chapter Four on Human Dimensions of Arctic Marine Activities for the Arctic Marine Shipping Assessment (AMSA), led by Dr. Henry Huntington. AMSA is the formal responsibility of the Protection of the Arctic Marine Environment (PAME) Working Group of the Arctic Council. AMSA is the Arctic Council's response to ACIA Finding #6 (described above), and is a follow-up to the Arctic Marine Strategic Plan which was adopted by the Arctic council in November 2004. In addition to a circumpolar assessment of social, economic, and environmental effects of Arctic marine shipping, and the development of a set of future scenarios for future Arctic marine navigation, AMSA will provide a regional and local focus on the current and anticipated effects of Arctic marine shipping.

In addition to our report, Inuit Circumpolar Council (ICC) Canada is conducting a scoping level of investigation on the impacts of increased marine traffic on Inuit use of Arctic sea ice and traditional ways of living. We consulted with ICC Canada on their AMSA contribution during the project period.

2 FACTORS OF SOCIAL AND ECONOMIC CHANGE RELATED TO INCREASED ARCTIC MARINE SHIPPING IN CANADA:

KEY TYPES OF SHIPPING ACTIVITIES:

A preliminary scoping of literature surrounding current and projected shipping in Arctic Canadian waters has identified three key types of shipping activity that will drive (or have the potential to drive) larger social and economic consequences for people living in the Canadian Arctic. These include:

- Resource development and economy;
- Community resupply; and
- The internationalization of shipping.

2.1 Resource Development and the Economy:

2.1.1 Mining

There are currently no operational mines in the Northwest Territories or Nunavut that directly involve the removal of ore concentrate via Arctic marine shipping. One mine (Doris North) in Nunavut utilized NTCL sealift operations for mine supply in the summer of 2007. Several mining operations are currently underway in the Slave Geological Province (SGP) including the Diavik, Ekati, and Snap Lake diamond mines in the Northwest Territories, and the Lupin gold mine in Nunavut. The Jericho mine, the first diamond mine in Nunavut, opened in August 2006 and the Doris North gold mine proposed by Miramar Mining Corporation was approved for construction and the first mobilization of building equipment and supplies (by sealift) and the preparation of site construction is underway at Hope Bay, Nunavut. The Raglan nickel-copper mine located in Nunavik, northern Quebec relies on shipping for both supplies and transportation of ore concentrate. Concentrate from Raglan mine is transported to Deception Bay, and from there to Quebec City. A two-phase expansion project for the Raglan nickel-copper mine is scheduled for 2008.

Two mines, now abandoned, that utilized Arctic marine shipping for the export of ore concentrate and importation of mine supplies include the Nanisivik mine, and the Polaris mine. Both mines are considered to have directly influenced Arctic marine shipping in the region. The Nanisivik zinc-lead mine was opened in 1976 on northern Baffin Island. Nanisivik shipped ore concentrate in the summer months from the Nanisivik site to refineries in Montreal until 2002, when it was abandoned and reclaimed. The

Polaris mine extracted calcium, lead, and zinc from Little Cornwallis Island. Polaris began operations in 1982 and also shipped ore to world markets until 2002 when it was decommissioned.

The Development of the Slave Geological Province (SGP) has been limited by ice-bound ocean access in the north, remoteness, and a lack of transportation infrastructure. There is currently a proposal before the Nunavut Impact Review Board (NIRB) to build a deep-sea port at Bathurst Inlet and to construct an all-weather road from the port to Contwoyto Lake. If approved, the project will service existing mines in the SGP, and result in increased certainty and decreased costs for mines already in operation. It is also anticipated that development of port and road infrastructure at Bathurst Inlet would result in bringing existing mineral deposits in the transportation corridor into production. For example, the Izok, George lake, Goose Lake, Gondor and Hackett River deposits would be able to use the project infrastructure. There is also the potential for the Bathurst Port and Road Project (BIPR) to attract additional mineral exploration, with the potential result being the discovery of new deposits (Government of Nunavut Department of Economic Development and Transportation, 2008, p. 16).

Mineral exploration expenditure in Nunavut in 2006 was approximately $200 million dollars (Government of Nunavut Department of Economic Development and Transportation, 2008). It is difficult to determine whether or not the development of new marine infrastructure, such as the BIPR, would induce further mineral exploration and production, or whether or not new mineral exploration and production will, in turn, drive Arctic marine transportation. It is also difficult to isolate the effects of increased Arctic marine shipping related to mining activity separate from the effects of mine itself. In total, five new mines are expected to be operating in Nunavut by 210, addition approximately $500 million annually to the territorial GDP and creating 1,700 new jobs (Government of Nunavut Department of Economic Development and Transportation, 2008). In order to examine the social, economic, and environmental effects of Arctic marine shipping relative to mining activity we have included case studies addressing the social, economic, and environmental effects stemming from the Nanisivik and Polaris mines, as well as anticipated social, economic, and environmental affect assessments from the proposed BIPR, in this report.

2.1.2 Oil and Gas

Arctic marine shipping for the oil and gas industry is required for a number of tasks. Offshore drilling operations require drill-ships, icebreaking ships, and resupply vessels. Marine transportation is often required for drill-ship crew changes, towing, and safety standby (Hetherington, 1997). And, icebreaking support and ship escorts through ice are essential tasks for Arctic offshore oil and gas exploration and production. In many ways the push to explore and extract the rich hydrocarbon resources of the High

Arctic, and particularly the Beaufort Sea, drove the development of new Arctic marine technology in Canada that is now being used in other ice-prone environments in Prudhoe Bay Alaska, off the Kamchatca Peninsula, Russia and in Northern Russia.

In 1961 the first well was drilled in the Canadian Arctic by Dome Petroleum at Winter Harbour on Melville Island. Later, in 1962 the first exploration well was drilled in the Mackenzie Delta, followed by the first off-shore well drilled by Imperial Oil in the Beaufort Sea in 1973. By 1976, Dome Petroleum had begun to use drill ships in the Beaufort Sea, and there was a proposal to build a pipeline(s) from the Mackenzie Delta to markets further south. From 1970 to 1985, with the assistant of the Petroleum Incentive Program (PIP) by the Canadian federal government, companies had drilled over one hundred and seventy exploratory test wells at onshore locations in the Mackenzie Delta, and another seventy wells in the south Beaufort Sea (H. Fast, Mathias, & Banias, 2001). Hydrocarbon exploration had also been taking place in the Canadian Arctic Islands. According to Cory Hetherington, during the peak period of hydrocarbon exploration in the Canadian Arctic over 4000 people were employed by industry in Arctic operations(Hetherington, 1997, p. 92). At the height of hydrocarbon exploration in the Beaufort Sea, it was not uncommon to see an average of over one hundred vessels in Kugmallit Bay alone (H. Fast et al., 2001).

All Canadian Arctic oil and gas operations were faced with immense obstacles. Drilling through ice, getting supplies and personnel to exploration sites, and the exportation of oil and gas to southern markets are among a long list of project challenges. The large number of workers camped at drill site and staging areas required large volumes of food. The gravel airstrip at Tuktoyaktuk was expanded to accommodate Boeing 737 aircraft so that fruits and vegetables could be flown in regularly. Adjacent communities to work-camps and other sites of exploration activity, such as Tuktoyaktuk, often received associated benefits of reduced food supply costs as well.

Bent Horn was the only project to ship oil from a producing well in the Canadian Arctic to markets further south. The operator, Panarctic, shipped Bent Horn oil from Cameron Island to a refinery in Montreal for over ten years from 1984 until 1996. The Bent Horn project is included as a case study in this report as the only example of long-term Arctic marine oil shipping to date in Canada, although oil was shipped as a test project from Amalaguk in the Beaufort Sea on two occasions.

By the late 1980s world market prices for oil had fallen and the federal government had phased out its incentive PIP program, making hydrocarbon exploration in the north expensive for companies. The last offshore well to be drilled in this period, the Kulluk well, was abandoned in the permitting stage due to uncertainty over the ability to address the environmental consequences of an oil spill in an ice-rich environment; shipping in and around ice (especially moving ice) bound drill sites remains a technical challenge. Exploration for oil and gas in the Canadian Arctic slowed immensely, and many companies cut back their Arctic operations. However, the intense oil and gas exploration activities in the Canadian Arctic during the 1970s and early 1980s spurred several significant political and conservation actions

aimed to address the effects of increased development, transportation infrastructure and shipping in the Canadian Arctic.

There has recently been renewed interest in the exploration and production of hydrocarbon reserves in the Canadian Arctic, particularly in the western Canadian Arctic. Heightened oil and gas activities in the western Canadian Arctic will increase ship movement and barge traffic in the Beaufort Sea. A case study on the social, economic, and environmental effects of ship movement in the Beaufort Sea as a result of previous hydrocarbon activities is included in this report, as well as a consideration of potential future impacts of increased oil and gas exploration and production. It should be noted, however, that there is still no licensed means to transport oil or gas to markets in the south, and further development is likely contingent on the construction of the Mackenzie Gas Project currently under review by regulatory authorities in the Northwest Territories.

2.1.3 Tourism:

Cruise ship tourism in the Canadian Arctic has been steadily increasing, and the number of cruise ships in Canadian Arctic waters doubled from eleven ships in 2005 to twenty-two ships in the 2006 summer tourist season(Stewart, Howell, Draper, Yackel, & Tivy, 2007, p. 286). The 2006 AMSA Progress Report shows that just over six and a half percent of 2004 Canadian Flagged Arctic Vessel traffic was comprised of passenger and cruise ships (AMSA, 2006, p. 5). Cruise ship passengers have taken excursions to the communities of Ulukhaktok (Holman), Cambridge Bay, Resolute, and Pond Inlet, as well as shore landings at places such as Beechey Island, Herschel Island, and King William Island (Stewart et al., 2007). Herschel Island alone is said to receive one hundred and fifty tourists per year (Fisheries and Oceans Canada, 2003, p. 46). Communities such as Pangnirtung, Pond Inlet, Resolute, and Grise Fiord hosted cruise ships in 2006, and Pond Inlet hosted as many as twelve cruise ships over a forty-one day period.

Cruise ships are also active in the western Arctic and Hudson's Bay. Three cruise ships including the Russian ship *Kaptain Khlebnikov*, the German ship the *MS Haneseatic*, and the US ship the *Frontier Spirit* all operated offshore of the Beaufort Sea, and some cruise ships have made the deep sea port at Churchill Manitoba a port of call (Newton, Fast, & Henley, 2002). In the eastern Arctic, Makavik Corporation recently created Cruise North Expeditions which offers one week tours aboard the ship *Ushuaia*.

In general, tourism employs very few permanent full time workers, though it does contribute substantially to seasonal employment and wages through guiding, carving and arts and craft sales (Myers & Forrest, 2000). Cruise ship tourists also contribute to the sale of goods at local Co-ops and other small businesses. Some port communities, such as Pond Inlet, and Resolute have built new hotels and have an interest in wildlife watching and outfitter tours (Myers & Forrest, 2000). Bathurst Inlet houses a world renowned eco-lodge, and several on-the-land campgrounds have been developed. While

no tourist operator conducts boating tours in Zone 1a areas of the Beaufort Sea as a result of beluga management restrictions, several tour operators have taken visitors to family camps near Kendall Island and have conducted whale watching near Kugmallit Bay (Fisheries and Oceans Canada, 2003, p. iv). As a result of the short tourist season, however, employment as a result of the tourism economy tends to be seasonal, with the exception of Churchill Manitoba which offers multi-season wildlife watching (beluga whales in the summer and polar bears in October/November and in the spring).

A large driver of the tourism economy includes wildlife and marine mammal watching. Communities such as Churchill and Tuktoyaktuk are home to estuaries where beluga whales come in the summer months. In Tuktoyaktuk, however, beluga whale watching is not a major tourism draw as restrictions have been put in place as a result of the Beaufort Sea Beluga Management Plan in order to maintain continued subsistence harvesting of beluga by Inuvialuit. In Churchill, the home of Canada's only Arctic deep sea port, concerns have been raised about the potential effects of increased cruise ship traffic on beluga whale habitat and populations. Concerns have also been raised regarding the potential conflict between tourism and increased shipping at the Churchill port. A review of the social, economic, and environmental effects of Churchill port is included as a case study in this report. While much of the tourism economy in Churchill is conducted by rail and jet service, some passenger cruise ships have made Churchill a port of call, and the intersection between tourism activities and shipping activities provides an excellent example of potential opportunities and challenges between diverse resource development sectors.

An important aspect of the tourism industry is the increased market for carvings and the sale other arts and crafts. Tourists have made stops in several Arctic communities (transported from the cruise ships in either Zodiac boats or in helicopters) and purchase goods from local artists. However, there is currently no data regarding the amount of money that tourists spend in communities on carvings or local arts and crafts. In Churchill, there is a general perception among local residents that tourists were not spending enough money in their community. While Newton, Fast and Henley report that seventy two percent of tourists leaving Churchill are satisfied with their visit, they also point out a 1998 study that estimated that tourists were leaving the community with between $400 and $500 dollars of unspent travel money (Newton et al., 2002, p. 285). With the demographic of Arctic cruise ship tourists generally people with high levels of disposable income, there is potential to increase sales in local arts and crafts sectors(Stewart et al., 2007, p. 286).

The expansion of the tourism economy is largely dependent on the extension of the tourist season (or the development of shoulder seasons), and the development and maintenance of transportation infrastructure. In Churchill, for example, coordination between air, rail, and boat services may facilitate tourism activity. In other communities, such as Resolute, the transportation services (including jet service and a port) as a result of the Nanisivik mine provided important services for cruise ships. In an interview for a Government of Nunavut Department of Sustainable Development report, a local resident stated: "Cruise ships start in Greenland. People fly to Greenland, cruise to Nanisivik then fly south on

the jet and a new group flies in. Probably a total of 400 people passing through here each summer"(Government of Nunavut Department of Sustainable Development, 2002, p. 22).

Increased cruise ship activity may also have some negative impacts for Arctic communities as well. The influx of tourists may put pressure on existing community services, and communities such as Clyde River on Baffin Island have decided that the positive effects of cruise visitation do not out-way the negative effects (Stewart et al., 2007). Additionally, because the growth of the tourism sector in Canadian Arctic waters has been relatively slow, there has been little coordinated trans-regional tourism planning.

Changes in ice conditions, weather, or operational difficulties necessitates that cruise ships sometime change plans, requiring vessels to occasionally bypass communities that were prepared for a visit, or, alternatively, arriving in the community at an unscheduled time (Stewart et al., 2007). Tourists into northern communities are 'guests' that come from different geographic regions and cultures. The effects of host/guest interaction is another potential factor influencing the culture and development of the region (Nash, 1977). Changing ice in the Canadian Arctic has potentially brought a new frontier and way of looking at the Arctic for the adventure traveler. The consequences (and curiosity) of climate change has brought a new application on frontier adventure. Many adventurers skiing to the North Pole, for example, talk about the need ski there before it becomes impossible. In a replacement to this activity, the first few independent sailing ships including the Norwegian Blue have crossed through the Northwest Passage (Norwegian Blue Co., 2008).

Early adventures and explorers had their effect on the Arctic as well. Those in search of the Northwest Passage brought, in many cases, first contact between European and Arctic cultures. Amundsen, trapped and overwintering on the shore of King William Island attracted local Inuit people to locate adjacent to his ships. That site became the community of Gjoa Haven, named after Amundsen's ship.

2.1.4 Fisheries:

Commercial marine fisheries are now operating in all three regions of Nunavut. The Baffin (Qikiqtaaluk) Region appears to offer the best potential for marine commercial fishery development (Topoluiski, Kerwan, & Kristofferson, n.d.), and large-scale off-shore turbot and shrimp fisheries have been established. Shrimp species are almost exclusively harvested by offshore trawlers, while turbot are harvested by both offshore trawlers and a number of smaller fixed gear vessels. There is also an inshore commercial fishery for turbot and scallops in Cumberland Sound. The Keewatin (Kivalliq) and Kitikmeot regions have focused on continued commercial development and marketing of Arctic char, and they have also begun to develop fish resources such as flounder, clams, crab, and scallops with some success (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005). In Nunavik, the Makivik Corporation, along with Qikiqtaaluk Corporation has a stake in an offshore fisheries license which is contracted out to a private company, Clearwater Fine Foods Incorporated. A Pacific herring stock

assessment was carried out in the Northwest Territories to determine the availability of herring roe in Liverpool Bay near Inuvik. The preliminary assessment suggested that the development of a herring roe fishery is not sufficiently economically viable to justify significant investment (Topoluiski et al., n.d.). There is a commercial fishery inland on Great Slave Lake, which relies on the fish Freight Subsidy Program delivered by the Government of the Northwest Territories Department of Industry, Tourism and Investment.

The allocation quotas set for the off shore turbot and shrimp fisheries in Nunavut-adjacent waters are based upon the health of the fish stock, rather than the amount of time the Arctic marine waters are ice-free in the summer season, implying that a reduction in sea ice would not impact the Nunavut off-shore fishery in its own right. However, if global climate change results in environmental warming marine waters in the Arctic, the health of the turbot and shrimp stocks may deteriorate. There are northward progressions of temperate fish as a result of the warming of the Atlantic Ocean, and the development of new fisheries over the next century in an ice-free Arctic Ocean is possible. However, as Barber, Fortier, and Byers point out, "given the low temperatures that will always prevail in polar waters, the growth of newly immigrated fish will be slow and the stocks will be highly vulnerable to over fishing"(Barber, Fortier, & Byers, 2005, p. 68).

The offshore fishery in Nunavut generates approximately $5.6 million annually in quota royalties and Turbot sales. An estimated additional $900,000 is generated as a result of offshore crew employment (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005, p. 8). Nunavut captures approximately thirty eight percent of shrimp and turbot allocations in Nunavut-adjacent waters with the remaining sixty-two percent divided between the provinces of Newfoundland and Labrador, Nova Scotia, New Brunswick, and Quebec (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005, p. 27). The Government of Nunavut estimates that the royalty value allocated to non-Nunavummiut in the Baffin region is approximately $6 million per year (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005, p. 28).

The Government of Nunavut estimates that approximately eighty percent of Nunavut's char fishery is utilized in the domestic economy, with the commercial fishery comprising the remaining twenty percent of Arctic char production (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005, p. 24). Commercial char sales in Nunavut are estimated at between $1 million and $1.2 million per year, and the annual commercial harvest employs approximately 75 individuals who earn a total of $220,000 per year (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005, p. 24). There are concerns that climate change may impact Arctic char fisheries in Nunavut, as Arctic char require cold waters and may relocate if marine temperatures rise.

In total, it is estimated that the Nunavut fisheries currently contribute between $12 million and $14 million to the Nunavut territorial economy (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005). Of this amount, $7.5 million to $9.5 million enters the economy as wage income (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005).

Overall, approximately 371 Nunavummiut are employed in commercial fisheries in Nunavut, with 135 jobs generated from inshore Turbot catch and processing, 146 jobs generated in inshore char catch and processing, and ninety jobs generated in offshore crew for the turbot and shrimp fisheries. Nunavut has four federally registered fish processing facilities. Kitikmeot Foods Ltd. in Cambridge Bay, Kivalliq Arctic Foods Ltd. in Rankin Inlet, and Iqaluit Enterprises focus on the production of Arctic char, while Pangnirtung Fisheries Ltd. focus mostly on Turbot with some Arctic char processing (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005, p. 8). There are also a number of small-scale community-based fish processing operations. According to the Government of Nunavut, these facilities contribute significantly to the communities in which they are based in terms of jobs in the facilities themselves, and for providing a venue for inshore fisherman to sell their catch (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005).

There is also potential to develop a seasonal cold storage operation in Nunavut. The offshore shrimp and turbot fisheries catch approximately 40,000 tonnes annually, and the majority of the catch is frozen at sea and landed at cold storage facilities for shipment to world markets. None of the cold store facilities are located in Nunavut, and the development of cold storage facilities within the territory may represent a significant opportunity to capture additional economic benefits from the offshore commercial fishery. Additionally, the development of small-scale cold storage facilities may foster the development of increased commercial Arctic char production in smaller Nunavut communities (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005, p. 40).

Despite the contribution made by offshore commercial fisheries to employment in Nunavut, the offshore fishery has been characterized by a heavy reliance on a southern labour force (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005, p. 9). A lack of adequately trained workers within Nunavut, and challenges surrounding the recruitment and retention of Inuit workers in the Nunavut fisheries have resulted in significant economic leakage from the territory. Largely due to the level of investment required for commercial offshore fishing, and limited local infrastructure, Nunavut's involvement in the offshore fishery has been largely in the form of royalties paid by outside commercial interests. Nunavut is currently seeking business partnerships and joint ventures to capture more of the offshore fishing industry.

There are several challenges to opening up Nunavut's commercial fishing resources. The current level of infrastructure to support fisheries development is basic. There is a need for strategic investment in physical infrastructure including harbor and port facilities, marine service centres, processing plants, and cold storage facilities (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005). . In terms of in-shore or near-shore fisheries, most communities in Nunavut do not have the necessary infrastructure to support fishing vessels, even of modest size (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005). The capital costs for off shore vessels are significant, and joint ventures and partnerships are needed in order for Nunavut organizations to participate (in ways other than royalty generation) in the offshore commercial fishery. Though Qikiqtaaluk currently have a stake in an offshore fishing license, Nunavut's offshore fishery is largely farmed out to companies from the south,

and this represents a loss of economic opportunity for the territory. Also, in February 2008 the Canadian federal government proposed an $8 million investment into Nunavut's turbot and shrimp fishery by proposing to build a commercial fishing harbor in Pangnirtung (CBC News, 2008).

Finally, Nunavut does not have control over the majority of its adjacent fisheries resources. The percentage of shrimp and turbot allocations in Nunavut adjacent waters, for example, is thirty eight percent (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005). The Government of Nunavut claims that the result is a loss of economic opportunities for Nunavummiut and Nunavut. The government of Nunavut argue that in addition to a need for more local control over offshore fishing and fisheries management, there is a strong need for Nunavut and the federal government to maintain an active relationship with Greenland regarding shared fish stocks in the Davis Straight and Baffin Bay, including the need for a bi-lateral annual meeting process to share information and engage in management planning (Government of Nunavut & Nunavut Tunngavik Incorporated, 2005, p. 19).

2.2 Community Resupply

All Nunavut communities, and several communities in the Northwest Territories are located on or have access to tidewater and depend seasonally on the summer open water seasons for the annual sealift community resupply of goods from the south. According to the Canadian Arctic Shipping Assessment, community resupply for dry cargo currently involves twenty to twenty two seasonal vessel trips in the eastern Arctic, and fourteen to fifteen seasonal tug-barge trips in the western Arctic (Transport Canada, 2007). Community resupply for transportation fuels is approximately fifteen trips each season for the eastern Arctic, with the western Arctic being serviced by ten river tugs that push or tow an average of six linked barges.

In the western Arctic, a significant component of the existing transportation infrastructure involves the Tug and Barge operations of the Northern Transportation Company Limited (NTCL). NTCL owns and operates approximately fifteen tugs and the vessels used in the Arctic sea-lift operations include the *MV Nunakuut, MV Pihurayaak, MV Kitikmeot,* and the *MV Henry Christofferson*. The tugs used by NTCL are shallow draft tugs which allow then to get close to many communities that do not have proper port or dock facilities. NTCL also operates over one hundred ice-reinforced barges that are capable of carrying bulk container modules and oil cargos (Duerden, 2004). The NTCL has also served as a sea-lift distributer to the central Arctic region since 1975 (Newton et al., 2002). As of 2002, NTCL traffic through the Churchill Port was at 35,000 tonnes annually, and included 9,000 tonnes of dry cargo, and 26,000 tonnes of fuel(Newton et al., 2002, p. 286). The social, economic, and environmental effects of shipping through the Churchill Port are included as a case study in this report.

In the eastern Arctic, the Eastern Arctic Sealift, Kivalliq Resupply, and Western Arctic Resupply also conduct sealift operations (Government of Nunavut, 2003). In many Nunavut communities, the beach

or the shoreline are the only offloading sites. There is a general need for port facilities in Nunavut, however, there are several challenges associated with the development of port infrastructure including low cargo volumes for individual communities, ice damage and high costs of maintenance as a result of extreme ice conditions, and short shipping seasons. For example, the Government of Nunavut estimates that a simple tug/barge crib docking face with a breakwater is estimated to cost at minimum $1 to $1.5 million(Government of Nunavut, 2003, p. 9). In addition, the lack of port and dock facilities and berthing facilities for tanker traffic increases the potential for environmental damage as a result of an oil spill.

The sealift resupply season in the Canadian Arctic is relatively short, from July until October. Though NTCL and other resupply distributors do operate ice-strengthened vessels, the system is not designed to travel through heavy ice conditions. While sea-lift is by far the cheapest means of bringing goods into Arctic communities, it also means that stores and other businesses must bring in as much of their goods as they can by sea-lift and warehouse them over the following year. Myers and Forrest point out that this requires a tight control of inventory and can result in shortages, having to import goods (if possible) via air, or pay expensive warehousing costs (Myers & Forrest, 2000). A significant volume of dry cargo is transported to Arctic communities via the annual sea-lift. For example, in 2000 the Northern store in Pond Inlet estimated that fifty percent of its annual stock came in by sea-lift (Myers & Forrest, 2000).

Goods shipped via sea-lift must not be perishable, and non-perishable items must be flown in to communities at considerable expenses. During the winter, when shipping is not possible, air freight is the only supply link available to Arctic people and businesses. The high cost of air-freight (often doubly increased because shipments must pay for both the outbound and return leg of the flight, unlike the shipment of goods in other parts of Canada) has been a significant concern in Arctic communities for several years (Government of Nunavut, 2003). The Food Mail program, also known as the Northern Air Stage Program, pays part of the cost of shipping nutritious perishable food by airlift to Arctic communities. The program supplements air transport of nutritious perishable foods for approximately $0.80 a kilogram plus $0.74 per parcel (Indian and Northern Affairs Canada, 2008). The rate for Food Mail shipments has not changed since 1993.

Myers and Forrest argue that because raw materials must be shipped to Arctic communities and then stored, it is actually much cheaper to import finished goods rather than to import them from within the region (Myers & Forrest, 2000). The costs of shipping from southern regions to an Arctic community are very similar to the costs of shipping between Arctic communities, limiting potential local trade and economic development. The importation of finished goods helps to reduce the costs of housing and infrastructure. However, the purchase of goods already produced in the south also results in a leak in the northern economy, as local workers are no longer needed for such work.

In addition to the high cost to import dry cargo, the cost to import fuel for power generation or gas for vehicle use is also extremely high. Prior to 1997, the Northwest Territories Power Corporation (NTPC) announced a change in its rate structure, moving from a subsidized rate for both businesses and

residences and public offices to having businesses be responsible for their own operational costs(Myers & Forrest, 2000). As Myers and Forrest point out, these costs are transferred to the consumer and make for some of the highest costs of living in Canada.

There are several proposals underway that, if approved, are anticipated to reduce the cost of community resupply in the Canadian Arctic, including the Bathurst Inlet Port and Road Project and the Mackenzie Valley Highway Extension. Both projects are included as case studies in this report. In addition, past research has shown that hydrocarbon exploration and mining activities contribute to the volume of freight shipped on barges, and can help to offset the high costs of shipping. For example, in 1988 after an intense period of hydrocarbon exploration in the Beaufort Sea, barges on the Mackenzie River carried half of their 1982 peak volume (Government of the Northwest territories Department of Transportation, 1999a, p. 341). Concerns were raised, as well, that the closure of Nanisivik and Polaris mines in Nunavut would impact community resupply in Arctic Bay and Resolute.

2.3 Internationalization of Shipping

The potential for decreasing ice cover in the Canadian Arctic, coupled with the increasing importance of resource development, raise questions surrounding the jurisdiction of Arctic marine resources and waterways. As we have already seen, increased emphasis on the Nunavut off-shore commercial fishery has resulted in complicated domestic issues surrounding shrimp and turbot allocations and the jurisdiction and management of Nunavut-adjacent waters. As previously mentioned, the Government of Nunavut has also called for a formal political relationship with Greenland in the management of shared fish stocks in the Davis Straight and Baffin Bay.

Issues of Canadian sovereignty have also become important in light of recent disputes over the ownership of Hans Island, and the political status of the Northwest Passage (Huebert 2005). Changing ice conditions in the Northwest Passage could provide a sea route between Europe and Asia that is 7,000 km shorter than the current route through the Panama Canal (Barber et al., 2005). And, while Canada has asserted sovereignty over the Northwest Passage, some countries consider the passage to be an International Strait (a straight adjoining two expanses of high seas) which means that it would be open to foreign shipping with almost no restrictions (Barber et al., 2005, p. 70).

Canada has asserted sovereignty over the Northwest Passage and the straits and channels in the Canadian archipelago in a variety of ways. In response to an American ice-strengthened oil tanker *SS Manhattan* test voyage though the Northwest Passage in 1969, the Canadian federal government granted permission for the voyage and sent an ice breaker to assist the vessel. It later adopted the *Arctic Waters Pollution Prevention Act* outlining safety and environmental requirements on shipping within 100 miles of the Canadian Arctic coast. In 1985 the Canadian government again granted permission to the US Coastguard ice breaker Polar Sea to sail through the Northwest Passage and, with

the consent of Washington, placed several observers on board the vessel. Canada has also claimed the straits and channels of the Canadian Archipelago as historic internal waters and, following an International Court of Justice ruling, argued that sovereignty could rest in strait baselines linking the outer headlands of the Canadian Archipelago.

An important element for many of Canada's sovereignty claims over the Northwest Passage and Arctic marine waters is the continued use and occupancy of the surrounding land, sea, and sea ice by Inuit people. Barber, Fortier, and Byers report that even during the SS Manhattan voyage through the Northwest Passage, the assertion of Canadian sovereignty was defended by Inuit hunters: "as the SS Manhattan ploughed through the ice near Resolute Bay, two Inuit hunters drove their dogsleds into its path. The vessel ground to a halt until the hunters –having made their point –moved aside" (Barber et al., 2005, p. 69). The Nunavut Land Claims Agreement also affirmed Canadian sovereignty over the waters of the Arctic archipelago as a result of continued Inuit use and occupancy.

In terms of environmental management and regulation, any increase in shipping activity involves the risks of accidents, including oil spills. While the 1982 United Nations Convention on the Law of the Sea, allows coastal states to impose laws against marine pollution out to 200 nautical miles when multi-year ice creates navigational hazards, and Canada has passed the *Arctic Waters Pollution Prevention Act*, the authority to regulate foreign vessels in the Northwest Passage is jeopardized without firm confirmation of Canadian sovereignty claims. The inability to regulate international vessels in the Northwest Passage poses risks of pollution, insufficient safety standards, and the importation of alien species as vessels discharge their ship ballast in Canadian Arctic waters.

Several projects, such as the Churchill port, the proposed Bathurst Inlet deep-sea port, the proposed Mackenzie Highway extension linking Inuvik with Wrigley in the central Mackenzie Valley, and the proposed investment in port and harbor infrastructure for fisheries in Nunavut, and investment in the development of a deep-sea port and re-fueling station at the Nanisivik mine-site have all made the case that maintaining and improving marine transportation infrastructure in the Canadian Arctic will serve to reinforce areas where Canadian claims to sovereignty have been contested. As Newton, Fast, and Henley point out, "these activities are a valuable supplement to the military and other government projects meant to confirm the Canadian presence in this territory, which could have implications for future gas and mineral claims"(Newton et al., 2002, p. 286).

3 SOCIAL AND ECONOMIC CONSEQUENCES OF ARCTIC MARINE SHIPPING IN CANADA

CASE STUDIES:

The following case studies have been identified as playing a significant role in Arctic marine shipping in Canada. Some of the case studies offer a diachronic perspective of social, economic, and/or related environmental effects on Canadian Arctic communities as a result of changes in marine shipping activities over time. Others are evaluated for their current or anticipated future social, economic and/or environmental impacts, as they are currently in operation or are still in development. Environmental Impact Assessments (where available) and other germane secondary literature will be reviewed and relevant social and economic effects of shipping activity will be documented for each case study. Finally, in addition to case studies pertaining directly to shipping activities, a case study on the proposed Mackenzie Valley Highway extension was selected as an example of social and economic impacts of changes in other Arctic transportation systems in Canada.

3.1 Bent Horn

In 1974, Panarctic Oils Ltd. (Panarctic) discovered the Bent Horn oil field on Cameron Island. Between 1982 and 1983, Panarctic began the planning, consultation and review process for a project that would see oil extracted from Bent Horn N-72 and shipped with an ice strengthened cargo vessel through the Byam Martin Channel into Melville Sound and Barrow Straight to Little Cornwallis Island. From there, Bent Horn oil could then be transferred to a conventional tanker for onward shipment to refineries in Montreal or elsewhere (Indian and Northern Affairs Canada, 2006, p. 20/24). Panarctic designed the Bent Horn project in two phases; Phase One included sufficient oil production to support two to three tanker shipments per year in the summer months. The exact number of yearly vessel trips would depend on ice conditions. Phase Two was essentially an expanded oil production and transportation operation and would require the addition of expanded storage capacity at Bent Horn, and additional shipping activity. The project was proposed to the federal government in 1984, and after a formal environmental assessment review, Phase One of the project was approved with conditions.

Construction on the seasonal production and storage facilities began in 1985, and later that same year the first shipment of oil was loaded onto an arctic tanker, the M.V. ARCTIC at the Cameron Island Facility and shipped the 200 miles to Little Cornwallis Island. Overall, the land footprint of the Bent Horn project was relatively small for the production and storage facilities. Panarctic placed twenty-six rubber storage bladders protected by a berm on Cameron Island, and oil was stored there to facilitate seasonal tanker shipments. Cameron Island also had an airstrip which could accommodate C-130 Hercules aircraft; personnel, material, and supplies could be flow to Cameron Island at little cost from the Rea Point base.

The communities closest to the Bent Horn project include Resolute, Grise Fiord, Arctic Bay, and Pond Inlet. The closest community to the Bent Horn field is Resolute, located approximately 300 kilometers east of Cameron Island. During the planning and review process for the project, Panarctic shared its draft plans and regulatory application materials with all four communities, and provided regulatory application materials to the communities prior to submitting them to the government. As Indian and

Northern Affairs Canada points out in their 2006 case study of the Bent Horn Project, this provided communities in the region with the opportunity to be informed about the project, and to influence project planning(Indian and Northern Affairs Canada, 2006). In addition, Panarctic officials met with the communities in the development of a benefits plan and regulatory applications.

Overall, the four communities were not opposed to responsible non-renewable resource exploration in the region, or limited and well regulated summer shipping activities. However, the communities were opposed to the use of the Northwest Passage for year-round shipment of oil or natural gas and turned to the federal government to control the level of shipping volumes and ensure that ship traffic would not interfere with Inuit harvesting activities or marine mammal migrations (Indian and Northern Affairs Canada, 2006). Conditions for government approval of the Bent Horn project included a requirement that should the Bent Horn project proceed to Phase Two of the development plan, a comprehensive socio-economic review would be required. Essentially, this condition meant that there would be no more than two to three tanker shipments of oil each year until a socio-economic review had been completed. The volume of oil produced at Bent Horn did not necessitate an increase in tanker shipments between the summers of 1985 and 1996, and thus a mid-project review was never triggered (Indian and Northern Affairs Canada, 2006).

Initially, Panarctic Oils attempted to find a domestic market for Bent Horn oil. Following the successful use of unprocessed Bent Horn crude oil in the boilers and air heaters at the Skybattle drilling location, Panarctic decided to utilize unprocessed Bent Horn crude to fuel generators and other equipment at their other High Arctic locations. The Bent Horn crude was reported to be equal to diesel fuel for the generation of power for the diesel engines in use at Resolute, and provided fuel for the Nanisivik and Polaris mine operations. Panarctic negotiated an arrangement to provide Bent Horn oil to the Northern Canada Power Commission for use in Resolute, however after a short experimental period the contract was not renewed because there had been environmental complaints from local residents about a foul odor that was emitted when Bent Horn oil was used in the power plant (Indian and Northern Affairs Canada, 2006).

Panarctic utilized a yearly summer sealift from southern Canada to the supply base at Rea Point, and the sealift resupply was substantially cheaper than the per pound freight for airlift (Hetherington, 1997). Initially, Panarctic considered having the sealift supply vessel continue on to Bent Horn to load oil and carry it south on its outbound voyage. However, heavy ice conditions necessitated the use of an ice-strengthened tanker.

The communities of Resolute, Grise Fiord, Arctic Bay, and Pond Inlet also depend on the annual sealift for the resupply of goods and fuel for domestic consumption. Given that the Cameron Island facilities were at least 300 kilometers away from the closest community (Resolute), there is no evidence that community re-supply by sealift was increased, or that goods were available at a lower cost. There is some evidence, however, that the use of Bent Horn oil for fuel in power plant operations in Resolute may have decreased the community's reliance on fuel re-supply, even if for only a short period of time.

The largest community near the Bent Horn facilities is Pond Inlet (estimated 1984 population of 700), followed by Arctic Bay (estimated 1984 population of 400), and these two communities supplied the majority of Panarctic's Inuit workers. Up to ten Inuit from Arctic Bay were employed during the 1985 construction period, for subsequent installations and construction, and during the decommissioning (Indian and Northern Affairs Canada, 2006). However, most Inuit worked at the Rea Point supply-base in warehousing activities. Panarctic employed a seasonal and rotational work cycle, with employees able to work a two-weeks-on, two-weeks-off work rotation that was attractive to some Inuit workers. Inuit workers were provided charter air transportation between their home communities and their work sites.

In terms of Bent Horn's effects on Inuit harvesting activities, Indian and Northern Affairs Canada reports that no resource harvesting by Inuit occurred on Cameron Island or the surrounding waters, and that the only resource harvested on Melville Island was Polar Bear, hunted by Inuit from Grise Fiord and Resolute (Indian and Northern Affairs Canada, 2006). The direct effects of increased shipping activities on Inuit use of Arctic sea ice and traditional ways of living is addressed in a report conducted by ICC Canada for the AMSA.

In the fall of 1996, the Bent Horn well was abandoned due to falling reservoir pressure. During the decommissioning, Panarctic offered to make the heavy equipment located at Bent Horn available to the community of Resolute at a low cost, and the community was able to purchase a front-end loader. Also, a contractor in Resolute was able to obtain nine C-130 Hercules loads of equipment and material (Indian and Northern Affairs Canada, 2006).

According to Indian and Northern Affairs Canada, the Bent Horn project had limited apparent socio-economic effects on the four communities "apart from generating some short-term employment opportunities for Inuit from Arctic Bay and Pond Inlet and increased business activity for a contractor in Resolute"(Indian and Northern Affairs Canada, 2006, p. 9). Other literature holds Bent Horn as an example of a successful project that demonstrated the shipment of oil could be conducted in an environmentally successful way into the eastern Northwest Passage in the summer months using an Arctic Class III tanker. In an interview included in Chris O'Neil's work on oil and gas exploration in the Canadian arctic, a CANMAR naval architect states 'nobody complains about it. There have not been any leaks, to the best of my knowledge, and they are doing it on a very low-key basis'"(Hetherington, 1997, p. 227). While the distance between the communities and the Bent Horn field limited some potential community benefits, such as increased community resupply at a lower cost, it also meant that other effects, such as disruptions in community services were mitigated. The Bent Horn project provided some employment in the wage economy for a limited number of Inuit workers. Importantly, it also involved Inuit, northern organizations, and the Government of the Northwest Territories in regulatory and planning processes, and kept communities and various levels of government well informed of project activities.

3.2 Nanisivik Mine

Nanisivik zinc-lead mine was the first mine built in the Canadian Arctic. In 1972 and 1973, Mineral Resources International (MRI) undertook production feasibility studies to lead-zinc ore from the Nanisivik area. Two possible scenarios were developed: a private sector scenario, where the project would run essentially as a bunk-house operation and would have an approximate seven to eight year life span, or a public/private scenario where the federal government would provide support to develop a town site. Under the second scenario, the anticipated lifespan would extend to between twelve and thirteen years. The town site scenario was preferred by the federal government, and was approved in 1974.

Construction of the town site began in 1974 and a dock and port was built by the Government of Canada. Breakwater (the mine operator) paid port dues and warfage on shipped concentrates from the Nanisivik mine (Transport Canada, 2007). The town site at Nanisivik was built only 21 kilometers from the community of Arctic Bay, and Nanisivik and the community of Arctic Bay are now connected by a road. According to a study on the socio-economic impacts of Nanisivik commissioned by the Government of Nunavut, the mine and the town site were "initiated in the midst of expectations that it would provide significant social and economic benefits to north Baffin communities"(Government of Nunavut Department of Sustainable Development, 2002, p. 1). The Nanisivik Mine operated from 1974 to 2002, when the mine was reclaimed and the Nanisivik town site abandoned.

The major direct economic impact of Nanisivik on the community of Arctic Bay was the wages paid to employees (Government of Nunavut Department of Sustainable Development, 2002, p. 34). According a study on the socio-economic effects of the Nanisivik mine commissioned by the Government of Nunavut, a limited but significant number of Arctic Bay residents worked full or part time in the mine over the thirty year mine-life, in 2002 directly contributed over $1 million per year over 25 years to Arctic Bay's total personal income (Government of Nunavut Department of Sustainable Development, 2002, p. iv). In 2002, fourteen people from Arctic Bay were employed full time at Nanisivik and earned an annual income of $25,000 or more. An additional thirty people from Arctic Bay have been working part time or gain casual income from the Nanisivik mine (Government of Nunavut Department of Sustainable Development, 2002). The closure of the mine is likely to result in the loss of jobs and associated wages, and is expected to decrease household income for those people employed at the mine. Employment opportunities in other sectors of the economy are limited, and the competition for other jobs is expected to increase (Government of Nunavut Department of Sustainable Development, 2002).

A loss of income may also impact harvesting activities because people may no longer be able to afford fuel and harvesting equipment, such as snowmobiles. According to the study commissioned by the Government of Nunavut, increased income as a result of employment at Nanisivik supported the purchase of harvesting equipment which was often shared with family members and others in the community. The report suggested that there is no evidence that the level of sharing of country foods was reduced by participation in a wage economy (Government of Nunavut Department of Sustainable Development, 2002, p. ii).

In addition to a decrease in household income, the loss of jobs and associated wages resulting from the closure of the Nanisivik mine is expected to have an effect on retail stores and other local businesses as

income (including disposable income) decreases. While only two local businesses have received contracts to conduct work at the Nanisivik mine and town site, earned income at the mine has contributed to the local economy through spending at Arctic Bay businesses (Government of Nunavut Department of Sustainable Development, 2002). The abandonment of the Nanisivik town site will impact Arctic Bay business, retail, and arts and craft sectors, as mine workers from other parts of Canada will likely leave the area.

In terms of transportation infrastructure, the port facility and the airstrip have provided decreased freight costs and have resulted in more frequent and reliable transportation services. The airstrip is able to feasibly accommodate jet service as a result of business provided by the mine. More frequent jet service has resulted in more convenient plane transportation to neighboring communities at a lower cost for travelers. In addition, the frequent jet service has reduced the costs of air freight, and fresh food is transported into the community more regularly. Tourists also make use of the frequent jet service, and it has been reported that groups of cruise ship guests fly both in and out of Arctic Bay (Government of Nunavut Department of Sustainable Development, 2002, p. 70). Jet service has also made it possible for tourists to travel to Arctic Bay for events such as the Midnight Sun Marathon. Nanisivik's port facility has provided for more frequent and less expensive shipping as a result of an increase in ship traffic due to mine re-supply. The port has also served as a re-supply point for cruise ships. Both the jet and the port facility have been identified as "contributing to tourism potential in the region by providing important services to cruise ships"(Government of Nunavut Department of Sustainable Development, 2002, p. 25). The port and jet facilities are anticipated to contribute to a growing tourism economy.

In the study on the socio-economic effects of Nanisivik commissioned by the Government of Nunavut, residents of Arctic Bay identified several negative effects of the Nanisivik mine. Alcohol associated with the Nanisivik mine and town site is generally associated with negative social impacts. In 1978, alcohol was permitted to be shipped to Nanisivik, and it is said that alcohol consumption increased(Government of Nunavut Department of Sustainable Development, 2002). The transition from a subsistence to a wage economy was also identified as a negative impact, as was changes in the roles of elders and parents in raising children. However, the authors are quick to point out that the transition towards a wage economy, and the role of parents and elders can not be attributed to the mine alone, and that general changes such as a move toward a formal education system, have also facilitated these impacts. Also, as mentioned earlier, in some cases wages earned as a result of working at Nanisivik resulted in a greater ability to participate in harvesting activities. Other indirect socio-economic effects on Arctic Bay include some (mostly temporary) stress on marriages as a result of family role changes from leaving the family for shift work, increased workload at home and increased contact with non-local workers. The authors point out, however, that mine workers rarely visited the community of Arctic Bay for social interaction and that the "physical and cultural separation" between mine workers and residents of Arctic Bay may have mitigated additional impacts (Government of Nunavut Department of Sustainable Development, 2002).

Finally, the authors of the study on the socio-economic impacts of Nanisivik on Arctic Bay point out that while the transportation infrastructure developed as a result of Nanisivik mine and town site may put the community of Arctic Bay in a favorable position in regards to a developing tourism economy, other infrastructure such as increased housing, schools, and business spaces has not benefited. The authors point out that the federal government invested in the infrastructure of the Nanisivik town site (now

abandoned as a result of the decommissioning of the mine), and consider the community's development status had the government invested in Arctic Bay infrastructure rather than infrastructure and services at Nanisivik.

Nanisivik mine and town site will have future uses, however, and in August 2007, Canadian Prime Minister Stephen Harper announced that the Nanisivik port will be refurbished for military and civilian purposes. The new port and refueling station are estimated to cost $100 million and is expected to begin in 2010. In addition to other activities, the port will serve as a training site for the Canadian military, and will help to strengthen Canada's sovereignty claim over the Northwest Passage (CBC News, 2007b).

3.3 Port of Churchill

The Port of Churchill is currently the only Arctic deep-sea port in Canada (Newton et al., 2002). Owned and operated by OmniTRAX International, the port offers four berths for the loading and unloading of grain, cargo, and tankers, and is able to accommodate Panamax class vessels up to a 60,000 tonne capacity. The port also has the capacity to clean and store grain in a 140000 grain elevator. The shipping season for the Port of Churchill is from July to mid November, and it has a throughput capacity is over 1 million tones of grain(Port of Chuchill, 2008). Grain accounts for ninety percent of the port's current traffic, and while ocean going vessels primarily export grain and other commodities to Europe, South America or Africa, the port also has the capacity to import products. The port is connected to the Canadian National Railway system through the Hudson Bay Railway which allows for efficient access to western wheat lands and North American markets. The resupply of fuel, good, and cargo to communities in along Hudson Bay and the central Arctic by Northern Transportation Company Limited (NTCL) has also become an important function of the port, making Churchill an invaluable transportation artery for northern Manitoba and the central Arctic region. In 1997 the transfer of the port from the Crown Corporation Ports Canada to OmniTRAX International required bringing the port up to environmental standards, and the majority of these tasks including dust control and remediation of contaminated oils surrounding the marine tank farm have been completed (Newton et al., 2002, p. 268).

Over the years Churchill Manitoba's location has fostered a range of Arctic-focused activities including international shipping, an international rocket research range, and Canadian and American military instillations aimed to track and monitor Arctic activity. Shipping access provided a core rationale for these services.

Historically, Churchill was one of two main export routes for the active for trade in the 17th, 18th and 19th centuries. When the Fort Churchill military base was decommissioned in the 1980s, there were concerns raised by local residents about abandoned and derelict buildings, dumps, and gravel pits used for construction in military sites. Also, new gravel pits along the Hudson Bay coast used for road and runway construction have yet to be reclaimed and are said to be of concern to local populations (Newton et al., 2002, p. 284).

Overall, the major employers in Churchill include the Hudson Bay Port Company, the Regional Health Authority, the Town of Churchill, Churchill Airport, and NTCL. The Hudson Bay Port Company is the

major employer in the region with 100 workers employed during the shipping season from July until November. In addition, NTCL employs 40 employs for their barge and resupply operations(Eddy, Fast, & Henley, 2002). In general, the Port of Churchill annual contributes approximately $6.5 million to the local economy(Eddy et al., 2002). In 1998, the Churchill Airport employed 37 people directly, and 82 people indirectly, contributing $14 million dollars in direct and indirect revenue(Newton et al., 2002, p. 286).

Tourism activities also contribute significantly to the Churchill economy, both directly and indirectly, and in 1997 the tourism industry is reported to have directly employed 130 local residents, and indirectly generated up to 50 jobs (Newton et al., 2002, p. 282). According to some studies, the tourism industry accounts for up to forty percent of Churchill's total local economy(Newton et al., 2002). Churchill is a popular destination for national and international tourists, and has become world renown as a wildlife sight seeing destination, including observing polar bears, beluga whales, northern lights, and various bird species. In 1996, 12000 tourists visited Churchill by air and an additional 6500 arrived by train (Eddy et al., 2002, p. 293). Cruise ships have also been making Churchill a port of call with increasing frequency over the past few years, and cruise ship passengers have been able to utilize the rail and airport services in Churchill to continue on to other destinations. However, some studies have reported that tourism growth may be limited by infrastructure demands, including a lack of quality accommodation. Furthermore, a developing tourism economy will depend on maintaining and increasing current infrastructure and expanding tourist seasons. More integrated transportation facilities and services that would allow for efficient travel, say between port and air facilities would provide for growth in the tourism sector (Newton et al., 2002, p. 287).

Despite the employment opportunities provided as a result of the shipping and tourism sectors, unemployment levels in Churchill remain fairly high compared to the rest of Manitoba, with twenty one percent unemployment in Churchill compared to an average of eight percent unemployment province-wide(Newton et al., 2002, p. 282). This is largely due to the seasonal nature of employment in both the tourism and shipping sectors, and results in seasonal employees having to depend on government subsidies for some portions of the year. An extension of the shipping and tourist seasons may provide for longer periods of employment for local residents.

A study conducted by Newton, Fast & Henley (2002) shows that local residents have reported a concern over the environmental effects of increased tourist activities. A significant number of people interviewed in Churchill identified tundra vehicle traffic as their main environmental concern in Churchill (Newton et al., 2002, p. 283). There is a general concern that too many tourists over a short period of time will result in environmental degradation and overburden local infrastructure. There is also concern that an increase in tourism will result in the disturbance of wildlife, and the pollution of aquatic and terrestrial ecosystems. There is also a general concern that increased commercial shipping activity and dredging of the port may result in a disturbance to the Churchill River estuary, which is vital to Beluga whale populations. An important consideration for increased ship traffic includes potential environmental impacts on important wildlife populations vital to the tourism sector, such as Beluga whales and some bird species. It is anticipated that conflicts may arise between tourism and shipping sectors if the shipping season is extended. However, Eddy, Fast & Henley (2002) report that local residents also see longer shipping seasons as the potential to have a positive effect on local employment.

Local residents have also reported negative impacts associated with increased dust from port activities, however, dust control facilities have been installed and dust mitigation has been in effect since 1997 when OmniTRAX took over port operations. There has only been one oil spill as a result of port activities, but local residents are concerned about the potential for additional spills. The Churchill River estuary and the Hudson Bay coastline represent important social, cultural, economic and recreational locations for local residents and activities such as hunting, fishing, and camping are important aspects of life for many people in Churchill (Eddy et al., 2002, p. 293).

The NTCL has utilized the Churchill port as a distribution centre for the central Arctic region since 1975. Cargo is transported to Churchill via railway and is then transferred to barges for shipment to northern communities. According to Newton, Fast & Henley (2002), NTCL traffic was at 35,000 tonnes annually (9,000 tonnes of dry products and 26,000 tonnes of fuel) in 1999 (Newton et al., 2002). An agreement between the Province of Manitoba and the Government of Nunavut to maintain Churchill as a gateway to Nunavut communities should ensure that shipping re-supply remains an important function of the port.

The Newton, Fast & Henley also identified local concerns over alcohol abuse, low educational levels, quality of health care, child neglect, drug use, insufficient youth programs, care for the elderly, and the use of video lottery terminals as the main social concerns in the Churchill community. However, the authors did not attribute any of these concerns directly to port or shipping activities.

In 2007 the port of Churchill received it's first ever shipment from Russia, and the first inbound shipment since 2000. The Murmansk Shipping Company vessel, the *Kapitan Sviridov*, unloaded fertilizer imported by Farmers of North America, and was loaded for outbound shipment of wheat to Italy. The Churchill port is actively promoting two-way trading opportunities with Europe, Russia, and Africa and promotes lessened nautical miles for ships wanting to reduce transportation time and distances. For example, shipments from Murmansk to North America through the St. Lawrence Seaway and the Great Lakes to western Ontario typically take 17 days, however the time between Murmansk and Churchill is only eight days under favorable ice conditions (Hudson Bay Port Company, 2008). Unloaded cargo can then be shipped via rail to multiple North American destinations. The development of the Murmansk to Churchill route is often referred to as the Arctic Bridge.

In 2007, Canadian Prime Minister Steven Harper announced that the federal government (along with the Province of Manitoba) would share $40 million in improvements to the Hudson Bay rail line between The Pas and Churchill, and $8 million for improvements to the Port of Churchill (CBC News, 2007a). While grain is presently the primary export shipped out of Churchill, OmniTRAX is attempting further diversification of ship traffic to include alternative crops, minerals, and bulk commodities such as potash.

3.4 Beaufort Sea

Early hydrocarbon exploration drilling began in the Beaufort Sea in 1973, with the majority of exploration drilling occurring between 1973-1989 (Fisheries and Oceans Canada, 2003, p. 39). By the early 1990s, over 210 exploratory test wells had been drilled in the Mackenzie Delta and offshore in the Beaufort Sea (H. Fast et al., 2001, p. 187).

The Tuktoyaktuk Harbour and McKinley Bay acted as staging areas for offshore drilling conducted in the Beaufort Sea in the 1970s and 1980s. Dome Petroleum and Imperial Oil set up large shore bases within a few miles of Tuktoyaktuk, and a dock was built to accommodate loading and unloading supply vessels. Although Tuktoyaktuk had existing infrastructure prior to early hydrocarbon development (including an airstrip and a natural harbor), the harbor was limited by a shallow and long entrance channel that was too shallow to accommodate large drill ships and larger vessels. Additional harbors were developed to store larger ships over the winter months (Hetherington, 1997, p. 88). However, vessels did over-winter at both Tuktoyaktuk and McKinley Bay locations, and those locations became significant in the resupply of drilling consumables and fuel, and dry dock repairs to base camps and drill ships. According to interviews conducted by Fast, Mathias, & Banias (2001) during the most intense periods of early hydrocarbon exploration activity in the Beaufort sea, it was not uncommon to see an average of 100 vessels including barges, drill ships, and supply vessels in Kugmallit Bay (H. Fast et al., 2001, p. 199).

The hundreds of workers associated with hydrocarbon exploration in the Beaufort Sea and Mackenzie Delta required a large volume of food which was flown in regularly. The airstrip at Tuktoyaktuk was expanded to accommodate Boeing 737 aircraft, and fresh fruit and vegetables were flown in almost daily (Hetherington, 1997, p. 89). Fuel was imported using tankers or barges.

Imperial Oil, Dome Petroleum, and Gulf Oil constructed work-camps near the town of Tuktoyaktuk, raising concerns among locals about industry employees interacting with community residents. Initially, all three camps but measures in place to prevent employees from entering Tuktoyaktuk, however, the community eventually approached the companies and requested that employees be allowed to access the town so that they could use Tuktoyaktuk services and shops. Employees were then permitted unlimited access to the town until eventually access was again restricted to certain chaperoned times, as a result of several complaints from residents about disruptions caused by southern workers. In contrast to Tuktoyaktuk, Chris O'Neil (1997) points out that resident of Inuvik generally did not have the same level of concern about an influx in southern workers because of an already existing military base, government, and industrial sectors (O'Neil, 1997, p. 154).

According to Jana Zavitz, training of northern employees was one of industries greatest positive contributions during early Beaufort Sea exploration (Zavitz, 1997b, p. 189). It was anticipated that northern residents would gain employment on drill ships, supply vessels, and that northern workers would staff the personnel and supply camps. Because this was the first time many northern workers had been exposed to oil exploration activities in the Beaufort Sea, they were in need of training. Initially, when workers were sent for training in southern programs, the recidivism rate was as high as eighty percent (Zavitz, 1997b, p. 189). Training programs were then revised to include classroom training, hands-on experience on practice drill rigs, and on-the-job training. Dome Petroleum was also instrumental in establishing Tuk Tek in 1980, a training program housed at Dome's camp near Tuktoyaktuk, during the winter months when the camp was empty. Eighty six northerners successfully completed programs at Tuk Tek during it's first two years of operation and the recidivism rate fell to as low as five percent (Zavitz, 1997b, pp. 187-189). In addition to skills relevant to employment, instruction was given in money management, dealing with financial institutions, and other skills needed to transition from a subsistence to a wage economy.

Generally speaking, oil and gas development provided employment, increased wages, improved community infrastructure and services, and opportunities for local businesses. They also change the way families and communities live as family members migrate or undertake rotational work away from their home, and bring home cash instead of going out on the land to bring home protein.

Some modest improvements occurred in areas of education, though educational attainment in the Inuvialuit Settlement Region remained, on average, generally lower relative to other jurisdictions in Canada. In a summary of a workshop conducted for the Beaufort Sea Strategic Regional Plan of Action, local residents also pointed to negative effects of hydrocarbon exploration including less country food consumption, lower participation in traditional harvesting activities, fewer people speaking Aboriginal languages, increased drug and alcohol consumption, increased crime and violence, and boom and bust cycles that resulted in unstable community economies (Beaufort Sea Strategic Regional Plan of Action, 2006, p. 7). While all of these impacts can not be directly attributed to hydrocarbon exploration in the region, local residents cited hydrocarbon exploration as a key factor in bringing these changes to communities, or in contributing to effects already experienced by community members.

In the 1980s world oil prices fells significantly, and the exploration for oil and gas in the Beaufort Sea stalled. Employment in Tuktoyaktuk, which had become a focus of exploration activity in the 1970s, was severely effected by the decline of the oil and gas industry. The cessation of oil and gas activity in the 1990s, coupled with the closure of the military base in Inuvik in 1986, meant that many southern workers who had come to Inuvik and Tuktoyaktuk for work, returned to the south. The lack of employment opportunities resulted in some local residents turning to government assistance while unemployed. At the same time, some studies suggest that substance abuse levels also rose when oil and gas exploration activities ceased (Zavitz, 1997a, p. 170). One study suggests that the lack of work has lead some northerners to return to hunting and trapping activities, as well (Zavitz, 1997a, p. 174).

The Tuktoyaktuk harbor also plays an important role in the shipment of dry-goods, cargo, and fuel throughout the region. The Northern Transportation Company Limited (NTCL) has a large docking and staging facility in Tuktoyaktuk and they operate a coastal community supply vessel through Kugmallit Bay every other day, on average, between July 1 and October 1 (Fisheries and Oceans Canada, 2003, p. 48). In addition, barge traffic consisting of ten river tugs that toe an average of six linked barges transit Kugmallit Bay approximately two to three times per week in the summer months, carrying bulk petroleum products, dry cargo, and supplies to communities, oil and gas exploration sites, and military instillations. According to Fisheries and Oceans Canada, other than a slight increase in tourism and an upsurge in oil and gas related activities, there has been little increase in the size or nature of barge traffic in recent years (Fisheries and Oceans Canada, 2003, p. 48).

In additional to transportation and petroleum industries, tourism provides some wage earning employment opportunities in the Inuvialuit Settlement Region. Tourism is the third leading export in the Northwest Territories (although small by comparison), and the tourism industry has potential to expand (H. Fast et al., 2001). Important tourism activities in the Beaufort Sea include observing wildlife, hiking, rafting, sports hunting and fishing, visiting whaling hunting and fishing camps, boating, and attending cultural events. There is some interest in exploring opportunities for beluga whale watching as well (Fisheries and Oceans Canada, 2003, p.iv). According to Fisheries and Oceans Canada (2003) no tourism operators conduct boat tours in Zone 1a areas, though several local outfitters have taken tourists to hunting and fishing camps. There are three cruise ships that currently travel in the offshore waters of

the Beaufort Sea. Cruise ships do not enter estuaries or the Mackenzie Delta areas due to insufficient water depth, but at least one of the cruise ships brings tourists to shore with helicopters or zodiac boats (Fisheries and Oceans Canada, 2003, p.48). Tours typically run from May to September each year and bring approximately four to six cruise ships (Fisheries and Oceans Canada, 2003, p. 46).

Beluga whales that aggregate in the shallow Beaufort waters in the summer months represent a large potential draw for tourism activity, however, since harvesting is also conducted during the summer the Beaufort Sea Beluga Management Plan prohibits tourism activities such as whale watching in Zone 1a areas from spring breakup until August 15 (Helen Fast, Chiperzak, Cott, & Elliot, 2005, p. 101). Beluga whales remain a significant traditional food harvested by people living in the Inuvialuit Settlement Region. According to a report commissioned by Fisheries and Oceans Canada: "these activities are much more than subsistence economic pursuits; they are integral to the Inuvialuit culture offering tremendous social benefits, reconnection with the land, continuance of cultural traditions, and strengthening of family and community bonds" (Fisheries and Oceans Canada, 2003, p.ii). It is estimated that seventy five percent of households in the Inuvialuit Settlement Region still rely on the land for hunting, fishing, and domestic food production (Fisheries and Oceans Canada, 2003, (Usher, 2000). An average of 111 Beluga whales were taken in subsistence harvesting annually in the Inuvialuit Settlement Region in the 1990s. Traditional foods are consumed by Inuvialuit for nutritional, cultural, spiritual, social and economic reasons. Economically speaking, the consumption of traditional foods can off-set the high cost of food items in remote communities, which can be significantly higher than in southern cities (Usher, 2002). In addition to the nutritional value of traditional foods, the cultural, social, and spiritual benefits that traditional foods supply can not be replaced by store-bought foods (Transport Canada 2003, p.27).

There are concerns regarding the potential effects of proposed future hydrocarbon activities on beluga whale populations. Beluga summering in the Beaufort Sea in the summer months concentrates in areas where deep water port development and shipping could effect water regimes, water quality, and food availability. Fast, Chiperzak, Cott & Elliot report that "such activities could affect beluga either directly (underwater noise, oil spills) or indirectly (changes in stability or integrity of ice, timing of breakup , chronic hydrocarbon contamination of food species)"(Helen Fast et al., 2005, p. 101). An additional study conducted by Fast Mathias, & Banias shows that some of the highest hydrocarbon concentrates in the Arctic occur near the Tuktoyaktuk harbor and appear to be a result of fuel spills and runoffs from work-yards (H. Fast et al., 2001, p. 199). For example, increased hydrocarbon activities would likely increase ship movement and barge traffic through the shipping corridor in Kugmallit Bay. This shipping corridor plays an essential role in the supply of goods and materials for coastal communities and oil and gas exploration sites, but is also an important beluga summering location. Presently, hydrocarbon seismic and drilling programs are being conducted in the winter months, when whales are not present in the area.

There has been a renewed interest in hydrocarbon exploration in the Beaufort Sea. Ten new exploration parcels were nominated during the summer of 2000, and the Inuvialuit Regional Council recently put some of their subsurface lands out for bid, resulting in four parcels being allocated. Devon Energy has also conducted seismic and exploration drilling activities. However, with the exception of the on-shore Ikhil field, no oil or gas fields have been developed in the Beaufort Sea or Mackenzie Delta and the extent and nature of future activity is likely dependent on the timing and approval of the Mackenzie Gas Project.

3.5 Bathurst Port and Road Project

If approved, the Bathurst Port and Road Project (BPRP) will consist of a deep sea port on Bathurst Inlet in the Kitikmeot region of Nunavut, and a 211km all weather road which would connect the port to existing Tibbitt to Contwoyto Winter Road at Contwoyto Lake. The infrastructure needed would include a wharf to serve vessels delivering fuel and bulk cargo to the port, a dock to handle barges for community resupply vessels, a 200 person camp, a diesel fuel tank farm, a truck and trailer maintenance shop, and a 1,200m airstrip. There would also be a twenty person camp at Contwoyto Lake. The BPRP has been designed in two stages: a construction phase, and an operations phase. A Draft Environmental Impact Statement for the BPRP has been submitted to regulatory authorities in 2008, and is currently under review by the Nunavut Impact Review Board.

The project Proponents are a joint venture (Bathurst Inlet Port and Road Joint Venture Ltd.) which is owned by Kitikmeot Corporation and Nuna Logistics Ltd. The project infrastructure will service the existing diamond mines in the Slave Geological Province, and serve to attract further capital investment in the exploration and development of new mines. Also, the BPRP is anticipated to serve as a community re-supply centre in order to reduce the cost of essential bulk and dry cargo to Kitikmeot communities.

Marine shipping to and from the deep sea port proposed for Bathurst Inlet is anticipated to occur during ice-free months between the middle of July and October 15. Marine access to the port would use the existing shipping lanes that currently serve the community of Resolute, and have previously been utilized to serve the Polaris Mine, Bent Horn, and Rae Point. Vessels of up to 50,000 tonnes will deliver over 300,000 tonnes of fuel and supplies for communities and mines (BIPR, 2004).

Generally speaking, a major objective of the BPRP is to induce further investment into proposed and potential future mining activity. The Proponents state that the mineral wealth of the Slave Geological Province has not been fully realized due to a lack of infrastructure resulting in high costs for mineral exploration, development, and production (BIPR, 2004, p. 10). The BPRP is aligned to be accessible by existing mines such as Ekati, Diavik, and Snap Lake, and projects in advanced stages of exploration such as Gahcho Kué, Hackett River, Hope Bay deposts, and Izok Lake. It is anticipated that these projects will utilize BPRP facilities to export products and import supplies.

It is anticipated that utilizing the BPRP, fuel, cargo, and services could be delivered to the mines sooner and at a lower cost than existing overland winter road transportation from Yellowknife. In addition to resupplying the mines, the BPRP is expected to significantly lower the costs of goods imported to Kitikmeot communities via the port at Bathurst Inlet. For example, the cost for fuel is estimated at $1.00/L from the proposed Bathurst Port as compared to $1.48/L barging from Hay River; and the cost of dry cargo is anticipated to be $315/tone from the proposed Bathurst Port as compared to $859/tone barging from Hay River (BIPR, 2004, p. 10). Goods shipped through the Bathurst Port are also anticipated to be delivered sooner, and the Proponents expect that cargo transport to Cambridge Bay, for example, could be delivered four to six weeks earlier than if it were barged from Hay River via the existing Mackenzie River route (BIPR, 2004, p. 90). It is anticipated that a reduced cost of freight as a result of the Bathurst Port would directly reduce the cost of living in Kitikmeot communities by transporting 256 million litres of fuel and 560 tonnes of general cargo through the port annually (BIPR, 2004, p. 24).

The BPRP is expected to have a direct effect on the creation of wage employment for Kitikmeot residents. During construction, the BPRP is expected to create 260 jobs, and there is a target to provide thirty percent of these jobs to Inuit workers. During the operations phase, an anticipated 57 jobs will be created. It is expected that fifty percent of operations jobs will be targeted for Inuit workers, and the percentage of Inuit workers would increase up to seventy five percent over ten years. Additionally, spin off businesses, particularly at the port site, are anticipated to create additional employment opportunities in support services and good suppliers.

The Proponents anticipate that construction and operation personnel will work on a two-weeks-in, two-weeks-out rotational work schedule, and that Kitikmeot Region personnel will commute from their homes to the operations or construction camps. Rotational work schedules are designed to maximize available harvesting time for Kitikmeot workers, and to mitigate potential impacts stemming from the interaction between southern workers and Kitikmeot communities. The lack of roads between the BPRP and Kitikmeot communities is also anticipated to mitigate adverse impacts of community exposure to southern personnel.

There is the potential for socio-economic effects as a result of rotational work schedules. The Proponents have identified a potential increase and family violence and potential disruption of the Aboriginal family unit and family cohesion as possible effects (BIPR, 2004, p. 10/14). Also, the Proponents have identified the potential for an increase in drug and alcohol consumption among BPRP workers and in Kitikmeot communities due to increased contact with southern workers who may bring drugs and alcohol into the work camps (BIPR, 2004, p. 6/4). In addition, increased wages and more disposable income might mean more available cash with which to buy drugs or alcohol (BIPR, 2004, p. 6/4). However, increased wages may also serve to offset the typically high cost of living in Kitikmeot communities.

The Proponents also anticipate that the need for skilled labour at the BPRP will encourage local residents to take training and educational programs sponsored by BPRP. These training programs will include skills in the areas of heavy equipment operation and supervisory training. The BPRP will also make a high school diploma a pre-qualification for work, and it is expected that the prospect of obtaining a high paying job after graduation will encourage more Kitikmeot youth to finish high school (BIPR, 2004, p. 20/24).

The BPRP is not expected to directly impact the hunting, fishing, trapping, and travel activities of Nunavummiut living within the Kitikmeot region. During the construction of the port smaller game such as waterfowl and ground squirrels may be disturbed for a short period which may effect harvesting of those species in the direct area of the port. The construction of the road linking the port to the existing winter road at Contwoyto Lake may produce noise and dust. Dust and noise mitigation measures are proposed, but there is potential that the construction of the road may impact caribou migration, making it more difficult for local hunters to locate the herds. Communities in the Northwest Territories and the Kitikmeot region continue to rely heavily on caribou for subsistence and cultural needs. Mitigation measures include construction periods that do not coincide with caribou migration or calving. Excessive dust may also disturb medicinal and edible plant species located near the proposed road route. There are also concerns that the use of water during road construction may lead to erosion and sedimentation caused by surface runoff, and an increased potential that contaminants would runoff into local surface

water resources. There are already concerns regarding the accumulation of contaminants in country foods, and there is a potential for these concerns to increase as a result of road construction and operation.

People in the Kitikmeot Region continue to harvest seals, whales, and other marine mammals. The Proponents have indicated that the effects on sea ice required for seal hunting will not be significant as shipping will occur in the summer months and icebreakers will not be used to extend the shipping season for vessels serving the project. Caribou herds that rely on winter sea ice for migration will likewise not be effected.

BPRP Proponents argue that although there may be a shift from traditional economic pursuits into a wage economy as a result of participation in BPRP activities, the project will open new lands for hunting and will make accessing the land easier for Aboriginal hunters and gatherers. During the construction phase it is estimated that approximately seventy eight Inuit trappers, hunters, and fishers will withdraw from the traditional economy. However, there is also potential that cash earned as a result of wage employment at the BPRP could finance the equipment and fuel needed to undertake traditional harvesting activities.

The Proponents stated that infrastructure created as a result of the BPRP may facilitate the movement of tourists into Nunavut, and particularly the Kitikmeot Region, thereby increasing future tourism potential. However, the owners of the Bathurst Inlet Lodge, one of the worlds top 25 eco-tourism destinations located in the immediate vicinity of the proposed port, believe that the viability of their business would be threatened by the BPRP. The Bathurst Inlet Lodge currently provides thirty nine full and part time jobs (CEAA, 2005).

As previously stated, the BPRP is currently under review by the Nunavut Impact Review Board. The Proponent's EIS submission has been delayed since 2004 due to project revisions.

3.6 Polaris Mine

The Polaris zinc-lead mine located on Little Cornwallis Island was the most northerly base-metal mine in the world (Natural Resources Canada, 2004). The mine, which was owned by Vancouver-based Teck Cominco Ltd. and extracted calcium, lead, and zinc, began operations in November 1981 and mine decommissioning was completed in September 2002. Shipments of mine concentrates were made to Europe during the July through October arctic shipping season. The mine was served by a fleet of ice capable vessels operated by Canarctic Shipping, a division of Fednav Ltd. from Montreal. The *MV Arctic,* also used in the Bent Horn project and Nanisivik Mine, carried inbound fuel and supplies to Polaris and ore concentrates on its outbound journeys. By 1997, the level of ore production was 152,000 tonnes. At its highest, the mine processed about 1 Million tones of ore per year.

The Polaris mine was one of the most compact operations in Canada (Nunatsiaq News, 2001). The processing plant for the mine was built on a barge in Montreal and towed to the mine-site where it was moored in place. Infrastructure included a powerhouse, maintenance services, dry-room, warehouse and operating offices, a concentrate storage building for 11 months of ore production, an airstrip, a

conveyer belt, and an accommodation complex housing up to 220 mine personnel. The total land use was approximately 170 hectares (Nunatsiaq News, 2001).

Polaris mine began operations with 231 employees in 1981 (Natural Resources Canada, 2004). In 1981, a Socio-Economic Action Plan was signed between Cominco Ltd. and the territorial government that set out guidelines to enhance employment and training opportunities for northern residents. Apprenticeship programs and other training initiatives at the mine did not attract the interest of the local populations. In fact, several reports suggest that there was a general lack of interest by local Inuit residents to participate in employment at the Polaris Mine (Indian and Northern Affairs Canada, 2006; Natural Resources Canada, 2004). A report commissioned by Indian and Northern Affairs Canada in 2006 suggests that the rotational work schedule of six-weeks-in, two-weeks-out was unattractive to most Inuit as it affected family and related community dynamics and the ability to hunt. According to the same study, in 1984 only one Inuk from Grise Fiord and one Inuk from Ranken Inlet were employed at the Polaris Mine (Indian and Northern Affairs Canada, 2006, p. 4).

Just prior to decommissioning, the Polaris Mine employed a total of two hundred and forty people, including contractors and subcontractors. In the sealift season, up to twenty to twenty five northerners from Resolute and other Nunavut communities were employees of the mine. Throughout the life of the mine, Polaris did change its work rotational schedule from an eight-weeks-in and four-weeks out, and Inuit employees had the option to work a six-weeks-in, and three-weeks out work schedule. Most people who worked at Polaris mine were flown in from Edmonton or Ottawa for rotational shifts.

As a result of the relatively low number of Inuit workers employed at the mine, direct job losses as a result of the closure of the mine were slight (Nunatsiaq News, 2001). However, the impact on spin-off businesses as a result of the closure of Polaris mine was more significant. According to a study commissioned by the Government of the Northwest Territories, more than thirty percent of jobs in Resolute are related to mine activities (Government of the Northwest Territories, 1997). A Resolute company, Narwhal Arctic Services, employed fourteen workers in Resolute and had a contract with the mine to handle freight and luggage that landed at the Resolute airport en-route to Polaris. Hotel services, including a hotel owned by Narwhal Arctic Services (Narwhal Inn) also used to accommodate mine workers coming through Resolute on their shift changes.

For mine closure and remediation, the Inuit owned firm Qikiqtaaluk Corporation was subcontracted under SNC Lavalin to provide equipment operators, general laborers, and mechanics. Local residents were also trained in environmental site assessment skills and assisted in guiding and assessing the effectiveness of the mine reclamation.

In terms of the regional economy, the lease-fees paid by Polaris went to the federal government in Ottawa, as the mine was on Crown land. The mine was required to pay corporate income tax to the Government of Nunavut, and mine workers paid some money to the Government of Nunavut through payroll taxes. The Polaris mine itself paid less than one percent of their total resupply and service costs in the north (Government of the Northwest Territories, 1997).

Though there is no evidence that the cost of freight was reduced to the community of Resolute as a result of the Polaris Mine, the mine did provide better air transportation services for the residents of Resolute. First Air provided 727 jet service two to three times per week from Ottawa (by way of Iqaluit)

and 737 jet service twice a week from Edmonton. After the mine closed, First Air –which transported Polaris workers and freight between the mine-site and the south –canceled their direct flights from Edmonton to Resolute. The decrease in air transportation services is expected to impact tourism industries and hotels in Resolute, though the scientific research station and associated researchers provide still provide business to the Resolute Bay Airport.

Teck Cominco Ltd., also contributed to Resolute infrastructure and services during the life of the mine. In 1990 Cominco was approached by the community to make a donation to build a local gymnasium, and Cominco Ltd. contributed $100,000 toward building a new community gym. The mine also provided scholarships to Resolute youth who graduated from high school and wanted to pursue post-secondary education (Nunatsiaq News, 2001).

Generally speaking, few Nunavummiut received direct benefits from the Polaris Mine. The mine employed few Nunavummiut workers, and Impact and Benefits agreements existed, but they were not enforced. For the most part, outsource contracts were not provided for Inuit businesses, and other than corporate income taxes, the Government of Nunavut did not receive any income from the mine activities (Impact Economics, 2005, p. 41). The closure of Polaris Mine did affect some spin-off businesses such as freight and service personnel at the Resolute Bay Airport and the volume of visitors to the hotels in the community.

3.7 Mackenzie Valley Highway

A case study involving a literature review of the anticipated social, economic, and related environmental effects surrounding changes in road transportation infrastructure was selected for this report. The Mackenzie Valley Highway Extension (MVHE) was selected as a proxy for increased shipping access in the Canadian Arctic. While the MVHE involves ground (road) transportation, it can also offer valuable insights into potential social, economic, and environmental affects of changes in transportation infrastructure in remote communities in the Canadian north.

Public Works Canada originally planned to complete the construction of the Mackenzie Highway from Fort Simpson to the Dempster Highway near Inuvik in a four year period from 1972-1976. However, construction of the Mackenzie Highway was only completed to a point south of the community of Wrigley. Presently, the communities of Tulita, Norman Wells, Deline, Fort Good Hope, Colville Lake in the central Mackenzie region can only be reached by winter road from December until April. The only all weather road to Tsiigehtchic and Inuvik is the Dempster highway, an all weather road connecting Inuvik to communities in the Yukon. Discussions about extending the Mackenzie Highway have continued since construction was ceased in 1976, and the Government of the Northwest Territories has recently conducted several scoping sessions to review the cost-benefit of extending the road. The original construction plan by Public Works Canada was stalled in large part because of uncertainty about economic prospects in the central Mackenzie region (Government of the Northwest territories Department of Transportation, 1999a).

The current consideration for the construction of an all weather road through the Mackenzie Valley (the Mackenzie Valley Highway Extension, or MVHE) involves building an 814 km all weather road from Wrigley to the Dempster Highway, with a possible side route to Deline. Depending on the design

selection, and whether the Deline spur route would be included in the initial proposal, the total cost for the construction of the MVHE would be somewhere between 400 and 500 million dollars (Government of the Northwest territories Department of Transportation, 1999a). It has been argued that a 'Community Construction' approach be adopted, meaning that construction would take place over a ten year period with an approximate $1 million per year construction project conducted in each of the five Mackenzie Valley communities on an annual basis. The Community Construction approach would shift the focus away from simple road construction to long-term economic development, provide a modest stimulus to local economies, and generate additional business and local labour income (Government of the Northwest Territories Department of Transportation, 1999b).

It is anticipated that the MVHE would generate employment and income benefits to the region through the hiring of construction workers and project spending on wages, materials, and supplies during construction. This may be especially beneficial for Mackenzie Valley communities, where unemployment is relatively high. It is estimated that the construction of the MVHE would generate between $41 million and $85 million in business and labour income, and that the on-going road maintenance and operation would provide regional businesses and workers with an additional $1.4 million to $2.8 million annually(Government of the Northwest Territories Department of Transportation, 2005). The current maintenance of the winter road by the Government of the Northwest Territories Department of Transportation is approximately $10,000 per km, or between 2.2 and 4.4 million annually (Government of the Northwest territories Department of Transportation, 1999a).

There is also an expectation that the construction of an all-weather highway loop connecting to the Dempster Highway would generate increased tourism in the region. At the same time, tourism industries will need to spend money to supply products desired by tourists including restaurants, tour operator supplies, wholesale groceries, and fuel (Government of the Northwest territories Department of Transportation, 1999a).

It is anticipated that the completion of an all-weather road will also encourage intensified resource development in the Mackenzie Valley, as would increased shipping access. Currently, the costs associated with oil and gas exploration and production, and resupplying work-sites are considered a major inhibitor in hydrocarbon and mineral exploration. Easier access to resources may cut costs for firms looking to explore and develop resource deposits. In addition, the MVHE is expected to reduce transportation costs for oil and gas companies and reduce stand-by costs that companies incur while equipment and supplies idle during ice freeze-up and break-up cycles.

Currently most goods for both community resupply and supplies for resource exploration sites are shipped by barge with sealift providing a substantial portion of resupply activity during the summer months. In the central Mackenzie Valley, barge is bar far the cheapest mode of transportation on a per tonne basis (Lonergan, DiFrancesco, & Woo, 1993). Barges currently provide cargo transportation up the Mackenzie River from Hay River, and are almost exclusively owned and operated by the Northern Transportation Company Limited (NTCL). The only rail line in the Northwest Territories ends in Hay River, and goods are often transferred from rail cars to the barges docked on the Mackenzie River. This inter-modal transportation necessitates costs for storage and the transfer of cargo from one mode of transport to another. The MVHE is likely to reduce the costs of storage for wholesalers (both in Hay River and the communities in the Mackenzie Valley) and reduce the need for large inventories. However, the possibility exists that once completed, the MVHE could divert cargo demand from NTCL.

It is likely that the price of food and other goods in the communities of Tulita, Norman Wells, Fort Good Hope, and Deline would be reduced as storage costs and transportation costs decrease. Also, there would be an increased quality and variety of goods available, and communities would likely have more reliable resupply.

It is also likely that transportation of individuals would increase, and that people would travel more frequently. People, businesses, and public sector organizations including people in need of health services in the Mackenzie Valley communities would have greater access to communities in the south (Government of the Northwest territories Department of Transportation, 1999a).

The results of the cost-benefits analysis conducted by the Government of the Northwest Territories indicates, however, that the financial capital required for the MVHE road extension and operation compared with the economic benefits indicated that the MVHE is not viable from an economic perspective (Government of the Northwest territories Department of Transportation, 1999a). The report does, however, go on to say that economic considerations should not be the only variable included in the MVHE assessment as public investments in infrastructure are conducted for both economic and social reasons.

Generally speaking, many communities (with the exception of Deline) are in favour of an all weather road through the Mackenzie Valley (Government of the Northwest Territories Department of Transportation, 2005). However, community members have also raised concerns surrounding anticipated environmental and social impacts as a result of the MVRE. It is recognized that along with greater access to communities, there is the potential for increased availability of drugs and alcohol. The Government of the Northwest Territories reports that "Elders remember previous pipeline and highway projects and the social impacts they had on the Mackenzie Valley communities, and do not want the impacts to be repeated"(Government of the Northwest Territories Department of Transportation, 2005). Concerns have also been raised about increased prostitution, family violence, gambling, and loss of traditional values. Elders in the community of Deline have voiced their opposition to a side road to Deline because they are concerned about the impact of an all-weather road on traditional activities(Government of the Northwest Territories Department of Transportation, 2005).

Other communities have expressed concerns over MVRE impacts to wildlife populations, and particularly the effects of mortality related to collisions on moose, caribou, and bears, and increased hunting and fishing pressure as a result of illegal harvesting. Inuvik residents are concerned that the road will allow hunters increased access to the Bluenose caribou herd's winter range near Travaillant Lake, and there have been proposals to move the MVRE to avoid this area(Government of the Northwest Territories Department of Transportation, 2005). Residents of Fort Good Hope have expressed concerns regarding the loss of moose habitat, the obstruction of caribou migrations, pollution, and the effects of increased hunting stresses (Government of the Northwest Territories Department of Transportation, 2005).

The MVHE project has not been formally submitted to regulatory authorities in the Northwest Territories. While the Government of the Northwest Territories has been actively assessing the economic feasibility of the project, and potential environmental, socio-economic, and cultural impacts

that an all-weather road through the Mackenzie Valley would bring, to make the project feasible would likely require an investment of private or federal funding sources.

4 COMMON FINDINGS

4.1 Case Study Common Findings

Although the above case studies represent diverse types of shipping activities, there are several trends that can be identified as likely larger social, economic, and related environmental consequences of increased shipping in Canadian Arctic marine waters. These trends would follow increased access to Canadian Arctic marine waters as a result of decreasing-sea ice and easier sea transport. The following presents identified common findings of the above case studies in relation to the previously identified key types of shipping activities:

4.1.1 Resource Development and the Economy

i) Increased marine shipping infrastructure is likely to induce resource development

One of the most significant challenges for resource economics in the Canadian Arctic is its harsh climate, ocean-bound ice, and remote nature. The costs and challenges of transporting equipment, goods and people to work-sites, and of transporting commodities produced in the region to outside markets, are significant. For example, the government of Nunavut has cited the lack of sufficient port infrastructure as one of the major challenges to developing the Nunavut fishery. Likewise, increased port infrastructure (and the coordination of inter-modal forms of transportation such as ship and jet services) may result in increased cruise-ship tourism in the Canadian Arctic.

Several proposed marine infrastructure projects are expected to induce resource development in the Canadian Arctic:

- A major aim of the proposed BIPR project is to attract further capital investment in the exploration and development of new mines;
- The federal government has proposed $8 million to build a commercial fishing harbor in Pangnirtung to boost Nunavut's turbot and shrimp fishery;

- The federal government has provided $100 million to refurbish the Nanisivik port for military purposes, but also to serve as a refueling station for cruise ships and other civilian vessels;

- The MVHE would generate tourism in the Central Mackenzie Valley region by forming a loop with the Dempster Highway, and encourage intensified resource development by enhancing reliability and reducing costs for resupply of hydrocarbon exploration sites. The MVHE is expected to reduce transportation costs and reduce stand-by costs that companies incur while equipment and supplies idle during ice freeze-up and break-up cycles.

At the same time, the intensification of resource development economies can also lead to increased marine shipping activities. The Nanisivik mine and Polaris mine increased ship traffic in their respective regions by the shipment of ore concentrates from the mine-sites to the south for processing. Likewise, the Bent Horn project required tanker vessels to ship oil to a Montreal refinery. However, in these cases the increase in actual ship traffic to and from the exploration and production sites was relatively minimal.

Hydrocarbon exploration in the Beaufort Sea in the 1970s and 1980s resulted in increased marine shipping activity, and the development or improvement of marine shipping infrastructure such as the port at Tuktoyaktuk. Future hydrocarbon exploration and production in the Beaufort Sea will result in increased shipping in that area.

ii) There is potential for opportunities and challenges between resource development economies as a result of increased Arctic marine shipping

While increased Arctic marine infrastructure is likely to result in opportunities for all sectors of the resource economy, there is also potential for challenges and competition between resource development sectors. As the Churchill Port case study demonstrates, the challenge of balancing tourism and trade economies, for example, or tourism and intensified marine infrastructure such as ports can lead to potential conflicts. For instance, in Churchill, while the dredging of the port site is important for the maintenance of the port facilities, it also has the potential to alter the marine ecosystem which may have negative effects on beluga whale populations –an important marine mammal species for wildlife tours.

Likewise, the Beaufort Sea case study demonstrates potential stressors between tourists who come to view beluga whales in the Beaufort Sea, increased shipping as a result of regional hydrocarbon exploration activities, and local Inuit harvesters who rely on beluga whales harvesting as an important cultural, spiritual, and subsistence activity.

In terms of Nunavut fisheries, increased marine infrastructure and shipping activities may enhance local tourism economies and Nunavummiut participation in the fisheries sector, however, increased ship traffic and environmental pollution may also pose a threat to fish exports that are marketed as coming from pristine environments.

iii) There is a relationship between the presence of additional transportation infrastructure, marine transportation infrastructure, and the development of local economies

There is a direct relationship between the presence of marine transportation infrastructure, additional transportation infrastructure, and the development of local economies. In other words, the presence of multiple forms of transportation options has the potential to increase the flow of goods and supplies, and may lead to increased tourism potential in the Canadian Arctic.

In terms of inter-modal transportation, the Government of the Northwest Territories argues that there is a direct relationship between the existence of an all weather road near a mine site and increased northern expenditures by the mining companies. In large part, this is because northern businesses can participate in contracts to build winter roads, but do not have the capital or experience to operate marine-only operations and supply (Government of the Northwest Territories, 1997). For example, both the Polaris and Nanisivik mines, which both relied almost exclusively on marine transportation services (with the exception of a 21km all weather road linking Nanisivik to Arctic Bay), less than one percent of the mine purchases for operations were made in the north (Government of the Northwest Territories).

As seen in the Churchill Port case study, the linkages provided by coordinated rail, ship, and jet service also contributes to increased tourism potential and inter-regional transportation of goods and supplies. The Nanisivik port and frequent jet services associated with the Nanisivik mine also provided increased tourism potential by allowing cruise-ship passengers to arrive and/or depart utilizing differing modes of transport. Coordinated inter-modal transportation may also facilitate the increased transport of community resupply goods as seen by the linkages between the Churchill port and storage facilities and the rail connection to southern markets.

In addition to marine transportation infrastructure, such as ports, investment in cold storage infrastructure and processing facilities may increase Nunavut fisheries potential. The ability to store and process fish and fish products in Nunavut would assist in capturing additional fisheries revenue that is presently leaked outside of the territory.

4.1.2 Community Resupply

i) Increased Arctic marine shipping will improve reliability and costs of community resupply for people living in coastal Canadian Arctic communities

As demonstrated earlier in resource development and the economy, improved Arctic marine transportation infrastructure and increased Arctic marine shipping willl result in increased reliability and decreased costs of community resupply.

The Nanisivik mine case study reveals that the Nanisivik's port facility provided for more frequent and less expensive shipping for the residents of Arctic Bay as a result of an increase in ship traffic due to mine resupply. Likewise, hydrocarbon exploration in the Beaufort Sea resulted in increased tug and barge traffic and increased freight resulting in reduced shipping costs. Several proposed infrastructure projects are also expected to enhance reliability and reduce costs of community resupply including the proposed BIPR and MVHE projects.

As a result of infrastructure investment and the connection between inter-modal transportation linkages, the Churchill Port has become a major NTCL distribution centre for the central Arctic. Infrastructure at Tuktoyaktuk harbor, developed in large part as a result of hydrocarbon exploration in the Beaufort Sea, has also become a hub of community resupply for nearby coastal communities in the western and central Canadian Arctic.

ii) Community marine resupply is likely to change in direct relationship to the development of resource-based economies

While improved Arctic marine transportation infrastructure and increased Arctic marine shipping is likely to result in increased reliability and decreased costs of community supply, much of the change in community resupply ship traffic is related to resource development economies. For example, while Arctic Bay did see increased reliability and reduced costs for community resupply while the Nanisivik mine was operating, much of the increased ship and jet service was directly related to mine activities. Nanisivik mine personnel and mine resupply needs was directly related to the volume of ship and jet traffic coming to the Arctic Bay airport and Nanisivik port facilities. When the Nanisivik mine was decommissioned the ship and jet traffic was also reduced, resulting in increased transportation and resupply costs for the community of Arctic Bay. Likewise, when hydrocarbon exploration in the Beaufort Sea slowed in the mid 1980s, the volume of freight and number of vessels also decreased. As reported previously, in 1988 resupply barges on the Mackenzie River carried half of their 1982 peak volume (Government of the Northwest Territories Department of Transportation, 1999a, p.341).

Fisheries and Oceans Canada have also reported that other than an increase in tourism over the past twenty years, and a recent upsurge in oil and gas related activities, there has been little change to the size or nature of barge companies offering community resupply services (Fisheries and Oceans Canada, 2003).

4.1.3 Internationalization of Shipping

i) *Integrated and cooperative management of Canadian Arctic marine shipping routes on local, regional, national, and international levels will be essential in the event of increased Arctic marine shipping activities.*

Berkes and Fast write that "Co-management involves the sharing of responsibilities among the expanded set of players in governance; it involves networks and partnerships of a diversity of actors and their institutions. Co-management may be defined as the sharing of power and responsibility between the government and local resources users, or a system that enables a sharing of decision-making power, responsibility and risk between government and stakeholders (Berkes & Fast, 2005, p. 14). As we have seen in the Bent Horn and Beaufort Sea case studies, the effective participation of local communities at all stages of project planning, development, execution, and remediation can result in long-term benefits for both industry and local communities.

As seen in the section on Nunavut fisheries, the Government of Nunavut argues that the current jurisdiction and management of Nunavut-adjacent waters limits local participation in offshore fisheries and fisheries management and asserts that increased local control over off-shore fisheries would result in an increased economic benefit for Nunavut communities. Additionally, the Government of Nunavut argues for strong bi-lateral relationships with Greenland to engage in fisheries management planning, given the shared fish stocks in Davis Straight and Baffin Bay.

In the western Arctic, legislation such as the Beaufort Sea Beluga Management Plan, have successfully integrated local community needs into multi-lateral domestic marine management plans. Management issues addressed in the Beaufort Sea Beluga Management Plan include oil, gas, and mining exploration, production and development, seismic and sounding surveys, vessel movements, helicopter and fixed-wing flights ice breaking, port development, shipping routes possible future commercial fisheries development, and contaminant levels in marine waters and animals, among others.

ii) Clarification of jurisdictional issues is key in establishing integrated and cooperative management of Arctic marine shipping

Given that increased shipping Arctic marine shipping activities will likely precipitate resource and industrial development in Canadian Arctic waters, there is a general impetus for the consideration and clarification of jurisdiction and management of marine transportation in high latitude waters. Relatively recent events, such as the settlement of many comprehensive land claims across northern Canada, and the implementation of resource management regimes will contribute to increased Canadian management and jurisdiction over Canadian Arctic waters, as will the development of Arctic marine transportation infrastructure such as the BIPR and the deep-sea port at the Nanisivik mine-site. In addition, as Westermeyer & Goyal point out, although the United States and Canada have taken

differing positions regarding the jurisdiction of Arctic waters, the two countries share concerns about increase shipping in high latitude waters, and there may be promising alternatives for jurisdiction and management in the future (Westermeyer & Goyal, 1986, p. 338).

4.2 Arctic Marine Shipping Assessment Scenarios of the Future

In 2007 the Arctic Marine Shipping Assessment (AMAP) developed four high-level scenario summaries related to the future of Arctic marine navigation in 2050. The scenarios include: Arctic Race, Arctic Saga, Polar Lows, and Polar Reserve. These will be considered briefly here in relationship to the common findings of this report:

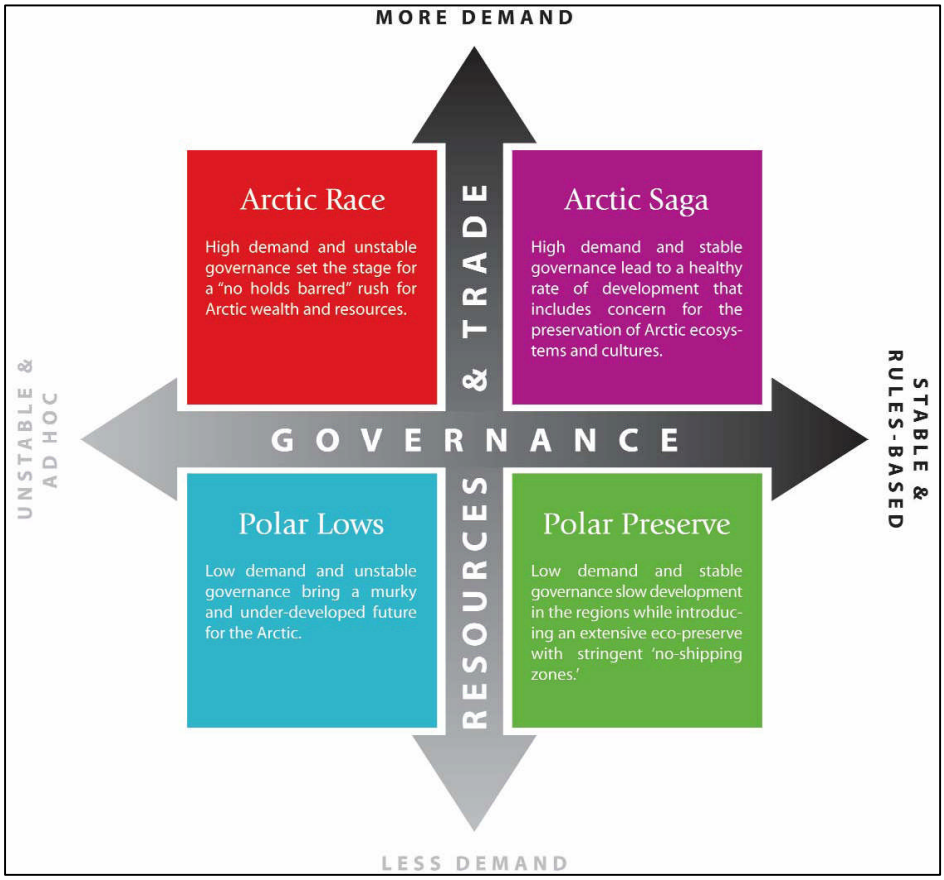

Figure 1 PAME (2007) "Scenarios on the Future of Arctic Marine Navigation in 2050"

4.2.1 Arctic Race

The Arctic Race scenario includes a high demand for Arctic resources and unstable governance structures resulting in a rush for Arctic wealth and resources. This scenario would include the rapid development of resource-based economies, and particularly oil and gas and mining, at the expense of Arctic communities and perhaps other regional economies such as tourism and fisheries. In the Arctic Race scenario, integrated co-management of resources would be difficult to implement and jurisdictional issues surrounding Canadian Arctic waters would not be resolved.

4.2.2 Arctic Saga

The Arctic Saga scenario includes a high demand and stable governance leading to a healthy rate of development that includes concern for the preservation of Arctic ecosystems, peoples, and cultures. This scenario would include investment in Canadian Arctic marine infrastructure including ports that would enable the development of sustainable local economies including tourism, oil and gas, mining, and fisheries. Investment in port and other marine transportation infrastructure would be conducted to maximize benefits for increased reliability and decreased cost of community marine resupply. Integrated and cooperative management regimes would be established to balance the environment, all sectors of the resource economy, and local harvesting and subsistence practices. Additionally, marine jurisdictional issues would be resolved so that local, national, and international interests were considered and addressed. Multi-lateral international management and research programs are in place.

4.2.3 Polar Lows

The Polar Lows scenario includes a low demand for Arctic resources and an unstable governance structure resulting in an under-developed future for the Arctic. This scenario would include a lack of investment in Canadian Arctic marine infrastructures resulting in little resource development (including oil and gas, mining, commercial fisheries, and tourism) or development of local economies. Modernization effects of development on the people and traditional culture in the region would be more limited. Integrated and cooperative management regimes would not be implemented and jurisdictional issues surrounding marine resources and transportation routes would not be resolved.

4.2.4 Polar Reserve

The Polar Reserve scenario includes a low demand and stable governance structure resulting in slow development in the region while introducing extensive no-shipping zones. This scenario would include a lack of investment in Canadian Arctic marine infrastructure resulting in little resource development or development of local economies. However, integrated and cooperative management regimes would be implemented and jurisdictional issues surrounding marine resources and transportation issues would be

successfully resolved and would incorporate local harvesting and subsistence practices alongside local, national, and international interests.

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