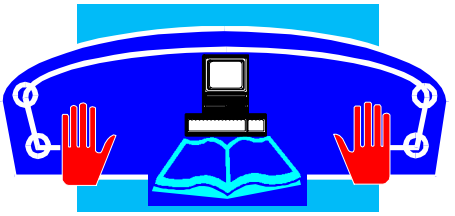

Community Economic Impact Of Commercial Fisheries Development In Canada's Eastern Arctic: The Pangnirtung Winter Turbot Fishery Fisheries, Baffin Cumberland Sound

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ECONOMIC IMPACT OF COMMERCIAL FISHERIES DEVELOPMENT IN CANADA'S EASTERN ARCTIC: THE PANGNIRTUNG WINTER TURBOT FISHERY

by

Bruce D. Ashley

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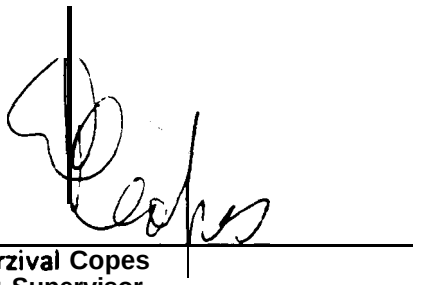

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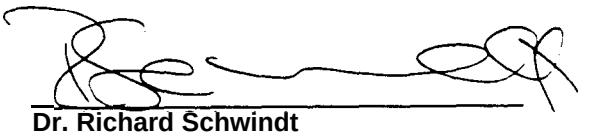

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Abstract

Since 1986, a commercial winter fishery for turbot (*Reinhardtius hippoglossoides*) has developed in the Inuit community of Pangnirtung, Northwest Territories, Canada. This fishery presents an example of commercial renewable resource development in an Inuit community which has generated jobs and income in the community.

The study attempts to determine direct benefits of the fishery. A cost and earning study of fishermen is also conducted. Opportunity costs of fishermen and plant workers are examined to determine what effect the fishery has on traditional pursuits of participants. Other socio-economic effects of the fishery are also considered. The commercial fishery development model is examined to evaluate its applicability to future commercial fishery development in Inuit communities.

Data were collected by examination of government and commercial fishing company records, and through interviews with fishermen, plant workers, fishing company managers and directors, and other people involved in the fishery's development.

The study documents the substantial number of fishing jobs and resulting income for residents of Pangnirtung. While the fishery income of processing plant workers and the gross income of fishermen has become large relative to the community personal income, this is overstated since costs of fishing are not considered. The cost and earning study identifies relatively high costs of fishing and hence a low net income from fishing, which questions the high participation in the fishery. The fishery does not appear to have a negative effect on traditional pursuits of participants. In fact, evidence suggests the fishery may support the traditional economy of subsistence hunting and fishing through provision of cash to hunters and through cost-sharing of snowmobiles.

A warning is issued to fishery participants and managers to be aware of turbot stock reductions and over-fishing caused by the fishery. Regulations to limit entry into the fishery and to place a restriction on gear are recommended to introduce controls to fishing effort.

Lessons learned during the development process are reviewed. Local ownership and control of the commercial fishing company is identified as a critical component in community economic development. A co-operative type of business might have served the mandate of the community better, rather than the private limited companies which have been established. Board size was considered to be too large as it included unnecessary representatives.

Dedication

This work is dedicated to the late Dr. Lawrence W. Copithorne, who died tragically on February 12, 1986. Dedicated teachers are long remembered.

Acknowledgements

The author wishes to acknowledge the assistance of many people in Pangnirtung who assisted with the research. Elisapee Angnatsiak and Andrew Diana deserve special mention and thanks for their work as translators and interpreters. During the composition of this research project, valuable comments by Dr. Parzival Copes and Dr. Richard Schwindt were received and appreciated by the author.

Disclaimer

During the research and writing of this project, the author was employed by the Department of Economic Development and Tourism of the Government of the Northwest Territories as the Economic Development Officer for Pangnirtung. All statements and conclusions expressed in this document are solely those of the author. Readers should be advised that these statements and conclusions may not reflect the position of the Department of Economic Development and Tourism or the Northwest Territories Development Corporation.

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ACRONYMS USED

CFCL	Canadian Fishery Consultants Limited
CPUE	catch per unit of effort
CSFL	Cumbedand Sound Fisheries Limited
DFO	Department of Fisheries and Oceans, Government of Canada
ED&T	Department of Economic Development and Tourism, Government of the Northwest Territories
GNWT	Government of the Northwest Territories
H&G	head off and gutted
HTA	Pangnirtung Hunters and Trappers Association
NAFO	Northwest Atlantic Fisheries Organization
NWT	Northwest Territories
NWTDC	Northwest Territories Development Corporation
MSY	maximum sustainable yield
P&L	P & L Services Limited
PFL	Pangnirtung Fisheries Limited
RCMP	Royal Canadian Mounted Police
SCONE	Special Committee on the Northern Economy
TAC	total allowable catch
UIC	Unemployment Insurance Commission

1.0 INTRODUCTION

Beginning in the 1970s with the Mackenzie Valley Pipeline Inquiry (Berger 1977), and continuing into the 1990s with several native land claim settlements (Anon. 1984, Anon. 1990) and other newsworthy events, aboriginal peoples' issues have become important in Canadian politics. One of the important issues of aboriginal peoples is that of economic self-sufficiency.

In small aboriginal communities where unemployment is high, it is recognized that economic development based on (biological) renewable resource industries offers promise for successful development (Simpson 1986, SCONE 1989, ED&T 1990). Such industries and their base of renewable resource harvesting are compatible with the lifestyles, aspirations, skill and education levels in smaller aboriginal communities.

Since 1986, a unique commercial fishery has developed in the Inuit community of Pangnirtung, Northwest Territories. During winter and spring, fishermen harvest turbot (*Reinhardtius hippoglossoides*) in deep water using long-lines fished from a platform of land-fast sea ice. The turbot is processed in Pangnirtung and the still-fresh product is shipped by air to markets in Canada and the United States. The fishery has created many jobs and considerable income which accrues almost entirely to Inuit residents of Pangnirtung.

The Pangnirtung winter turbot fishery presents a good example of the commercial development of renewable resources leading toward economic self-sufficiency of aboriginal people. This study describes the development of the fishery and examines the benefits and costs of the fishery to the community. The study also identifies some potential problems in the fishery's future, and discusses some of the lessons that have been learned from commercial fishery development in Pangnirtung.

In order to introduce the specific objectives of the study, the remainder of the introduction briefly describes Pangnirtung and its history, and some aspects of the economy in Inuit communities and of the Pangnirtung winter turbot fishery.

1.1 Pangnirtung and its History

Pangnirtung is a community of 1,135 people (NWT Bureau of Statistics 1992a) located on the east coast of Baffin Island in Canada's Northwest Territories. Its population consists predominantly of Inuit, many of whom, only 30 years ago, were living in traditional camps along the shores of Cumberland Sound.

Pangnirtung is located 40 kilometers south of the arctic circle. It is subject to harsh and prolonged winters and some months with days characterized by only a few hours of daylight. Winter temperatures drop to about minus 45°C. Arctic wind storms are common and can be destructive. Conversely, summers, though not warm by most Canadian standards, are characterized by about two months of 24-hour daylight. Summer temperatures rise to about 15oC and occasionally higher.

The history of Pangnirtung is perhaps more interesting than that of many other arctic communities. The word Pangnirtung (pronounced as it appears) is an English derivation of the Inuktitut (the Inuit language) word *Panniqtuuq*, meaning "the place of many bull caribou" (Hamilton 1993). The settlement originated in 1921 when the Hudson's Bay Company chose the site for their trading post in the Cumberland Sound area (Usher 1971; Duffy 1988). This occurred as the eastern Canadian arctic and Greenland commercial bowhead whale fishery was in the final stages of decline. Since the 1860s, Scottish and American whalers had over-wintered at Kekerten and Blacklead, two permanent shore

stations in Cumberland Sound, to get an early spring start to the whaling. The contact with the whalers became a significant force of change for Cumberland Sound and its people. The Inuit were actively involved in the commercial bowhead fishery; exchanging their labour in the fishery for manufactured goods supplied by the whaling stations. In 1894, the Anglican missionary, E.J. Peck, followed the whalers into Cumberland Sound. He introduced the syllabic writing system to the Inuit of Baffin Island. This Inuktitut writing system remains in common use throughout the eastern NWT and northern Quebec. It is also noteworthy that Franz Boaz spent 1883-84 at Blacklead. The Central Eskimo (Boaz 1964), resulted in part from this year of study in Cumberland Sound.

Following the closing of the Cumberland Sound whaling stations, and the establishment of the Hudson's Bay Company post at Pangnirtung, the RCMP set up a post in Pangnirtung in 1923, and the Anglican mission moved from Blacklead to Pangnirtung about 1925 (Stevenson & Associates 1990). An Anglican mission hospital was built in 1930 (Stevenson & Associates 1990) which served the entire eastern arctic until the establishment of Frobisher Bay (now Iqaluit) during the Second World War (Duffy 1988).

In the 1960s, two factors influenced the move of many Cumberland Sound Inuit into permanent residence in Pangnirtung. The first of these was' a distemper epidemic which killed many of the dogs which the Inuit used for winter and spring transportation. Unable to travel to hunting and fishing areas to provide food for themselves, they had little choice but to relocate to settlements where social assistance could be provided. Added to this was the desire of the federal government to move Inuit into settlements where the government could better attend to their educational, medical and social needs.

This relocation policy assumed that Inuit would adapt to living in settlements, abandon their nomadic ways and traditional ties to the land, and seek jobs. However, many traditional

ties to the land were not abandoned, perhaps because seal skin markets were strong and few Inuit had the skills and education required to take the jobs that were available in the settlements. Despite a generation of living in communities complete with many modern conveniences common in rural communities in southern Canada, Inuit retain strong ties to their traditional culture and land-based subsistence economy.

1,2 The Pangnirtung Economy and Fishery Development

The economy in most Inuit communities in Canada is described in Quigley & McBride (1 987) and Wenzel (1 991). It consists of two economies; the traditional (subsistence hunting and fishing) and the modern (wage employment). Wenzel (1 991) describes the economy in Inuit communities prior to the early 1980s when the sale of seal skins provided cash to hunters. These skins were derived from ringed seals, a staple in the eastern arctic Inuit diet, and from seasonally abundant harp seals. In effect, hunters earned cash for a by-product while they hunted a desired food. This cash income provided, among other things, the means to purchase and maintain hunting equipment and to purchase hunting supplies. However, the anti-sealing campaign broke the seal skin trade in the early 1980s and an important source of cash for Inuit disappeared. The result was a loss of self-esteem and much self-sufficiency on the part of eastern arctic Inuit, and a dramatic increase in social assistance payments in their communities.

Several studies (Usher 1976, Myers 1982, Quigley & McBride 1987, Smith & Wright 1989) point out the importance of country foods in Inuit communities. Country foods are traditional foods such as caribou, seal and char, usually distributed within the community through traditional means such as sharing. Imputed values of country foods are high, relative to the cost of imported food and with respect to the nutritional value of country foods. Therefore, the loss or lack of opportunities for hunters to earn cash to purchase and

maintain hunting equipment and to purchase supplies suggests the supply of country foods will decrease (Myers 1982, Quigley & McBride 1987). Over time, traditional skills may decrease, further eroding the supply of country foods.

These arguments challenge governments to create and support income opportunities in traditional aboriginal communities which support the traditional economy. Policies must be consistent with the aspirations and lifestyles of these communities, in order to retain traditions and to successfully utilize existing skills and education levels in these communities. Policies must also result in increased self-sufficiency through support of both income earning opportunities and subsistence hunting and fishing activities.

The Pangnirtung turbot fishery may support the traditional economy by providing cash to hunters. It may also create opportunities for younger men to learn traditional land skills while they are earning cash. Alternatively, the fishery may discourage subsistence activity since turbot are not a product of traditional hunting and are apparently sought primarily for cash. Therefore, one objective of this study is to examine opportunity costs associated with participating in the fishery; especially the effects of the fishery on country food harvesting, The study also examines the opportunity costs of fishery plant workers, with respect to the traditional activities of Inuit women.

The Pangnirtung winter turbot fishery has developed very rapidly since 1986. This fishery has been attractive to Inuit and does not require expensive or unfamiliar equipment nor the acquisition of many new skills. For the most part, this fishery is accessible to the average male resident of Pangnirtung through his ownership of a snowmobile and *qamutiik* (Inuit sled), and his arctic outdoor skills. Though the fishery has attracted many individuals, and apparently generates cash for its participants, the net monetary benefits of the fishery are unknown. Gross revenue of fishermen is commonly used as a measure of the economic

impact of the fishery and the benefits to fishermen, But there is a lack of information on fishermen's expenses owing to the unique harvesting technology and the lack of record keeping by fishermen. To a certain extent, fishermen are aware of these costs but because many of them have little if any formal education, and all come from a culture with oral rather than written traditions, record keeping is uncommon and the actual costs and net income of turbot fishing unknown. In order to better assess the impact of the fishery on its participants and the local economy, it is a second objective of this study to quantify the cost of turbot fishing to derive the net average income of turbot fishermen.

In addition to statistics of income generated by the fishery, other statistics have been used to identify the fishery's impact on the community. Therefore, a third objective of the study is to examine social assistance payments in Pangnirtung to determine if any changes have resulted which can be attributed to the turbot fishery.

The apparent success of the Pangnirtung turbot fishery has resulted in suggestions that commercial fishing provides an appropriate model of economic development for smaller communities in the Northwest Territories. Notwithstanding the presence of commercial fish stocks, markets for products and factors such as transportation links, success of this development model requires establishing and maintaining local control such that benefits, both monetary and otherwise, accrue to the community. To achieve effective local control and management, information and education on conditions relating to the fishery are needed by local decision makers. Therefore, a final objective of the study is to identify and discuss the positive and negative lessons learned during the development of the fishery. This will allow the development model to be assessed for appropriateness and desirability in other eastern arctic communities.

2.0 THE ECONOMY OF PANGNIRTUNG

This section describes the demographics and economy of Pangnirtung in order to establish the context within which the Pangnirtung winter turbot fishery has developed.

Pangnirtung is one of 29 communities in a region to become known as Nunavut (the eastern or Inuit part of the Northwest Territories). With a 1991 population of 1,135, it is one of seven Nunavut communities with populations over 1,000 (NWT Bureau of Statistics 1992a). Since 1986, Pangnirtung's population has grown by 13.0% for an annual average of 2.6%. For the same period this compares to an annual average growth rate of 2.1% for the Northwest Territories, and 1.6% for Canada (NWT Bureau of Statistics 1992a).

In 1991, Inuit made up 94.5% of Pangnirtung's population for which 41 .5% of the population was under 15 years of age and 62.6% under 25 years of age (NWT Bureau of Statistics 1992b).

Education levels are low in the eastern arctic. For the 58.8% of the Pangnirtung population 15 years of age and over in 1986, 61 .9% had less than a grade nine education (NWT Bureau of Statistics 1991). Only 11.0% of this group over 15 years of age had at least some post-secondary education (NWT Bureau of Statistics 1991), and many of these are transient government workers such as teachers, nurses and administrators.

In 1989, labour force participation in Pangnirtung was 63.4% and the unemployment rate was 32.1 % (NWT Bureau of Statistics 1989). Revenue Canada repotted 510 personal tax returns from Pangnirtung in 1990 totalling $9.2 million in personal income for an average income per return of $18,043 (NWT Bureau of Statistics 1992b). Based on the 1990

Table 1. Sources of income, Pangnirtung, 1982.

Wages		
Civil Service	$2,214,547	51.1%
Publicly funded agencies	83,795	1 .9%
Retail	379,007	8.7%
Construction	170,000	3.9%
Tourism	99,197	2.3%
Mining	93,754	2.2%
Other	5,000	0.1%
Arts and Crafts Production (estimate)	270,000	6.2%
Social Assistance	298,131	6.9%
Other Transfer Payments	472,819	10.9%
Renewable Resource Harvesting		
Fish Sales (estimate)	17,040	0.4%
Fur Sales (estimate)	158,950	3.7%
Ivory Sales (estimate)	71,828	1.7%
Total	$4,334,068	100.0%
Imputed value of country foods (1 981)	$3,151,979	

Adapted from Worrall (1 984).

Table 2. Sources of income, Pond Inlet, 1987.

Wages (except tourism related)	$4,200,454	80.4%
Tourism wages (estimate)	25,000	0.5%
Directors fees and stipends	41,535	0.8%
Carving	52,293	1 .0%
Social Assistance	300,261	5.7%
Other Transfer Payments	583,387	11.2%
Fur Sales (estimate)	21.745	0.4%
Total Income	$5,224,675	100.0%

Adapted from Huestis (1989).

population estimate of 1,115 (NWT Bureau of Statistics 1992c), the average per capita income for Pangnirtung in 1990 was $8,253.

Income is derived to a large extent from the public sector. Table 1, adapted from Worrall (1 984), shows about 70% of income to be derived from employment with ail levels of government and government transfer payments. Results of a more recent study in Pond Inlet (Huestis 1989) are shown in table 2. Pond Inlet is another Baffin Island community slightly smaller than Pangnirtung, but with many similar characteristics. According to Huestis (1 989), 98.1% of income in Pond Inlet is derived from tax dollars. Only 1.9% is considered as "new wealth"; consisting of carving income, net tourism income and fur sales. Generally "new wealth" is described as income derived from non-public sources outside the Northwest Territories. It is used as a general measure of the strength of the community economy or its self-sufficiency. To use a similar analysis on Worrall's (1 984) income data for Pangnirtung in 1982, new wealth is calculated at 16.4%. This is certainly much more significant than Pond Inlet's 1.9%, however it should be noted that 1982 was the last year of significant fur (primarily seal skin) sales in the eastern arctic (Worrall 1984). The anti-sealing campaign had destroyed seal skin markets by 1983 (Wenzel 1991) and seal skin sales have never recovered.

The cost of living is very high in Nunavut. The federal government's isolated post, living cost differential for Pangnirtung in 1990 was 160-165 using a base of 100 for Montreal (NWT Bureau of Statistics 1992b). Pangnirtung's food price index in 1991 was 168 using a base of 100 in Yellowknife. The Yellowknife food price index in 1991 was 127 relative to a Montreal base of 100 (NWT Bureau of Statistics 1992b).

As in most communities in Nunavut, the major employer in Pangnirtung is the local government or hamlet, responsible for municipal services and often other services provided

under contract for some territorial and federal government departments. The territorial government is also a major employer in Pangnirtung, as it is in most Nunavut communities, where it is responsible for education, health, social services, economic development and other public services. In Pangnirtung, the federal government also employs several people at the Eastern Arctic District Parks Office, the main office for Auyuittuq and Ellesmere Island National Park Reserves. The main access point of Auyuittuq National Park Reserve is only 30 kilometers from Pangnirtung.

There are also several private sector employers of note in Pangnirtung; three general stores, a hotel, an artists' association operating two art studios and two commercial fishing companies.

As discussed above and outlined in tables 1 and 2, Pangnirtung appears to have a stronger economy than Pond Inlet based on the concept of new wealth as well as other factors. This can be attributed to the fine art studios, a stronger tourism industry than that of Pond Inlet's, and the commercial fishery.

In the late 1960s the federal government established a weave shop in Pangnirtung where Inuit women were trained to produce woven tapestries from images by local Inuit artists. The facility was transferred to the GNWT in 1969. Through support from government in the early 1970s, the Pangnirtung Eskimo Co-operative Ltd. opened a print shop where limited edition prints were produced. Both of these facilities operated throughout most or all of the 1970s and 1980s and have provided numerous jobs. In 1991, both facilities were transferred to a local artists' association which now operates both studios on behalf of the artists. These studios and the art created within them, have given a prominent place within Inuit art circles to a community not particularly well known for soapstone carvings, the much more common arctic art form.

Pangnirtung became known as a tourist destination in the 1960s and 1970s, owing to the fine arctic char sport fishing in the area and the establishment in 1972 of Auyuittuq National Park Reserve (then Baffin Island NPR). This reputation was augmented in the early 1980s when Pangnirtung was chosen by the GNWT and the Baffin Regional Council (of municipalities) for a pilot project on community-based tourism development. Two results of this initiative were the first visitor information and interpretive centre in the NWT, and the first territorial historic park. This development and the earlier tourism attraction of the national park reserve and char fishing camps have resulted in employment and income opportunities for the community which continue today.

There is a well established informal economy in arctic communities. Part of this is the cash sale of goods and services directly between producer and consumer. Much of this involves goods such as arts and crafts and country foods. The amount of this informal type of economic activity is difficult to estimate. Both Worrall (1 984) and Huestis (1 989) attempt to include it in their analyses, however none of this informal economic activity appears in income statistics from Revenue Canada.

Better documented is the activity and output of subsistence hunting and fishing (for country foods) which has been studied by Usher (1976), Myers (1 982), Quigley & McBride (1987) and Smith & Wright (1 989). Quigley & McBride (1987) analyzed the economy of Sanikiluaq, an Inuit community of 526 on the Belcher Islands in southern Hudson's Bay. For 1984 they calculated that the imputed value of country foods harvested by Sanikiluaq residents totaled $2.92 million and that total personal cash income in Sanikiluaq was $2.20 million. Worrall (1 984) estimated the imputed value of country foods in Pangnirtung in 1981 at $3.15 million. While Sanikiluaq is a community generally considered to be

traditional whereas Pangnirtung is not, the value of country food compared to cash income in both communities is significant.

Many studies (Myers 1982, Quigley & McBride 1987, Smith & Wright 1989, Stabler 1989, Wenzel 1991) have discussed the dual or mixed economy in northern Canadian communities consisting of traditional (harvesting of country foods) and modern (wage employment) sectors. The conventional wisdom regarding the dynamics of this mixed economy is that participation in the traditional sector is supported by cash transfers from the modern sector. These transfers provide cash to hunters who have limited access to cash resources for the purchase of hunting equipment and supplies and for equipment maintenance. Myers (1 982), Quigley & McBride (1 987), and Smith & Wright 1989, conclude that production from the traditional sector which provides significant amounts of food, is constrained by the availability of cash to hunters. They suggest government policies to support the subsistence economy.

The Pangnirtung economy can be summarized as being relatively well diversified compared to many eastern arctic communities. It has notable arts' and crafts, tourism and commercial fishing industries that account for many jobs in the community. However, the economy remains heavily dependent on government jobs and transfer payments. As in less developed communities in the eastern arctic, the traditional economy is visible and remains important for its production of country food.

3.0 DEVELOPMENT OF THE FISHERY

This section describes the development of the Pangnirtung winter turbot fishery from the first developmental efforts in 1986 through to the 1992 commercial fishery season. The description is important when discussing and evaluating the appropriateness to other communities of the fishery development model followed in Pangnirtung. The description is also useful in providing background for discussion of the lessons learned through fishery development.

In the mid 1980s the GNWT re-assessed its economic development priorities, One of the resulting changes was an emphasis on the renewable resource sector of the economy. Not only was this sector recognized as less susceptible to economic cycles, relative to sectors such as mining, and arts and crafts, but more compatible with the lifestyles and aspirations of aboriginal communities (Simpson 1986). These shifting priorities occurred at a time of increased awareness of marine resources in the Baffin region of the NWT, which may have resulted from the declining seal skin industry and a search for new opportunities to replace it. Because of geographical proximity and cultural similarities, Greenland's commercial fisheries were noteworthy as an example of successful development.

The first efforts to examine the potential of commercial fishing in the Baffin region was in Cumberland Sound in the summer of 1985 as described in MacKay (1986a). The objectives of the project were to determine the commercial fishery potential of Cumberland Sound using regional skills and resources, and to introduce methods and equipment used in commercial fisheries to Pangnirtung residents (MacKay 1986a). Achieving these objectives involved retrofitting an existing 46 foot Pangnirtung vessel for exploratory fishing, trial fishing for a few targeted species (including turbot) and on-board training. Three Pangnirtung residents and two government personnel also travelled to New Brunswick after

the trial fishing was complete. Fora week, they observed harvesting and processing in some New Brunswick fisheries, and toured several fishery facilities involved in gear manufacture, aquiculture and biological research.

3.1 The 1986 Fishing Projects

Turbot remains had been found by hunters in Cumbedand Sound near seal breathing holes in the sea ice and in seal stomachs. This suggested that turbot were present in Cumberland Sound. Therefore in March 1986, two Greenland fishermen were brought to Pangnirtung to demonstrate long-lining for turbot from the winter sea ice (ED&T 1987). This type of fishing had been done in Greenland for several years. The demonstration by the Greenlanders verified the presence, if not abundance of turbot in Cumberland Sound during winter months and verified that under-ice long-lining was a practical method of fishing in Cumberland Sound. The only detailed written record of this project appears to be reconstructed catch data of several line sets of two fishermen and a rough estimate of daily income for a two-fishermen team based on this reconstructed catch data. This record appears in a report of the summer 1986 fishing project (MacKay 1986b).

The objectives of the 1986 summer fishery project in Cumberland Sound did not change from the summer 1985 project objectives mentioned above. The efforts proved successful with the discovery of several beds of Icelandic scallops (*Chlamys islandicus*) very close to Pangnirtung. The report recommended privatization of this summer scallop fishery for the 1987 season (MacKay 1986b). Other species were encountered but not in commercially viable concentrations. Turbot catches from five long-line sets during the summer project produced poor results. MacKay (1986b) recommended that future development efforts be aimed at the winter turbot fishery and the summer scallop fishery.

3.2 The 1987 Winter Turbot Project

The positive results of winter exploratory fishing in 1986 led to further effort in 1987 as described in MacKay (1 987). Unlike the 1986 project which concentrated simply on determining the presence and availability of the stock, the 1987 season effort was more comprehensive with the aim of investigating commercial possibilities of a winter turbot fishery. A fisheries development consultant was hired to oversee the project.

3.2.1 Harvesting

As in 1986, Pangnirtung residents were introduced to the harvesting technology; this time by the students of the previous year who had picked up the technique quickly from the Greenlanders. At such an early stage in the development, all fishermen were paid by their time rather than by their landings. By the end of the project a total of fifteen fishermen had learned the ice platform long-lining technique. Twelve of them indicated they had a strong interest in continuing to fish turbot commercially (MacKay 1987).

Another aspect of harvesting which was addressed in 1987 was further exploration to locate other turbot fishing grounds in Cumberland Sound. In 1986 only one area was tested and it proved to be productive. During the 1987 project, effort was directed at three areas in Cumbedand Sound, including the area fished in 1986. Within these three areas were seven fishing stations, all of which were within 60 kilometers of Pangnirtung. Though"about 90% of the effort was targeted at the two stations closest to Pangnirtung, all seven stations recorded turbot catches (MacKay 1987), suggesting turbot were distributed throughout this area of Cumberland Sound.

When abrasion from Greenland sharks and rough bottom conditions caused large losses to Greenlandic ground lines, ground lines used in Atlantic Canada were substituted. These we're introduced to Cumberland Sound during the summer exploratory fishing in 1985 and 1986. Several types of hooks were tested, as were bait types and other terminal tackle. MacKay (1987) outlines these and the results which refined these simple but effective fishing technologies.

The 1987 fishery also introduced the use of insulated containers common in the seafood industry (MacKay 1986b, ED&T 1987). Stored inside these seawater-filled containers for up to a few days, the "reverse super-chill" resulted in the turbot arriving unfrozen at the processing plant and therefore retaining greater value and more options for processing. The sea-water also cushioned the turbot during transportation over rough sea ice between the fishing grounds and the processing plant. The high quality of these hook and line caught turbot was recognized early in the development of the fishery as an important factor in retaining high market value of the product which could offset factors working against commercial viability such as high freight rates.

3,2.2 Processing and Plant

The 1987 project included upgrading the community-owned processing plant, a 30 X 38 foot building consisting of a walk-in freezer and a food processing area. It was intended for processing and storing country foods, not commercial food processing. Consequently, it did not meet regulations set by DFO for a commercial fish processing plant capable of export (inter-provincial trade). However, recognizing the role that such a facility could play in the development of a commercial fishery in Pangnirtung, DFO agreed to grant the facility an interim licence. The interim licence would be conditional on some renovations to the

physical structure of the plant. Where renovations were not practical, staff training would be necessary to ensure that quality control standards were met.

There were also efforts in 1987 to train plant personnel in processing turbot, especially filleting (ED&T 1987). This followed from market information in 1986 suggesting limited Canadian demand for whole turbot (ED&T 1987), as well as a desire to add value to the product in order to create additional jobs and income in the community,

3.2.3 Marketing

The first market development efforts for Pangnirtung turbot were undertaken during the 1987 project. While it was known that fresh turbot was scarce in southern Canadian markets during winter months and hence fetched a high price, initial effort was directed at markets within the NWT. One of the reasons for this was the shortcomings of the Pangnirtung processing facility with respect to DFO plant licensing regulations. Until the facility was licensed, extra-territorial exports were not allowed. More importantly, regional distribution allowed for tests of more easily supplied regional markets, and development of a consistently high quality product before confronting proven and competitive products in southern markets. Therefore, most of the 12,000 pounds produced in 1987 was supplied to Iqaluit which was a conveniently close, albeit small market, Samples of fresh turbot were sent into Ottawa to introduce the product to brokers there. Interest in this fresh product was expressed by two seafood firms in southern Canada (ED&T 1987).

As the 1987 season progressed, southern Canadian market conditions were observed. These observations indicated intense competition from well established Greenlandic and eastern Canadian fisheries (MacKay 1987). However, Boston markets showed a less continuous supply of turbot, and therefore more potential (MacKay 1987). With respect to

potential markets for Pangnirtung turbot, MacKay (1 987) quoted the need for preferential freight rates and treatment to overcome some of the (extra-territorial) export problems.

3.2.4 Viability

MacKay (1987) also attempted to determine the viability of the fishery through an overall feasibility analysis (ED&T 1987). Though data were analyzed for different components of the fishery, it was acknowledged that many factors prevented proper analysis in 1987. Among these were unpredictable ice conditions which delayed by several weeks the start-up of fishing, a lack of experience on the part of staff, the testing of new procedures and techniques both in harvesting and processing, and a lack of market development. On the whole these factors could be summarized as a general lack of experience which would be expected in any new and developing industry.

Despite these shortcomings and problems, the 1987 season contributed to the knowledge base and to a positive momentum which continued to indicate potential for the fishery. This provided the necessary justification to continue and increase development effort the following year.

Among the more positive indicators of potential for the fishery, was the speed with which the fishermen picked up the technique of the type of fishing involved and the interest they showed in it. While it can be argued that the fishing technique is quite simple, it is nevertheless noteworthy that the Greenlanders' services were not required after the initial demonstration project in March of 1986. The students in 1986 became the instructors in 1987 (MacKay 1987). Fishermen's desire to fish has been attributed to a combination of a need for cash and an enjoyment of turbot fishing (Weihs 1989). Fishing provided cash for a harvesting activity to traditionally skilled men who did not always have the skills or desire

to enter the wage economy, but nonetheless needed cash in the changing community-based economy.

Unlike many contemporary fish harvesting technologies, the technology of the harvesting sector in this fishery was not capital intensive. Furthermore, snowmobiles are ubiquitous in Canadian arctic communities, as they are the major means of winter and spring transportation. Any able bodied man in the community who had access to a snowmobile, already had the major piece of equipment needed to enter the fishery. And he was already familiar with its maintenance and use. For a few hundred dollars he could equip himself with the additional gear needed to go winter turbot fishing.

The timing of the fishery in late winter and spring was another indicator of potential for the fishery. The competing turbot fishery in Quebec's Gaspé did not open until April. This meant market prices prior to April would be higher (ED&T 1987) and could help to offset high air freight costs associated with transposing the product to southern markets. Effective exploitation of this advantage would require the product's high quality being retained through to the marketplace. The introduction of the insulated containers and the "reverse super-chill" storage preserved the quality of the product at the fishing grounds and during transportation to the processing plant. Though no commercial shipments to southern Canada were made in 1987, it was known that daily flights to the regional transportation hub of Iqaluit, half of which connected within a few hours to flights to major eastern Canadian centres, would ensure rapid delivery of fresh processed product to large southern markets.

One more factor may have contributed to early success and optimism. The mid-eighties was a time when attention to healthy lifestyles and diet was in vogue. Fish was high on the list of healthy foods and as a result was much in demand. Further contributing to this

was the somewhat intangible factor of the pristine arctic environment from which the turbot was harvested.

3.3 The 1988 Project

The 1988 fishery was funded by the Canada/Northwest Territories Economic Development Agreement which afforded a more comprehensive approach than the 1987 project. It was the successes and other positive signs shown in 1987 that drew support for funding from this source. Large financial resources were now available to advance the project to a near-commercial scale.

A plant manager from Newfoundland was hired to oversee the processing and other plant functions including marketing (ED&T 1990). Canadian Fisheries Consultants Limited (CFCL) was contracted to assist the plant manager in developing and monitoring productivity measures and to undertake an economic assessment of the fishery.

3.3.1 Harvesting

As in 1987, unpredictable ice conditions delayed the start-up of fishing. The most popular fishing grounds were not accessible in 1988 (CFCL 1988), and fishermen were forced to fish less-favoured areas. This resulted in a delay until March 3 of the first landings. Over a seven-week season, and involving up to 14 fishermen, (CFCL 1988) 26,059 pounds of head off. and gutted (H&G) turbot were landed at the processing plant.

A decision had been made by the 1988 project coordinators to pay fishermen by the weight of their landings. In the previous two years, fishermen were paid a daily wage. Another change which affected fishermen was an arrangement whereby only non-fishermen would

be designated to transport turbot from the fishing grounds to the processing plant. This would force fishermen to concentrate on fishing and hopefully increase landings at the plant. Based on this arrangement, the price set for fishermen was $0.60 per pound H&G. They were paid no more if they delivered their catch to the plant. After the first week of fishing and lower landings than expected, a meeting with fishermen revealed they would prefer a price which included delivery to the plant, This was more convenient for the fishermen since they returned to Pangnirtung every few days for supplies and a rest from the work and cold weather. The plant manager supported this change which simplified administration. Thus the price paid to fishermen rose to $0.90 per pound H&G for the remainder of the season.

The season started with six fishermen working as three teams. When the season ended, about seven weeks later, there were fourteen fishermen involved. CFCL (1 988) considered the increase in fishermen to be an indication of good interest in the fishery since two non-fishing training courses were occurring in the community at the same time. The content of these courses was traditional men's activities; topics suspected to be of interest to potential fishermen.

As in previous years there was some testing of various types and sizes of hooks and lines. CFCL (1988) notes that despite circle hooks having better retention properties, fishermen preferred semi-circle hooks followed by "J" hooks as these were easier to bait, a relevant consideration in extreme sub-zero temperatures. CFCL (1 988) recommended that larger #3 and #2 "hooks be used because they expected that they would be preferred by fishermen.

ED&T had tendered a contract to develop a motorized, hydraulic long-line hauler intended to improve the productivity of fishermen. Prototypes were tested during the 1988 fishery though results were not stated. However, the viability assessment in CFCL (1988)

assumed fishermen used these haulers and included the capital and operating costs of the haulers in determining the costs of fishing.

The significant problem of Greenland sharks was briefly discussed in CFCL (1988). The extent of shark damage by gear loss and mutilation of catch reported in MacKay (1 987) continued in 1988,

The use of the insulated containers to hold the turbot at the fishing grounds and to transport product to the processing plant in Pangnirtung, continued to work well during 1988. CFCL (1988) noted the excellent quality of the turbot on arrival at the plant,

3.3.2 Processing and Plant

Based on the processing plant inspection and report completed by DFO in 1987, identified deficiencies were corrected in order that the facility could be licensed for inter-provincial . fish export. The plant was certified by DFO on 25 February 1988.

The newly recruited plant manager made a short trip to Pangnirtung in early January 1988 to assess and evaluate the physical plant. This assessment was discussed with CFCL and a list of equipment needs and other recommendations sent to ED&T in Iqaluit. Most of the items listed were to address general needs, quality control and productivity improvements in processing. Among these were a skinning machine and a larger ice crusher. Unfortunately the skinning machine was late in arriving and not installed prior to the completion of the season. A suitable ice crusher could not be ordered in time. Hence two major pieces of equipment, important to productivity improvements and quality control, were not introduced in the 1988 season. A small ice crusher continued to supply crushed ice in the plant.

Without the skinning machine, all processing was done by hand, and CFCL (1988) reported an increase in fillet yield to 48°A of H&G weight. This was considered good since some of the fish arrived partially frozen. CFCL (1988) predicted that had the skinning machine arrived, fillet yields would have reached 55% of H&G weight.

At the same time as these productivity increases were being achieved, the plant manager was emphasizing quality control. Since quality control began with the harvesting, factors affecting product quality before the fish reached the plant were discussed with fisherman. High quality of product was sought for the potential long-term benefit of identifying the product as unique, and the premium price this would fetch. Measures practiced during the 1988 season to achieve this result are listed in CFCL (1988).

Most of the production in 1988 went toward 12,000 pounds of fresh fillets, as market reports indicated these would fetch the best price. Lesser amounts of frozen fillets, and frozen and fresh whole dressed turbot were also produced.

3.3.3 Marketing

With the DFO interim licensing of the Pangnirtung plant granted in February 1988, the project was able to ship turbot to southern Canada. Since market inquiries were first made in 1987, turbot markets had softened. This was attributed to large offshore landings into American markets, and foreign vessel landings at under-utilized inshore plants in Newfoundland. The decline in turbot prices in southern Canada caused the Greenland winter turbot fishery to withdraw from the North American market which they had previously supplied via Iqaluit. This resulted in the new Pangnirtung product being the only fresh turbot available until the Gaspé fishery opened in early April. So while prices were

not as high as was hoped, there was nonetheless a strong demand for fresh fillets and to a lesser extent fresh whole dressed turbot. Despite a higher price in the Ottawa market ($3.00 per pound for fresh fillets), most of the fresh Product was supplied to Montreal at $2.70 per pound. Ottawa markets demanded limited quantities while demand in Montreal was much stronger.

Post-season evaluation and discussion with market watchers noted that the 1988 price was on average about one dollar per pound lower than a year previous and the current price was on the low side of what would be expected in a more stable market (CFCL 1988).

Turbot is also known as Greenland halibut. This alternative name was devised to help market turbot, since it is considered a coarse fish in southern Canadian markets. Halibut is considered a desirable fish and the price premium which could be gained though the use of the more desirable name is obvious. Unfortunately, DFO's inspections branch does not allow the use of the name Greenland halibut or halibut when marketing turbot in Canada. CFCL (1 988) made inquiries with DFO on the usage of alternate names such as Baffin Island halibut and noted that such a request would require a formal proposal to DFO. A consideration of alternate names began in hope of lifting the profile of the product above that known with some disdain in the south as turbot.

3.3.4 Economic Evaluation and Viability

CFCL (1'988) undertook an economic evaluation of both the harvesting and processing operations. The harvesting evaluation is presented and discussed in section 4. The economic evaluation of the processing operation considered two scenarios; continued use of the existing processing plant, and use of a new designated processing plant. Where possible, operating costs were collected during the season. Because of insufficient

landings, improper equipment and a lack of experience, productivity rates and yields were estimated. Existing government subsidies (plant utility costs and 30% of product air freight) were identified and assumed to remain constant. It was further assumed that in both scenarios, 100% of production went toward fresh fillets. Based on these conservative, mostly status *quo* assumptions in the existing processing plant, the per pound production cost of fillets delivered to market was $3.59, $2.90 and $2.18 in projected years 1, 2 and 3 respectively. A break-even analysis equated these production costs to $0.51, $0.71 and $1.00 per pound paid to fishermen for whole H&G turbot, This analysis indicated the existing processing plant would be profitable by year 3, assuming the current price of -$0.90 per pound H&G paid to fishermen held.

The second scenario assumed a new, 40 x 65 foot, designated processing plant was to be constructed at a capital cost of $743,000 (1988 dollars). Based on the same set of assumptions as the previous scenario, and with a 75% capital cost subsidy provided by government on the new plant, the per pound production cost of fillets delivered to market was stated to be $3.12, $2.00 and $2.03 in projected years 1, 2 and 3 respectively. With a 25% capital cost subsidy provided by government on the new plant, per pound production costs increased to $3.87, $3.04 and $2.44. The corresponding break-even per pound H&G whole price paid to fishermen was $0,39, $0.65 and $0.86 with a 75% capital cost subsidy and $0.05, $0.38 and $0.64 with a 25% subsidy for projected years 1, 2, and 3 respectively. In order for the fishery to be profitable in the proposed new processing facility under the prevailing conditions, the subsidy on the capital costs of the new facility would need to be in excess of 75%.

Despite a delay in the opening of the fishery because of late sea ice formation and some equipment supply problems, the 1988 turbot fishery added more information to the

knowledge base and continued the momentum of development and optimism about the fishery.

3.3.5 Recommendations of the 1988 Project

CFCL (1988) made several recommendations related to all aspects of the fishery. Because the price paid to fishermen was the greatest cost to the processing operation, some changes to the harvesting sector were suggested in hopes of reducing harvesting costs through increased productivity. It was suggested, that three-man teams fish a double-ended long-line through two holes in the ice. This change from two-man teams, fishing the conventional long-line technology, was expected to increase fisherman productivity, and thus allow a decrease in price paid to fishermen.

Recognizing the problem of Greenland sharks, CFCL (1988) recommended markets be sought for sharks. They also recommended an investigation of shark repellents/detractors, which were used in the Greenland winter turbot fishery to reduce shark by-catch. The development of a portable shelter within which most of the harvesting activity could occur, was also suggested.

Among CFCL's (1988) recommendations for the plant was a suggestion to supplement processing with arctic char filleting during periods of low turbot landings. This would enhance plant viability. They also suggested the price paid to fishermen for turbot should fluctuate with the market price. Lastly, they recommended an experienced manager operate the processing plant for the next two years.

3.4 1989- Cumberland Sound Fisheries Limited

Following the successes of the 1988 season, and in accordance with recommendations of MacKay (1 987) and the mandate of ED&T, government and community members involved in the Pangnirtung turbot fishery decided to incorporate a private sector company to take over the processing operations of the turbot fishery in Pangnirtung. Up to and including the 1988 season, turbot fishery projects were sponsored by the Pangnirtung Hunters and Trappers Association (HTA), a publicly elected board representing hunters. Sponsorship reflected funding program requirements though project decisions were made largely by government personnel responsible for fishery development. To encourage more community involvement through local decision making and to begin linking production to the market, it was necessary to establish a locally owned and controlled commercial entity. Further, as was learned in 1987 with the establishment of a commercial scallop fishing operation in Pangnirtung, a new commercial fishing entity should be broadly owned throughout the community. This would enable DFO to assign resource allocations to the commercial entity ' without seeking the community's input (through the HTA). In effect, the input would be implied through an overlap of ownership and community representation.

During the summer and autumn of 1988, community meetings and discussion toward the establishment of a commercial fishing entity occurred and in December 1988, Cumberland Sound Fisheries Limited (CSFL) was formed. It was a private company incorporated under the laws of the NWT. Among its shareholders were the Pangnirtung HTA, the Pangnirtung Eskimo Co-operative Ltd. and P & L Services Ltd., as well as 40 other individual residents of Pangnirtung. The co-operative operated a general store in the community and had been very interested in, and supportive of commercial fishery development. P & L Services Ltd. (P&L) was a local Inuit partnership that owned and operated a scallop dragger which had been fishing scallops in Cumberland Sound since 1987.

The 1989 turbot fishery began under the auspices of CSFL, with some government funding for start-up cash flow (Simpson 1990). Government also assisted by providing funds to hire the plant manager from the previous season.

Another major change to the fishery was the establishment of a new GNWT staff position of fishery development officer. This position was filled by a person with experience in the Atlantic Canada fishing industry. Shortly after the 1989 fishing season began, and immediately on starting his new position, the fishery development officer was sent to Pangnirtung. It was initially believed he would concentrate on harvesting and the supply of product to the plant by working with the fishermen. It was soon discovered that there was to be no shortage of product arriving at the plant from the fishing grounds (Simpson 1990). Therefore the fishery development officer assisted at the processing plant. However his approach to management was very different from that of the plant manager's, and conflict soon led to the manager's resignation. The fishery development officer took over management of the plant and processing, coordinating fresh shipments with the air carrier, and communicating and negotiating with buyers in the south. This was a crucial position because so much product was landed by fishermen that the processing plant became a bottleneck to production.

The 1989 fishery began on March 5 and continued 14 weeks until May 30. During that time 276,082 pounds of whole H&G turbot were landed at the plant by 43 licensed fishermen and their "helpers". This was a sharp increase over 1988 when 26,059 pounds of H&G turbot were landed in seven weeks by six to 14 fishermen and helpers (see table 4).

As recommended in CFCL (1 988) the price paid to fishermen in 1989 was adjusted during the season to reflect market prices. Fishermen were paid $0.80 per pound for H&G turbot at season start. Two downward adjustments to the price occurred during the season and at season's end the price was $0.60 per pound for a season average of $0.67 per pound. The average price in 1988 was $0.89 per pound.

As the season progressed and the temperature rose with approaching spring, and encouraged by the success of those already fishing, a stream of additional individuals joined the fishery. This increased the rate at which turbot was arriving at the plant. The first bottleneck affecting the increased supply was the processing capacity of the plant, as to physical size, extent of facilities, and human resource capabilities. Fortunately, experience gained as the season proceeded could be applied by staff to mitigate some of these constraints. Freight capacity, originally thought to be a strength with eight scheduled south bound flights per week, was taxed at times, especially when weather prevented the carrier from flying. This resulted in backlogs of finished product and a second bottleneck. . The carrier, while accustomed to regular northbound shipments of perishable goods, was not accustomed to regular south bound cargo, let alone perishables. This required constant monitoring to track each shipment through to its destination since almost every plane flying out of Pangnirtung carried a load of fresh turbot (Simpson 1990).

Additionally, because of the unexpected and unprecedented volumes being processed, the plant ran short of packaging materials. These had to be special ordered and air-lifted to Pangnirtung. Limited storage capacity prevented stockpiling of packaging materials, making regular monitoring a necessity. Running out of any critical item, would stop production until that item was air freighted to Pangnirtung.

Everyone involved in the processing operation was taxed to their limits with the exception of the fishermen, who continued to fish and supply product to the processing plant. However, the stresses and strains at the plant and the efforts of fishermen were rewarded by the new found jobs and income the fishing created. A few months later when CSFL's year-end audit was announced, a small but important $63,211 profit before taxes on sales of $438,894 was further reward and set expectations for the future very high.

3.5 The 1990 Season

In preparation for the 1990 fishery, the deficiencies identified in 1989 were addressed. Mainly these related to the lack of facilities in which to hold and process the fish, and in which to store packaging materials and finished product. CSFL applied for funding to expand the plant and to construct a small storage cooler at the Pangnirtung airport. This airport cooler would be for finished product awaiting incoming planes. Only the plant expansion funding was approved and in December 1989, construction began on a 750 square foot plant extension. It included a large addition to the processing area, a storage area on a second level and a small office. The work was completed just prior to the start up of the fishery in January 1990.

The single-minded goal of CSFL in the 1990 season was to land a million pounds of turbot or reach a million dollars in sales, This misguided goal, based on equating success with the high 1989 landings, was frequently mentioned by company management during the season. While the Baffin region ED&T management wished to have the fishery development officer focus his attention elsewhere, and hopefully begin developing commercial fisheries in other Baffin communities, the CSFL board of directors pressured ED&T to have the fishery development officer remain in Pangnirtung to manage CSFL. He was popular in the community and was a key figure in the 1989 success.

Unfortunately the fishery development officer had no organizational or administrative skills. Management and accounting systems suitable to the size of the operation, were never set up. Without proper systems in place, other weaknesses emerged as the season progressed. The fishery development officer's ability to work with the board of directors was limited. His approach was to tell the fishery- and business-inexperienced directors what to decide rather than providing them with information to make their own informed decisions. Although the business required quick decisions, not necessarily a reasonable expectation for an inexperienced board of directors, local decision making was considered critical for the new company to develop as an Inuit-owned and controlled business. While the board recognized the importance of the fishery development officer in the success of the 1989 season, they also credited other participants with a significant role in the success. They were therefore not always pleased when the fishery development officer made decisions without their input.

The season began with the price for fish set at $0.90 per pound H&G. This higher price was a result of the 1989 profit and a desire by the board of directors to pay the fishermen a better price. Although the price paid to fishermen dropped as the season progressed (to follow decreases in the market price for turbot), a stream of individuals continued to enter the fishery.

The capacity of the plant was again taxed; the inadequate working space was perhaps exacerbated by the lack of formally-established processing procedures. Plant workers were again required to work extensive overtime to process the fish being landed at the plant. Rather than close the fishery for a few days when required to clear up a backlog of fish, management kept the fishery open to achieve the single-minded goal. Air charters were

occasionally arranged to move large quantities of perishable product to Iqaluit or to fill an immediate need for packaging materials.

In late April 1990, the board and the fishery development officer had a disagreement resulting in the fishery development officer voluntarily leaving Pangnirtung. The fishery continued without a general manager since fishermen continued to fish and land product at the plant. The Montreal-based buyer encouraged continuation of the fishery by demanding all product that CSFL could produce. In early May, ED&T were concerned about the fishery continuing while market prices were falling, so they contracted a consultant to travel to Pangnirtung to do a quick assessment of gross margins. After a three-day examination of the company's production, revenue and operational expenses, the consultant concluded the processing plant was operating at a loss. The consultant recommended to the board of directors and ED&T that the fishery be shut down for the season. This advice was heeded. ED&T extended the consultant's contract by requesting a more thorough assessment of the processing operation. A comprehensive report by C-Mac Consultants (1990b) made recommendations to ED&T and the CSFL board on all aspects of the business.

After the season ended it was discovered that the buyer of essentially all the fish was controlling the price well after delivery, despite CSFL claims of previous verbal agreements of higher prices. Certain shipments were claimed, well after delivery, to be spoiled and these invoices were not paid. In general, invoices were extremely slow in being paid. Inadequate accounting systems probably resulted in few follow-ups on unpaid invoices and contributed to the problem.

In both 1989 and 1990, CSFL arranged with a local store to accept chits issued by CSFL to employees and to fishermen. These chits were for either a CSFL employee's wages or a fisherman's landings and were good for credit or cash at the store. On a regular basis the

store would invoice CSFL for the total chits issued. This worked well in 1989, but in 1990 these invoices were not paid regularly. This and other signs of financial trouble began surfacing shortly after closure of the fishery. The air carrier was also claiming a large account receivable from CSFL. Inadequate accounting systems resulted in little attention to and therefore an accumulation of accounts payable during the fishing season. Following the year-end audit, the company was found to have a large operating deficit and would require a major cash investment to avoid bankruptcy.

3.6 1991 - The NWT Development Corporation

Much discussion occurred over the summer and autumn of 1990 with respect to the future of CSFL. The CSFL board of directors had two choices for an investment partner to inject new cash equity into the company to pay creditors. One of these was the NWT Development Corporation (NWTDC), a newly-formed GNWT crown corporation whose mandate was to invest in job-creating business opportunities considered too risky for the private sector. The second potential investor/partner was CSFL's major buyer based in Montreal. The board decided in favour of the NWTDC because of its policy of divestment of shares following achievement of operating profits. Therefore local ownership and control could resume. However an investment by the NWTDC would require the preparation of a detailed business plan for review by the NWTDC's board of directors. On assurances from ED&T officials that accounts receivable would be paid, CSFL'S creditors agreed to wait-out the process. As unsecured creditors, this was to their benefit. Not only would they realize their account receivable with accumulated interest (an unlikely event if CSFL declared bankruptcy), but both major creditors were well aware of the positive impact the turbot fishery had on their businesses. The 1991 season did not begin until mid-February when the NWTDC funds became available to CSFL.

The business plan (C-Mac Consultants 1990a) identified the critical need for qualified management, and with the help of ED&T, CSFL hired a general manager with experience in fish processing and marketing. An experienced office manager was also hired.

The new manager made changes to the fish plant layout to increase processing efficiency and also had a small cooler constructed inside the plant's freezer to store fresh product ready for shipment. Because of difficulties with the Montreal buyer in 1990, new buyers were sought. The price paid to fishermen was lowered to $0.70 per pound H&G, where it remained until the fishery closed at the end of April.

Overall the company proceeded with caution in 1991 to stabilize the operation and begin recovery from the 1990 loss. Thus the first signs of decreasing market price, caused by the opening of the Gaspé fishery, signaled a close to the Pangnirtung fishery. This was not well received by fishermen and plant workers who had gotten used to the exuberant manner of the 1990 season and the increased income that resulted.

3.7 1992- Competition

The 1992 season began with an interesting twist. P & L Services Limited (P&L), a major shareholder in CSFL and the owner and operator of the commercial scallop dragger in Pangnirtung applied for and received from DFO its own allocation of turbot. P&L had formed an alliance with a small regional charter airline, the fishery's 1989 and 1990 Montreal fish buyer who had not been supplied turbot in 1991, and ED&T's ex-fishery development officer who had recently resigned from his government position. The result was competition between P&L and CSFL for fishermen and turbot. Consequently the price paid to fishermen for H&G turbot began at $0.90 per pound. The fishery opened in late January as soon as the sea ice was stable.

The P&L alliance had quickly constructed a small building in which they could package turbot. By DFO regulations, without a federally inspected fish plant they could not process fish for (inter-provincial) export. Instead they acted as the Montreal buyer's agent and assisted fishermen prepare their catch for shipment south.

CSFL had not been pleased with their 1991 buyer and marketing agent and began an arrangement with another agent.

As the season progressed the per pound price paid to fishermen dropped and rose on a few occasions as the two companies made adjustments. CSFL stopped purchasing turbot and shut down their processing plant in late May. P&L continued purchasing turbot into early June, when the deteriorating condition of the sea ice between the fishing grounds and Pangnirtung effectively closed the fishery.

Encouraged in part by competition between the two companies, as well as information gained through experience, fishermen were offered and chose to have unemployment insurance premiums deducted. Once they qualified for UIC benefits they could then receive a year-round income; from the fishery during the fishing season, and from UIC in the fishery off-season. While several of them qualified for unemployment benefits, very few completed the paper-work required to collect these benefits in the summer and autumn of 1992.

The results of the 1992 season, relative to previous seasons show another sharp increase in the fishery's output and local income (see table 4 and figures 1 and 2). The fishermen were pleased with the long season and relatively high prices. The high volume of turbot purchased by both companies was good for the community as to the income and

opportunity it provided. CSFL alone, could not have moved such volume through their plant, The high volume indicated that the removal of constraints such as the present plant capacity would result in a continued increase in the numbers of fishermen and landings. This suggested a new, higher capacity fish plant, which CSFL envisioned in their future, could probably be justified and utilized.

Based on recommendations by the CSFL general manager, during the summer of 1992 the NWTDC considered another major investment in the Pangnirtung turbot fishery. It would include the construction of a new fish plant, designed to address the unique characteristics of the Pangnirtung winter fishery. The investment would also include operating subsidies for the first five years, allowing the company to carry operating losses while it was implementing a new strategy to diversify. The P&L scallop dragger was available for purchase, and ownership of this vessel would enable access to the summer scallop fishery and expected exploratory fishing contracts to be funded by the Canada/Northwest Territories Economic Development Agreement over the next few years. In addition to entry in the inshore scallop fishery, the diversification would also include attention to the eastern NWT supply of arctic char, and entry into the Davis Strait commercial fishery. CSFL had applied for and been granted an allocation of the 1992 Groundfish Developmental Quota in NAFO division O, and they had plans to arrange a joint venture with an appropriate vessel to fish this allocation. The Pangnirtung fishery was rapidly becoming a player of note in the arctic seafood industry.

Despite's loss of local control through majority ownership and management by the NWTDC, the shareholders of CSFL agreed to the NWTDC plan requiring the incorporation of a new company; Pangnirtung Fisheries Limited (PFL). The share structure of the new company is legally complex, but in essence the NWTDC holds 51 % of controlling shares and appoints four of the seven directors to the board. CSFL will remain active though reduced in

visibility, and is a major shareholder of PFL. The continuation of CSFL is a means of accessing new stock allocations, as DFO is not expected to assign commercial fish allocations to a GNWT crown corporation when private sector companies are also requesting allocations.

4.0 COST AND EARNING STUDIES

As early as 1986 in MacKay (1986b), the financial viability of winter turbot fishing in Cumberland Sound was under scrutiny. Such an unusual and new method of commercial fishing, along with large distances to markets challenge the viability of the fishery. Since an objective of the present study is to conduct a cost and earning study on the harvesting sector of the fishery, this section reviews the three previous cost and earning studies done on Pangnirtung winter turbot fishing and their assumptions and results.

As one of the terms in their 1988 contract with ED&T, CFCL (1 988) projected the costs and revenue of turbot fishermen, Their analysis is shown in table 3. It is important to note that the terms of reference of the CFCL contract were to evaluate the feasibility of the fishery; both in harvesting and processing. At the time of their data collection, the fishery was in its infancy and while the fishermen participating were quickly gaining the skills of the new technique, they had certainly not yet applied the concept of maximizing their profits as an individual fisherman would. For example, in 1988, fishing occurred in teams, and to whatever extent costs and revenues to fishermen existed at that point in the government projects of test fishing, they shared those costs and revenues. It was therefore assumed that in a shift to commercialization of the fishery, fishermen would adopt partnerships and share all costs and revenues. However, beginning in 1989, the better fishermen began splitting their teams, with each partner employing a younger man as a "helper", to which he paid a per trip wage. This practice of employing a helper has become the predominant practice in the fishery. Partnerships remain, but usually they occur only when less experienced participants are learning the fishing technique together, or in a few cases where the younger partner is assisted by an older relative.

Table 3. Comparison of three previous harvesting cost and earning studies for the Pangnirtung winter turbot fishery.

	CFCL (1988)		Weihs (1989)	C-Mac Consult. (1990)
Season Length (wks)	12	12	13	16
Per pound turbot price	$0.90	$0.70	$0.67	$0.80
	25,000 lb	25,000 lb	21,134 lb	516 022.5
Gross Revenue	$22,500	$17,500	-$14,200	$14,818
Expenses				
Fuel	2,105	2,105	1,200	1,010
Food & Supplies	-	-	1,800	4,200
Cooking & Heating Fuel	-		-	1,428
Fishing Gear	716	716	1,002	1,770
Maintenance	1,464	1,464	600	1,429
Interest expense	1,040	1,040	-	
Depreciation	1,646	1,646	1,923	2,194
Total Expenses	6,971	6,971	6,525	12,031
Net Annual Income (two-man team)	15,529	10,529	7,674	785
Net Annual Income (per individual)	7,765	5,265	3,837	393
Weekly Income (per individual)	$647	$439	$295	$25

Much of the CFCL (1988) cost and earning study was based on estimates, owing to a lack of harder data at that time. Thus behaviour of individual fishermen was not considered. Ironically, one of the CFCL (1 988) recommendations, complete with a financial analysis to justify it, was a suggested different fishing technique requiring a three-man team and employing a double-ended long-line fished through two holes in the sea ice. This technique required use of a newly developed, self propelled under-ice homing device to initially set the line in both holes. While the technique was expected to increase catch through use of a longer ground line and therefore more hooks, it has never been further investigated. Fishermen adopted their own innovations.

For a 12 week season, CFCL (1 988) estimated fishermen capable of earning an average net income of $7,765 with an H&G turbot price set at $0.90 per pound. At $0.70 per pound for H&G turbot, average net income decreased to $5,265. These estimates assumed the two-man team was capable of landing 25,000 pounds during the 12 weeks.

Weihs (1 989) estimated turbot fishermen's monthly net income based on the 1989 season records of landings by those fishermen who began fishing within two weeks of the season start-up. Costs of fishing were estimated from interviews with fishermen. His analysis showed average monthly gross revenue to be $4,733 and average net income to be $2,558 for a two-man team, Over the course of the 1989 season of 13 weeks this resulted in an estimated average net revenue of $3,837 per participant. Details are also shown in table 3.

C-Mac Consultants (1 990) also estimated the revenue of fishermen through fishermen surveys, examination of CSFL records and local merchant price surveys. They surveyed fishermen representing 20 partnerships and "fisherman/helper" teams which were said to account for about 85°A of the turbot landings in 1990. Their analysis is also shown in

table 3 and shows a net revenue of $785 per fishing unit on average gross revenue of $12,818 for the 16 week season.

The summarized results of the three studies outlines substantial discrepancies owing at least in part to the differences in approach. The CFCL (1 988) study was a pro *forma* feasibility study, and estimated that a two-man team could land 25,000 pounds of turbot during a 12 week season, Two different prices to fishermen were evaluated and resulted in a $5,000 difference in estimated gross revenue. Weihs (1 989) examined actual information collected from the 1989 fishery. His calculation of the gross revenue figure was averaged from the landings of fishermen who began fishing during the first two weeks of the season. The C-Mac Consultants (1 990) study was based on 1990 fishery data. Their estimate of average landings is derived from twenty fishing teams which accounted for 85% of the 1990 landings.

Substantial discrepancies exist between the various costs. Most notable is the failure in some studies to include costs in their analysis which another study found to be a major expense. These resulted in large differences in net incomes. CFCL (1 988) predicted good returns for fishermen; up to an average of $647 per week. However, the two studies based on actual fishery data show more modest results; $295 and $25 per week average incomes (Weihs 1989, and C-Mac Consultants 1990 respectively). While $295 per week is better than minimum wage and likely to still attract participants, one questions why an individual would fish for only $25 per week.

An examination of the assumptions of these studies (when stated) offers suggestions why they have such different results. For example, CFCL (1988) assumed fishermen will fish five days per week not including time for travel, gear preparation, or equipment maintenance. In fact, fishermen may fish any number of days in a week, depending on

factors such as weather, the price of landed fish, the availability of "helpers", and the condition of their gear and equipment. C-Mac Consultants (1 990) assumed all fishing teams used a motorized long-line hauler at a capital cost of $2,600. As recent as the 1993 season, hand-operated haulers or "gurdies" were still more common than motorized haulers. C-Mac Consultants (1 990) also assumed insulated fish-holding containers valued at $1,250 were replaced every one to two years. Many fishermen continue to use home-made fish-holding containers constructed at low cost from scrap plywood, styrofoam insulation and plasticized tarps. Factory-built insulated containers have been shown to be quite durable, lasting about five years.

The manner in which at least two analyses attribute the depreciation of snowmobiles to the fishery is questionable. C-Mac Consultants (1 990) assume 57% of snowmobile cost is attributable to the fishery based on a four-month fishing season in 1990 and a seven-month snowmobile season. They also assume that all fishermen purchase a new snowmobile at a cost of $6,000, depreciated over two years after which there is a salvage value of $500, CFCL (19881 uses a similar formula for depreciation while Weihs' (1989) assumptions are not stated. Generally with respect to these studies, the stated assumptions about snowmobile depreciation and relative use attributable to the turbot fishery are too broad and not applicable to all participants.

Perhaps the best general explanation for the wide differences in these studies' results is the analyst's unfamiliarity with the fishery and hence an inability to properly determine the characteristics of the fishery and thus the relevant cost and revenue determinants. The most blatant of these is the absence of heating fuel in the CFCL (1 988) study.

5.0 COLLECTION OF DATA

In order to achieve the objectives of the study introduced in section 1.2, it was necessary to collect data from several original sources. The first of these sources was written records of a government department and the two commercial fishing companies in Pangnirtung. Secondly, data were obtained through personal interviews, questionnaires and discussions with fishery participants and residents of Pangnirtung. Each of these sources and the procedure of data collection is described in detail throughout the remainder of section 5.

5.1 Fishery Records

During the 1988 fishery project, records of fishermen landings and gear purchases were kept by the project manager. Since the fishery project was the only buyer of turbot and the only seller of the specialized long-line gear used by the fishermen, the records of the fishery project formed a complete set of earnings and fishing gear costs for individual fishermen. In 1989 and 1990, CSFL continued to keep detailed records of transactions with fishermen, As fishermen landed their catch, their revenue was recorded in receipt books. Because CSFL was required to supply the specialized long-line gear and other fishing gear not available in Pangnirtung or the Baffin region, sales of all fishing gear were also recorded, often detailing individual gear items. These records from 1988 through 1990, formed a valuable resource which was compiled into computer spreadsheet files for analysis. However, in 1991, with CSFL under new management, gear sales were turned over to one of the company's major shareholders, the Pangnirtung Eskimo Co-operative Ltd., which operated a general store. With this change, records of gear sales were no longer available because of simpler sales transactions at the co-op.

Records of fishermen landings for the 1988 through 1992 seasons were also compiled into computer files for analysis.

5.2 Personal Interviews and Questionnaires

Since the fishery records did not consist of a complete set of information to evaluate the impact of the fishery on Pangnirtung, further information was needed. An obvious source of this information was from participants in the fishery. For the years 1988 through 1991, individual fishermen landings, the number of trips per fishermen per year, and the frequency distribution of landings by fishermen were examined. The rules affecting fishermen qualifying for unemployment insurance benefits were also considered. From this information a sample of 20 fishermen was randomly chosen for which further information would be gathered during and following the 1992 fishing season.

In gathering and analyzing data from local residents, special attention was paid to several factors affecting the collection and interpretation of data.

The first difficulty associated with collecting information from fishery participants was that their first, and in most cases only language, was Inuktitut. This required the use of an interpreter for almost all interviews. Questionnaires also required translation into Inuktitut and the responses translated back into English. Two interpreter/translators were used for the research, both of whom have had recent experience translating and interpreting for academic research purposes. This need for the use of interpreters for so much of the primary data collection had a limiting effect on data quantity owing to financial and time constraints.

Other cultural differences also made data collection from fishery participants difficult. Traditionally, Inuit learn by observing and listening. Direct questioning is not always an effective means to gain information or answers, though it is becoming more commonly accepted. Another difficulty is the educational differences which exist between researchers and many Inuit adults. Most Inuit in Pangnirtung over 40 years of age and some younger have no formal education since day-schools were not established until the 1960s. Quantitative record keeping, both mental and written, can be uncommon in Inuit culture and can affect the collection of information through interview or questionnaire.

There is also a reluctance or skepticism in Inuit communities about researchers in general, perhaps owing to the regular occurrence of researchers in Inuit communities, and the cultural and educational differences that exist between the research community and the residents of an arctic community. Despite some researchers' efforts to explain the purpose of their research to the community and its utility to them, as well as the results and interpretations of the completed research, Inuit communities and their residents may have difficulty understanding academia and therefore contributing to and gaining from research.

5.2.1 Fishermen Interviews and Questionnaires

Two types of questionnaires were developed to gather information from fishermen. One of these was designed to gather fishing trip expenditures and is referred to as the trip questionnaire. The second questionnaire was designed to be used during a personal interview, and sought information on fishing expenses, capital costs, and opportunity costs associated with the turbot fishery, It is referred to as the comprehensive questionnaire. These questionnaires and their use are described below.

The intent of the trip questionnaire was to gather common expenditures and periodic maintenance and repair costs of equipment associated with each turbot fishing trip, from the random sample of fishermen in 1992. Owing to financial and time constraints, it was impractical to do personal interviews with each of these fishermen upon their return from each fishing trip. Therefore the questionnaire was designed to be completed by the fisherman and returned before his next fishing trip. The random group of fishermen were approached to determine their interest in participating in the research. Twelve agreed to complete the questionnaires and were given a supply of the one-page form. Five dollars was paid for the return of each trip questionnaire. Following translation of responses into English, the information was compiled into a computer file for analysis.

The comprehensive questionnaire was completed in a personal interview with the random sample of fishermen. In most cases these interviews required the assistance of an interpreter. On average the interviews were about one hour in length. The information gathered was also compiled into three computer files for analysis.

5.2.2 Plant Worker Interviews

A questionnaire was also developed to use in personal interviews with a small random sample of CSFL plant employees with at least three seasons of experience. These interviews usually required about 15 minutes, and except in one case, required the assistance of an interpreter. The questionnaire was designed to determine alternative types of employment of plant workers and opportunity costs of working at the fish plant. The questionnaire also tried to determine on what their income from work at the plant was spent. Responses were summarized and compiled in a computer file for analysis.

5.2.3 Manager Interviews

Several interviews were also done with persons involved in the development of the turbot fishery as well as the management of the commercial fishing companies. These included government personnel who played lead roles during the development phases, members of the CSFL board of directors, and the current managers of both Pangnirtung fishing companies. The interviews sought to explore the development phases of the fishery as well as current approaches to management, in order to evaluate from different perspectives, the success of the development model of CSFL.

5.3 Price Survey

During interviews with fishermen, some responses to questions on fishing costs did not quote the cost of items. For example, fuel was always referenced in gallons. In these cases, prices were gathered by visiting and phoning local suppliers and merchants.

5.4 Social Assistance Payments

Statistics on monthly social assistance payments in Pangnirtung were gathered from the GNWT Department of Social Services Minister's Reports (Social Services 1983 to 1992). These payments were compiled back to April 1983 when this information was first computerized. UIC benefits are not included.

Total monthly social assistance payments were averaged for each year. Payments for March and April were also averaged for each year since March and April are the only two months of each year since the fishery began commercial production in 1989, in which the fishery has operated throughout those two months. While in some years fishing started as

early as January or ended as late as June, this was not consistent for all years. Hence March and April are characterized as fishery months.

5.5 Personal Observation

It is significant to this study that the author has been a resident of Pangnirtung since April 1989. Living within a small community allows one to get a good understanding of the community and personal knowledge of at least some of its residents. To a certain extent, this allows a bridging of cultural differences.

Further, the author has been employed since 1989 until the present as the GNWT's economic development officer representing the Department of Economic Development and Tourism in Pangnirtung, the government department which has led the development of the turbot fishery. This meant the author was often privy to information and insights about the fishery which were not always common or public knowledge. These factors tended to ameliorate some of the difficulties conducting research described in section 5.2.

6.0 RESULTS

This section presents results of the data collection and analysis described in section 5. Discussion, interpretations, and the relevance of this information to the study objectives is presented in section 7.

6.1 General Statistics of the Fishery

Table 4 outlines general statistics of the Pangnirtung winter turbot fishery. Some of the statistics are also shown graphically in figures 1 and 2. Table 4 shows commercial landings have increased 171 % in three years from 276,082 pounds in 1989, to 748,480 pounds in 1992. A 195% increase in gross fishing income from $184,459 in 1989, to $544,822 in 1992 has also occurred. Licensed fishermen have increased in numbers from 43 in 1989, to 93 in 1992. Processing and packaging operations of CSFL between 1989 and 1992 and P&L in 1992 added between $70,572 and $203,967 in local annual income as outlined in table 4. Annual summation of processing income and gross fishing income is shown with annual landings in figure 2.

6.2 Cost and Earning Study

Of twelve fishermen who agreed to complete trip questionnaires during the 1992 fishing season, only five returned completed questionnaires. Of these five fishermen, only three returned more than two questionnaires. Examination of the responses on the completed questionnaires of the three fishermen left doubt about the usefulness of the information. Key responses were left blank in many instances. Owing to this poor participation rate, as well as the lack of complete information, the trip questionnaires were not used for any fishing cost analysis.

Table 4. Pangnirtung winter turbot fishery statistics 1988- 1992.

	1988	1989	1990	1991	1992
Landings (H&G pounds)	26,059	276,082	431,843	267,990	748,480
Season Length (weeks)	7	14	18	12	21
Number of Licensed Fishermen	9	43	77	61	93
Direct Local Income ($)	eat. $32,182	$255,031	$550,602	$259,351	$697,969
Gross Fishing Revenue ($)	$23,282	$184,459	S346,635	$187,593	$544,822
Processing Income ($)	est. $8,900	$70,572	$203,967	$71,758	$153,147
Average Turbot Price ($/H&G pound)	$0.89	$0.67	$0.80	$0.70	$0.73

Figure 1. Pangnirtung winter turbot fishery, landings and gross fishing revenue, 1988-1992.

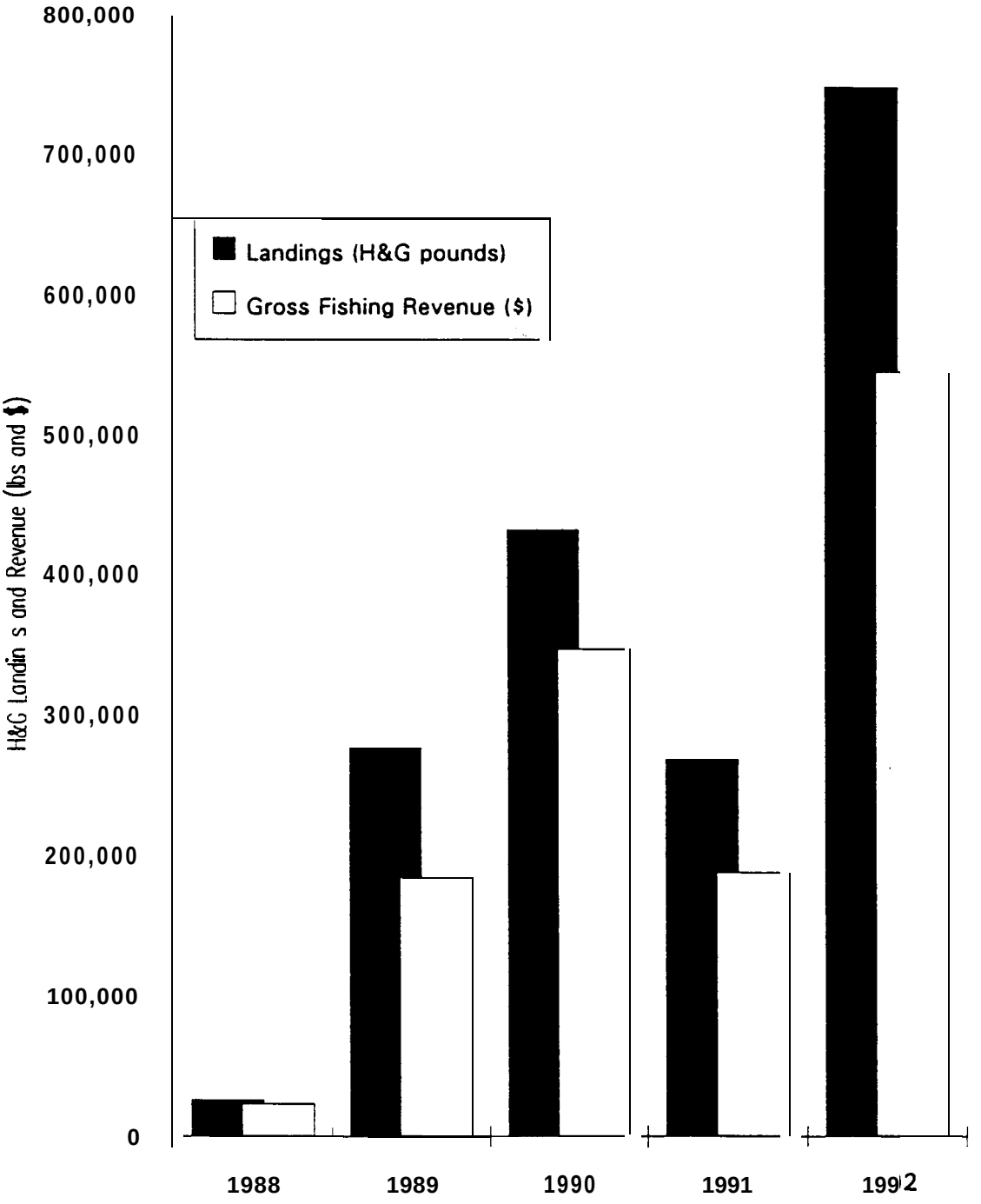
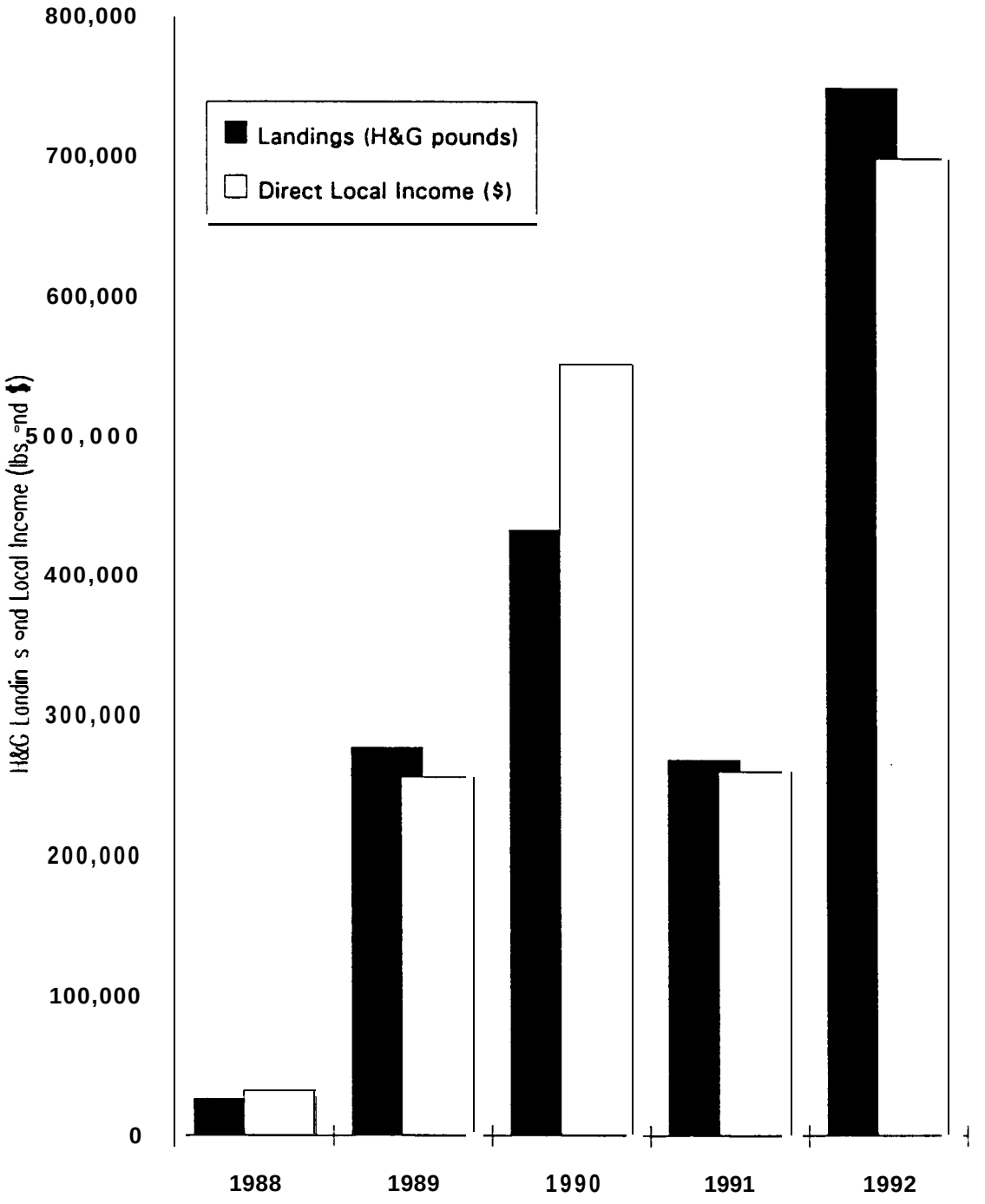


Figure 2. Pangnirtung winter turbot fishery, iandings and total direct local income, 1988-1992.



Interviews with two of the 20 randomly chosen fishermen could not be arranged. The random choice of fishermen was made prior to the start of the 1992 fishery and prior to complete analysis of fishermen landings in 1991. Consequently, the results of the interviews for two fishermen in 1992 and three in 1991 could not be used because they either did not fish in those years or their participation was very limited. Thus the 1991 cost and earning analysis consisted of 15 fishermen representing 49% of the fishery's production. For the 1992 cost and earning analysis, the sample consisted of 16 fishermen representing 44% of production, The results in tables 5 and 6 were drawn from personal interviews with fishermen, the landings records of CSFL and P&L, the fishing gear sales records of CSFL, and price surveys of local inputs.

From table 5 it can be seen that in 1991, the average net income to fishermen was $1,241 on an average landed value of $6,156. For the 1992 season shown in table 6, average net income was $4,316 on an average landed value of $15,030. Expenses are shown as a percent of gross income for both years which shows consistency in variable costs such as fuel and labour. However depreciation of equipment, while having increased absolutely from 1991 to 1992, is reduced as a percent of gross revenue.

6.3 Fishermen Opportunity Costs and Benefits

The subjective responses of fishermen to questions concerning opportunity costs of fishing are summarized in table 7. From this summary, it is evident that most turbot fishermen were primarily occupied with hunting in winter and spring, prior to the inception of the turbot fishery. It is also quite evident that the main reason they began turbot fishing was to earn cash income. While several mentioned they enjoy fishing because of its similarities to traditional Inuit men's work, they acknowledged the need for cash income. When asked for what this money was used, many mentioned household expenses without hesitation.

Table 5. Average costs and earnings of Pangnirtung turbot fishermen in 1991 (n= 15).

Gross Revenue	**$6,156**	**100%**
Expenses		
Fuel	618	10%
Food	883	14%
Labour	1,022	17%
Fishing Gear	520	8%
Repairs	170	3%
Depreciation		
Snowmobile(s)	1,055	17%
Capitalized Fishing Equipment	452	7%
Other	194	3%
Total Expenses	**4,915**	**80%**
Net Income	**$1,241**	**20%**

Average Weekly Income	**$103**
Fishing Season Length (weeks)	**12**
Average H&G Turbot Price ($/lb)	**$0.70**

Table 6. Average costs and earnings of Pangnirtung turbot fishermen in 1992 (n = 16).

Gross Revenue	$15,030	100%
Expenses		
Fuel	1,658	11%
Food	- 2 , 0 7 3	14%
Labour	2,746	18%
Fishing Gear	1,220	8%
Repairs	457	3%
Depreciation		
Snowmobile(s)	1,791	12%
Capitalized Fishing Equipment	503	3%
Other	265	2%
Total Expenses	10,714	71%
Net Income	$4,316	29%

Average Weekly Income	$206
Fishing Season Length (weeks)	21
Average H&G Turbot Price ($/lb)	$0.73

Table 7. Summary of responses of fishermen to questions not relating to direct costs of fishing (n = 18).

Questions	Responses and Frequency				
Previous winter activity before turbot fishery?	Hunting 13	Job 4	Carve 1	Nothing 1	
Reason for changing to turbot fishing?	Money 14	Enjoy Fishing 1	N/A 3		
Has turbot fishing affected how often you hunt during the turbot fishery?	Much Lass 8	Less 5	No Effect 2	N/A 3	
Do you hunt during turbot fishing trips?	Never 4	Sometimes 11	Oftan 2	N/A 1	
Has turbot fishing affected how often you hunt during sea ica months before and after the turbot fishery?	Mora 6	No Effect 5	Lase 3	N/A 4	
What do you buy with tha money you aarn from turbot fishing 7	Household Expenses 7	Fishing Equipment 5	Snowmobile 4	Gae 2	Outboard Motor 2
Why do you fish for turbot?	Money 12	Enjoy Fishing 5	Purchase snowmobile 3	Something to do 2	Fill Inuit Quota 1

N/A No answer or not applicable

Note: Rows with total responses greater than 18 caused by more than one response per question.

Another common response was re-investment in supplies and equipment, including snowmobiles, to continue turbot fishing.

With respect to the effect of the fishery on fishermen's hunting activities, almost all mentioned they hunted less or much less often during turbot fishing months than before there was a turbot fishery in Pangnirtung. However, responses indicate that most of the fishermen occasionally take short trips for seal, caribou and narwhal at appropriate times of the fishing season. This is possible in part, because these hunting grounds are closer to the fishing sites than is Pangnirtung. The effect on hunting activity of turbot fishermen in the early winter months prior to the turbot fishing season, and in the spring following the turbot fishing season, but before the sea ice breaks up, is not as strong as the change in activity within the turbot fishing season. About twice as many fishermen reported they hunted more often in the spring than in the early winter before the turbot fishery season begins. Almost one third reported no change.

6.4 Plant Worker Opportunity Costs and Benefits

Responses to the plant worker questionnaires are summarized in table 8. All but one plant worker was previously employed although some of the employment was in casual or irregular positions. Yet most also reported they would not be working if it were not for the fish plant jobs, Most of the women had virtually no formal education and therefore had job skills limiting them to janitorial and traditional types of work. Almost unanimous was the response that work at the fish plant resulted in less attention to traditional duties in their home, However, they noted that such duties could wait until the fishing season was over. Alternatively, if something was important, a relative would help out with the task. Half of the women felt this change in their activity from traditional women's duties to a job outside the home was a positive change because of the need to earn cash income. Women's

Table 8. Summarized responses of fish plant workers (n= 6).

Questions	Responses and Frequency			
Previous employment?	Retail Clerk 1	Janitor/Maid 2	Sewing/Weaving 2	None 1
Why change to fish plant?	More enjoyable 1	Regular hours 2	Laid off 1	N/A 2
Where would you be working if there was no fish plant?	Janitor 1	Retail clerk 1	No 4	
For which other jobs are you qualified?	Retail Clerk 1	Janitor/Maid/Kitchen 3	Sewing/Weaving 2	
Are those jobs better than fish plant jobs?	Yes 1	No 2	Depends 2	N/A 1
During turbot fishing season do you spend more or less time at traditional women's activities?	Less time 5	No change 1		
Is this change good or bad?	Good 3	N/A 3		
What do you buy with fish plant income?	Household Expenses	Furniture 2	Clothing 2	Food 2	Hunting Equip. and expenses

N/A No answer.

Note Rows with total responses greater than six caused by more than one response per question. Responses may not be mutually exclusive.

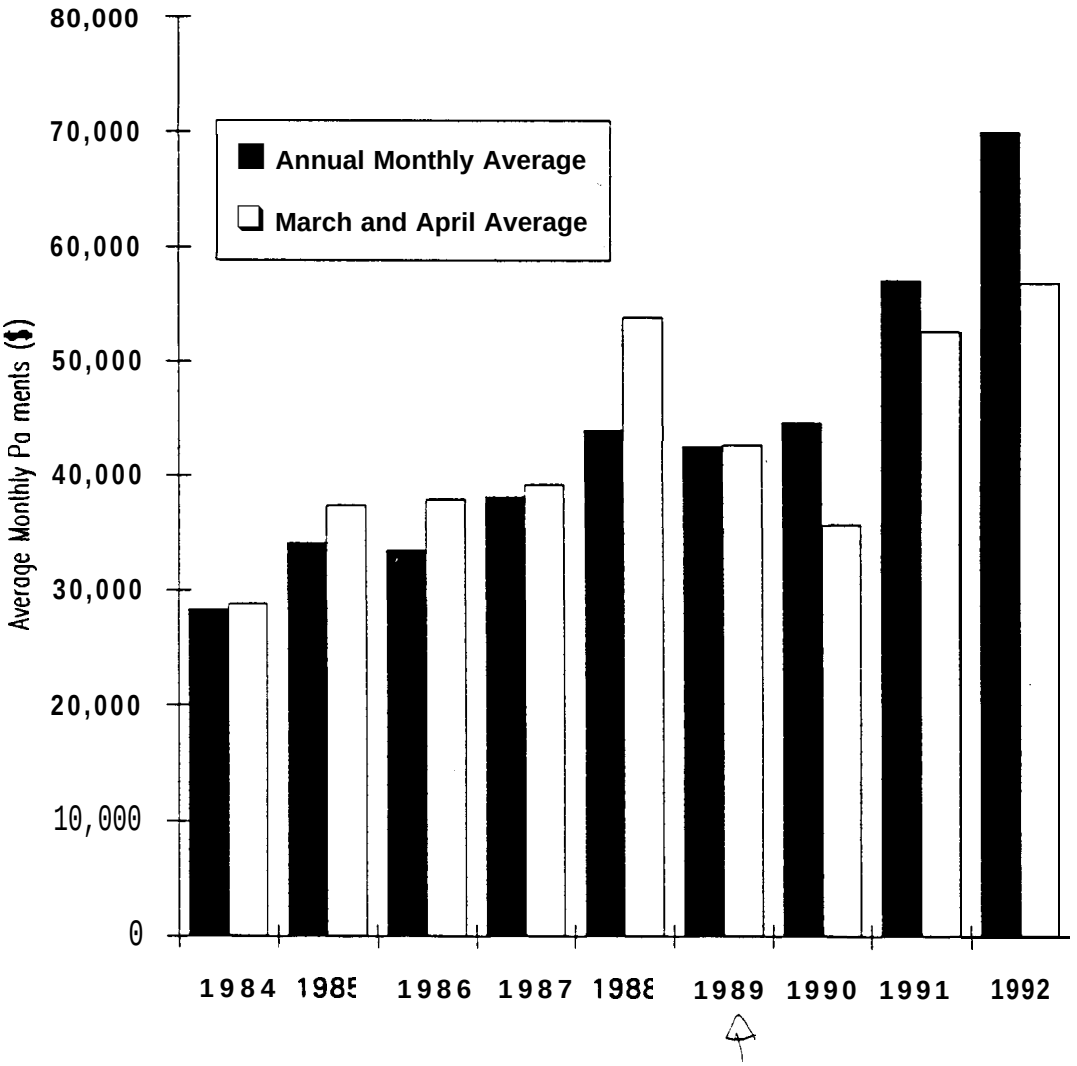
income from the fish plant tended to be spent on household expenses. Only one woman stated some of her money went to help purchase equipment and expenses for hunting.

It is also interesting to note that most women felt the seasonal nature of the fishery was positive since it provided them with at least ten weeks of annual employment. With ten weeks of employment they would qualify for unemployment insurance benefits in the remainder of the year, and would have ample free time to pursue other interests. Only one woman stated she would prefer a full-time, year-round job.

6.5 Social Assistance Payments

The effect of the Pangnirtung winter turbot fishery on social assistance payments in Pangnirtung is shown in figure 3. Beginning in 1989, the first year of commercial production in the fishery, March and April social assistance payments show a decline relative to average monthly payments for the entire year. Prior to 1989, March and April social assistance payments were higher than average monthly payments for the same year.

Figure 3. Total monthly social assistance payments in Pangnirtung (does not include UIC benefits), 1984-1992.



7.0 DISCUSSION

This final section discusses and interprets the results presented in section 6 with respect to the goals and objectives of the study. Three major themes are pursued. The first is the degree of success achieved by the Pangnirtung winter turbot fishery, as demonstrated by various indicators; the jobs and income that have resulted, the fishery's effect on traditional activities of participants, and its effect on social assistance payments and crime. The second theme is potential future problems created by the fishery. These should be recognized, discussed and addressed by managers of, and participants in the fishery. Lastly, the fishery development model is evaluated in the context of the long-term economic development of the community. Certain lessons, both positive and negative, have been learned in Pangnirtung through development of the fishery. They are useful lessons to share with others. The section ends with a few concluding paragraphs,

7.1 Success of the Fishery

The most visible impact of the turbot fishery on Pangnirtung is the income and jobs created as outlined in table 4. This income has grown to almost $700,000 in only 4 years of commercial production. Compared to the gross annual income in Pangnirtung ($9.2 million in 1990 (NWT Bureau of Statistics 1992b)), income directly from the fishery is becoming significant.

There has also been a large increase in the number of licensed fishermen; from nine in 1988, to 93 in 1992. These numbers represent only licensed fishermen and do not include the fishermen's helpers. There are three sources of new fishermen to account for the increase. Some individuals may start fishing without much direct practical experience. An annual, six-week commercial fishing course offered through Arctic College, which includes a

practical on-ice turbot fishing module, accounts for some of the entrants. Other entrants haye participated in the fishery for varying lengths of time as helpers and have now acquired the equipment and experience to become independent. Lastly, the fishery is drawing participants from two neighboring communities; Broughton Island to the north and Iqaluit to the south. These fishermen travel by snowmobile to Pangnirtung to take advantage of an opportunity not available in their own communities. Participation from other communities started in 1990, but involved only a few individuals in 1991 and 1992.

The length of the season is controlled by two independent factors. Fishery start-up depends on the readiness of the sea ice. Since the fishing grounds are 20 to 40 kilometers offshore, it takes one to two months for the floe-edge (transition of open ocean and sea ice) to move this distance from shore, Though the ice may be able to support sufficient weight earlier in the winter, fishermen must be reasonably confident that the ice is stable enough to remain in place during storms when winds may break free large ice pans and carry away the fishing platform and fish camps.

The close of the season is controlled by the market price of turbot. Because turbot from the Gaspé fishery appear in markets in April, the Pangnirtung fishery is under some pressure afterwards to drop its prices. As the Pangnirtung fishery becomes established, and depending on its success in reaching specialty markets, its price may stay high enough to continue production into May and June as it did in 1992. By mid-June the sea ice is becoming weak. It usually breaks up in early July. As has been seen between 1989 and 1992, the longer the season, the greater the landings and income generated. At 21 weeks, the 1992 season probably represented the longest possible fishing season. Any future increases in production will likely result from more participants and greater productivity on the part of individual fishermen. However, increased production must be considered in the context of the effect of fishing effort on the fish stock. This is discussed in section 7.2.1.

7.1.1 Cost and Earning Study

Tables 5 and 6 show that average net income of Pangnirtung turbot fishermen is considerably less than average gross income. Yet it has become common among government and industry to reference gross direct income when discussing the impact of the fishery. However, depending on the costs of fishing and related factors this may not be a fair surrogate to use as a measure of economic impact. Inputs to fishing, with the exception of labour, are not purchased locally, resulting in high leakage from the economy. Therefore, the use of gross fishing income as an indicator of the impact of the fishery should be replaced by or supplemented with the average net fishing income.

The initial intent of the study was that much of the information regarding fishing costs would be derived from the trip questionnaires. However, as stated in section 6.2, the trip questionnaires did not yield useful information. There are several reasons for the poor yield. " Many fishermen have little or no formal education. Thus they are not in the habit of writing and have limited writing and reading skills even in Inuktitut. The implications of this poor yield is not considered to have had a negative impact on the results since returned trip questionnaires showed rounded or estimated figures in many cases. This rounding or estimating occasionally occurred during the fishermen interviews. In these cases, as well as when a question or answer was not understood by either party, further discussion led to a more specific answer or clarification. This would not have occurred using the trip questionnaires.

Generally speaking the results of the fishermen interviews showed consistent responses to questions where this would be expected. Many fishermen remember exact prices (to the dollar) of equipment, supplies and replacement parts. The area of greatest variability is that

of capital equipment. It can be explained by different strategies of fishermen. Some fishermen purchase a new snowmobile each season. They have few repairs, fish often and tend to be highly productive. Others use a snowmobile for several seasons resulting in lower annual depreciation and higher repair and maintenance costs in later years. Fishermen's strategies also vary with respect to the use of one or two snowmobiles. Their helper may use a second machine or ride as a passenger on the fishermen's machine. Large differences in the capital costs and depreciation result from this variable.

Despite estimates of many expenses difficult to track, it is believed the cost and earning study presented is more accurate than previous studies. Some of the weaknesses of the previous studies are listed in section 4. One of the more serious of these is assuming a single or average strategy for snowmobile use. The present study collected actual details of snowmobile use and value from the fishermen sample, and calculated annual depreciation and relative use attributable to turbot fishing to arrive at an average 'depreciation. This is believed to be more accurate as shown in snowmobile depreciation differences between 1991 and 1992 (tables 5 and 6) reflecting the different lengths of fishing season in those years.

For comparison purposes of the cost and earning results of the Pangnirtung turbot fishery, table 9 presents results of costs and earnings of the smallest fleet sector of the Newfoundland fishery in NAFO division 3K (Newfoundland northeast shore). For the two years presented in table 9, total revenues at $15,558 and $10,368, producing net revenues of $6,395 and $4,051 respectively, are slightly better than the performance of the Pangnirtung turbot fishery. This fleet sector, of vessels under 25 feet in length overall, is comparable to the Pangnirtung turbot fishery with respect to several characteristics; total revenue, season length, and size of crew. There are also several differences, most notably the fishing platform. Many of the operations in the Newfoundland fishery employ more

Table 9, Results of costs and earnings studies of selected inshore fishing enterprises (less than 25 feet length overall) in NAFO division 3K (N. E. shore Newfoundland) in 1989 and 1990.

	1990	1989
Total Revenue	$15,558	$10,368
Fieh soles	15,463	10,368
Other	95	
Operating Costs	2.165	1,469
Fuel, Oil, Grease	1,602	1,167
Bait	96	61
Ice/Salt	79	64
Provisions	122	31
Non-fishing Labour	6	0
Othar	260	146
Repair and Maintenance Costs	431	209
Hull	131	8
Engina	148	61
Deck Equipment	36	15
Electronic Equipment	4	3
Facilities and Equipment	112	48
Net Gear Purchases	2.148	1,475
Nat Gaar Acquisitions	1,018	883
Gear Repairs	1,130	592
Fixed Costs	609	435
Insurance	61	55
Interest due	272	150
Wharf age	6	0
Storage	14	0
Faes	250	202
Other	6	28
Total Operating Costs	5.353	3,586
Labour costs	2,320	1,729
Depreciation	1,490	1,000
Return to Skippars and Boat owners	$6,395	$4,051
Season Length(weeks)	20.6	20.4
Per pound turbot price	$0.36	
Per pound groundfish price (average)	$0.26	$0.22
Par pound fish price (average)	$0.20	$0.27
Average siza of crew including skipper	1.3	1.6

Adapted from DFO (1 991a) and DFO (1991b).

than one type of gear and fish more than one species. Per pound prices tend to be lower in Newfoundland and the vessels land a much greater quantity of fish than does an average operation in the Pangnirtung turbot fishery. Nevertheless, the comparison is useful since it demonstrates the type and magnitude of costs for another fishery with comparable sales.

7.1.2 Fishermen Opportunity Costs and Benefits

Tables 5 and 6 show relatively low returns to fishermen for their effort and use of equipment. For only $100 to $200 per week, one wonders why the fishery is so attractive. There are several possible answers to this apparent anomaly which can be drawn from table 7.

It would appear that income from the fishery contributes to the cost of the fisherman's snowmobile which is also used for hunting and in-town transportation. Almost all Inuit men still hunt and supply at least some country food to their family and friends. As shown in table 7, 13 of 18 fishermen interviewed, considered themselves hunters prior to the inception of the fishery, All except one acknowledged they continue to hunt. However, the fishery has had an impact on their hunting activity.

Most of the fishermen stated that their hunting activity was reduced during the fishing season. However, most also stated they hunted during turbot fishing trips at least sometimes, which would tend to ameliorate the effect of reduced hunting trips during the fishing season. One third of fishermen interviewed, stated they hunted more often during winter and spring months prior to and following the turbot fishery, compared to before the inception of the fishery. For these individuals, this may support the argument that cash from the fishery is invested in equipment and expenses for subsistence hunting. In fact, these individuals agreed with that specific assertion on further questioning and discussion.

This assertion is not completely supported by the responses of fishermen to their uses of cash income from the fishery without further analysis. The most common response suggests cash is used for household expenses. Four of 18 respondents mentioned that cash from the fishery is used to buy snowmobiles. Five more respondents stated cash was used to purchase fishing equipment, which on further questioning was found to include snowmobiles. This totals half of the sample. It is suggested that income provided by the turbot fishery is used to purchase snowmobiles which, in addition to being the major capital item required for turbot fishing, are the major capital item required to hunt during winter and spring. This could imply the fishery does support the subsistence economy since cash earned in the fishery is used to help pay for hunting equipment. Without the additional income earned in the fishery, hunters might find it more difficult to purchase hunting equipment and supplies. Further, this income is paid to those with traditional skills more likely to utilize a greater portion of their cash for hunting activity.

Two interesting comments about the effect of the fishery on hunting patterns and perceptions were mentioned by a few fishermen. They said they learned through experience to hunt more frequently just prior to the fishery season. This allows them to "stock up" on country food. Once the sea ice is ready at the turbot fishing grounds and fishing begins, they would rather direct their efforts to the fishery. It was also noted that owing to the hard work and effort required of the turbot fishery, hunting activity following the season may drop. This is because some fishermen take the opportunity of relaxing after the fishing season, especially if their bills are paid and they have some savings from the fishing season.

Two fishermen reported that the turbot fishery, and the cash income that it generates, have caused them to be more aware of their lack of cash prior to the turbot fishing season. This

lack of cash in autumn and early winter has only recently become noticeable, as fishermen anticipate the coming of the fishing season and the cash it generates.

7.1.3 Plant Worker Opportunity Costs and Benefits

Table 8 summarizes the interview responses of plant workers and provides the information discussed below, Plant workers tend to be unilingual (in Inuktitut) women. Most of them were underemployed prior to the inception of the turbot fishery. Because they tend to lack skills gained through formal education, their employment opportunities are limited to jobs such as fish processing and sewing or weaving. There are also a limited number of janitorial jobs in Pangnirtung which are typically filled by unilingual women. While most stated they would be unemployed if the turbot fishery did not exist, on further questioning they stated they would probably return to the casual work they did prior to the inception of the fishery. The implication is that value-added jobs created by the fishery, are jobs for which the necessary skills are in ready supply in Pangnirtung. If job vacancies in casual or irregular non-fishing jobs result when people take jobs at the fish plant, these vacancies can be readily filled by unemployed workers in the community.

The Pangnirtung fish plant does, however have a definite effect on the activity of its employees. Almost all women stated they had less time during the turbot fishery to attend to their household responsibilities, especially at times during the season when they worked overtime. But with half of them considering this to be a positive change in their activity, while the other half did not respond to the question, one might imply opportunity costs appear to be well below the value to plant workers of the cash income they receive from work at the fish plant. Most commented that cash income was a necessity. Several also stated that despite their job at the fish plant interfering with their household responsibilities

during the turbot fishing season, these things could wait, or a relative or friend could assist in the interim.

Since the Pangnirtung turbot fishery began commercial operations, many fish plant workers have qualified for unemployment insurance benefits from their seasonal employment at the fish plant. The result of this is a further injection of cash into the local economy. Women, many of whom previously worked only casually and probably did not qualify for unemployment benefits now qualify and collect these benefits between fishing seasons. Most of the plant worker sample commented on the fish plant/UIC cycle, stating it was an attractive feature of fish plant work. Several noted this cycle allowed them to engage in traditional pursuits, with strong social or cultural returns during the rest of the year, despite these activities having small or negative economic returns. Only one respondent reported a preference for a full-time job over work at the fish plant and UIC benefits. She enjoyed keeping busy and work did not interfere with her household duties. These comments might be interpreted as implying the fishery supports cultural traditions to a very small extent. A future implication of the preference for collecting UIC benefits rather than seeking summer seasonal employment is briefly discussed in section 7.2.2.

7.1.4 Social Assistance Payments

As discussed in section 6.5 and shown in figure 3, the Pangnirtung turbot fishery has a significant effect on social assistance payments in Pangnirtung. Prior to 1989 and the inception of the fishery on a commercial basis, social assistance payments in March and April tended to be higher than the average monthly payments for the same year. After 1989, with the fishery operating at a scale large enough to impact many people, March and April social assistance payments began to decrease below the average monthly social assistance payments. Further, as seen in figure 3 and table 4, there appears to be a

relationship between this decrease in March and April payments and length of fishing season or 'monetary benefits in the same year. The longer the fishing season (for example 1990 or 1992), the greater the monetary benefits of the fishery, and the greater the decrease in , March and April social assistance payments relative to average monthly payments for that year. The relatively short fishing season of 1991 shows a much smaller decrease in March and April social assistance payments.

Beyond the obvious reduction in social assistance payments during the fishery, there are other significant impacts relating to social assistance payments. For example, until 1993 in Pangnirtung, social assistance payments could only be issued as a conditional cheque for credit at a local store toward certain purchases. Restrictions applied, especially on conversion to cash, to limit abuse. In the context of this study and the dynamics of the mixed economy, it would also limit the ability of recipients to use social assistance to invest in hunting or fishing equipment or expenditures such as gasoline. It" would also limit the ability of those social assistance recipients with a desire to turbot fish but without the cash resources, from purchasing the equipment or expendable inputs. The effect of the change in social assistance policy from restricted to discretionary use of social assistance, will take time to evaluate.

The opportunity for participants in the fishery to earn a cash income rather than having to rely on social assistance must also be considered in terms of the impact on the self-esteem of individuals. This could include UIC benefits collected between fishing seasons and considered by some as an earned benefit. This positive impact on self-esteem may be an explanation for the strong interest in turbot fishing when compared to the relatively low returns shown in tables 5 and 6. The opportunity of earning an income, even when the monetary returns are lower, may be preferable to collecting social assistance. This argument is strengthened when the job is desirable.

7.1..5 Other Social Impacts

A reduction in crime during months of the turbot fishery has been noted by the Pangnirtung RCMP (Cpl. W. Leil, personal communication) and some community leaders. It is attributed to the opportunities the turbot fishery creates and the constructive occupation of young men whom some would say otherwise have nothing to do and therefore break the law. One fisherman stated during an interview, that his helper may not be available in the coming season because he was scheduled to appear in court soon on charges dating to the turbot fishery off-season, and may be imprisoned. Because the fishermen believes that the turbot fishing keeps this individual constructively occupied and earning an income during the fishery, he plans to speak to the court on behalf of his helper to suggest that fishing in combination with retribution or community service, rather than imprisonment, might better serve justice.

7.2 Potential Future Problems

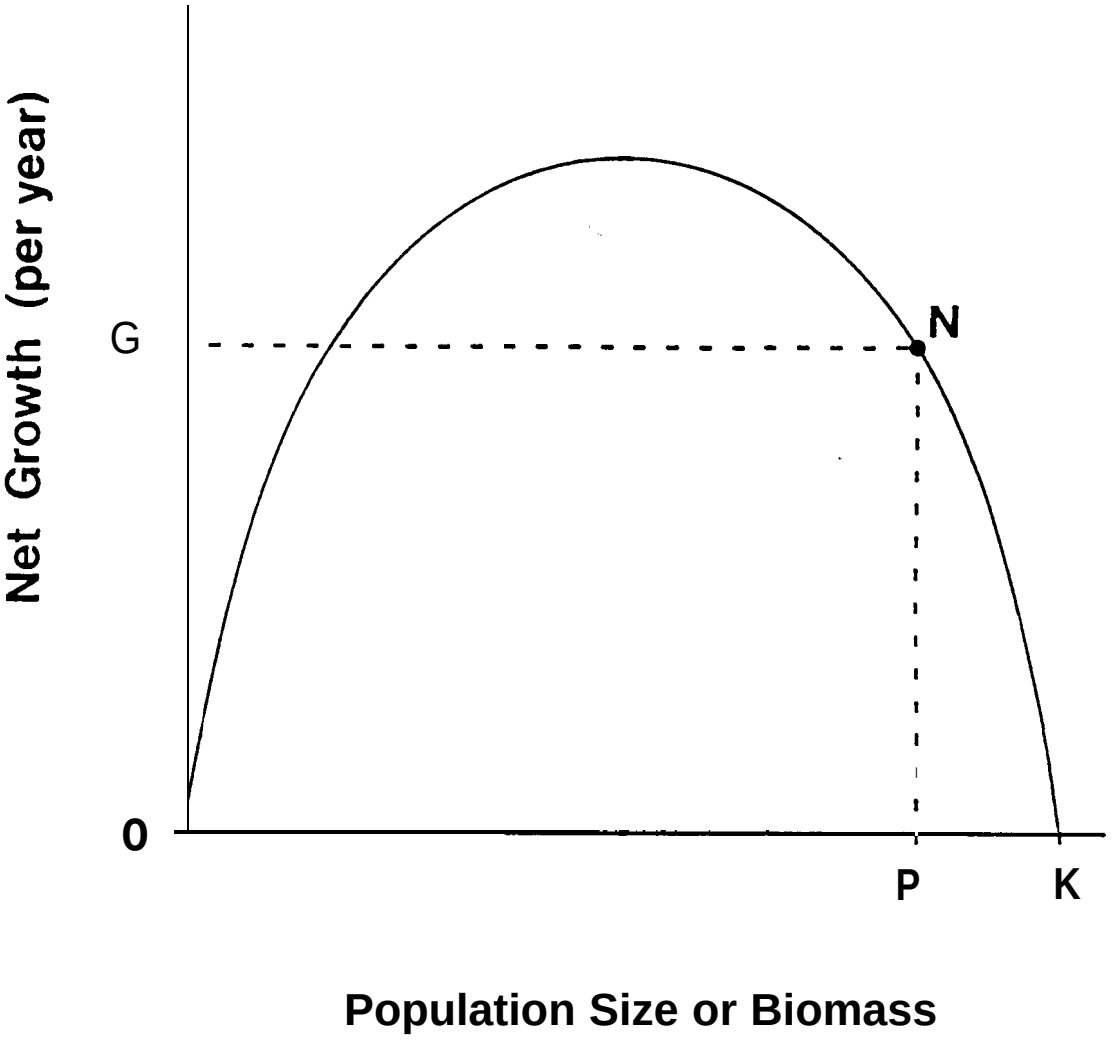
This sub-section is a warning to participants in the Pangnirtung turbot fishery, especially those who have come to rely on the fishery as an important source of income. It is also a reminder to fishery managers who tend to have difficulty controlling fishing effort, which too often leads to over-fished stocks that can no longer provide the income participants have come to expect from the fishery. Section 7.2.1 reviews a basic model of a fishery to outline how fisheries become over-fished. A suggestion is made to control effort in the Pangnirtung turbot fishery. Section 7.2.2 comments on access to UIC benefits created by the fishery and the potential danger this can cause to the economy.

7.2.1 Effect of Fishing Effort on the Turbot Stock

The impact of a fishery on the local economy must include consideration of the effect of fishing effort on the fish stock. This is especially true in a previously unexploited or under-utilized stock. The Cumberland Sound turbot stock is considered under-utilized. At present, Cumberland Sound turbot are managed by DFO as part of the NAFO division O (the west side of Baffin Bay and Davis Strait) stock (DFO 1991 c). While DFO research to learn more about the stock dynamics is underway, no definitive results have yet been published. For turbot in NAFO division O, the annual total allowable catch (TAC) is set at 12,500 tonnes based on J.A. Gulland's principle of $F_{0.1}$ (see DFO 1991 c). $F_{0.1}$ is the level of fishing mortality (or catch in a fishery) set as one tenth the initial catch per unit of effort (CPUE) in a very lightly exploited fishery. Prior to 1992, part of the TAC has been held in reserve. But in 1992, this reserve was allocated to unassigned quota which became available to the groundfish developmental program, designed to harvest under-utilized species. Thus this stock, which was previously under-utilized, has in the past decade become exploited by two new fisheries; the (offshore) groundfish developmental program and the Pangnirtung winter fishery, This increased pressure on the stock calls for caution on the part of fishery managers, who should review regulation of the fishery,

Fisheries are managed using models which describe relationships between variables in the fishery. These models are used to predict the effect of certain variables on others. A very simple and useful model describing the relationship between (fish) population size or biomass and its net growth per time period (usually per year), is the logistic growth model shown in figure 4. It should be noted that not all fish stocks behave according to the relationship described by the logistic growth model. However, most groundfish stocks do behave according to this relationship and this model may therefore be useful in describing the Pangnirtung turbot fishery. At K, the population is at the environmental carrying

Figure 4. Logistic Growth Model



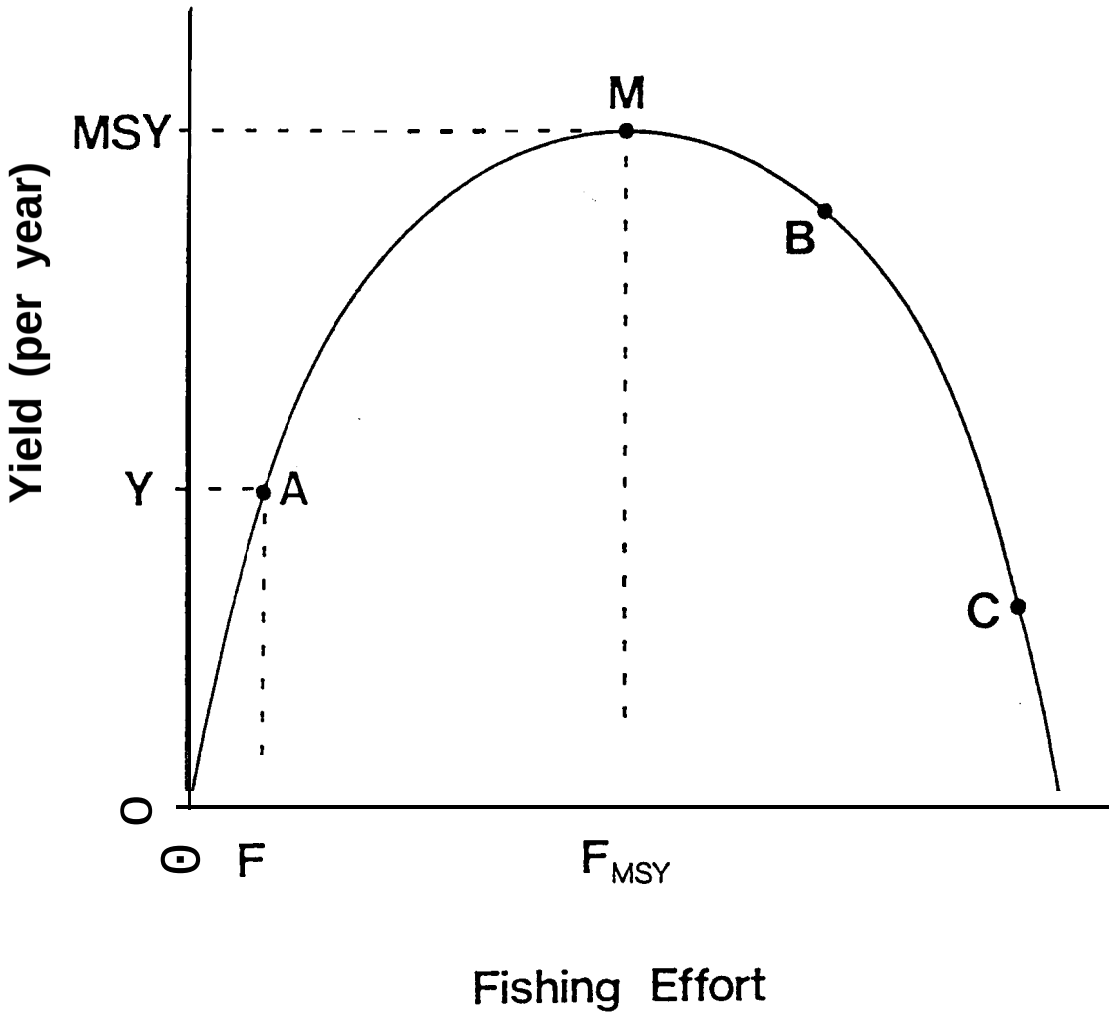
capacity and net growth is O. If the population has a reduced biomass, for example at P, the model describes the net growth of G that will occur. Eventually, net growth will return biomass to K.

The logistic growth model suggests a sustainable fishing strategy. If the biomass of a fish population is below K, then the net growth that will occur can be removed from the fish stock as a yield. The population will remain at that level of biomass. That same net growth can be removed on a sustainable basis. At N for example, net growth of G can be removed as a yield and biomass will remain at P. This same yield, equivalent to G can reoccur on a sustainable basis, since the population biomass will remain at P as described by the logistic growth model. A sustainable yield can occur at any point along the curve described by the logistic growth model.

Figure 5 shows a curve of long-run yield from a fishery as a function of fishing effort, It is known as the surplus yield or Schaefer fishery model (see Cunningham, Dunn & Whitmarsh 1985 and Pitcher & Hart 1982). This curve is a mirror image of the logistic growth model in figure 4 such that K in figure 4 corresponds to a fishing effort of zero in figure 5. High levels of fishing effort in figure 5 correspond to low levels of population size or biomass in figure 4. Each point on the curve in the Schaefer model represents a long-run equilibrium between yield and fishing effort and thus a corresponding level of biomass, such that the yield in figure 5 matches the net growth in figure 4. To achieve this equilibrium, fishing effort must settle at or around a stable level long enough for the biomass to adjust to a size corresponding to that effort level.

Fishing effort consists of two components. The first is the capacity of the fishing unit such as a fishing vessel or a long-line. The second component is the period of time that the unit

Figure 5. Schaefer Fishery Model



is fishing such as a day or an hour. Thus fishing effort is expressed as a vessel-day, or in the case of a long-line fishery, a skate-soak (the setting and retrieval of a long-line).

Increases in fishing effort occur in many ways. These can be obvious such as a longer fishing season, larger fishing boats or more fishermen. Increases in fishing effort can also be more subtle such as gains in experience of fishermen or technological innovations in their gear. The challenge for fishery managers is to be aware of these changing factors and to account for them in fishery regulations in order to control fishing effort. This has proved elusive in many fisheries.

A newly exploited or under-utilized fishery might have a sustainable effort and yield relationship at point A on figure 5. Yield is well below maximum sustainable yield (MSY); in fact MSY and F_{MSY} are probably unknown. As fishing effort increases, yield increases. However these increases in yield are gained not only by increased net growth described by the logistic growth model, but also by reductions in stock biomass since the Schaefer model relates increased fishing effort to decreased biomass. Fishermen come to expect high yields from the fishery for relatively low levels of effort. But while yield is increasing (until MSY), catch per unit of effort (CPUE) is decreasing. Because, fishermen are largely unaware of these dynamics, they tend to expect increased effort to result in increased yield. Decreases in CPUE can be hidden by experience gains and gear innovations. At M, further increases in effort (such as to points B or C on the curve) can no longer result in increased sustainable yields. To avoid over-fishing and depleting fish stocks as described above, fishery managers must regulate effort at conservative levels while the stock dynamics and MSY of new fisheries are being determined through study and monitoring of the fishery.

Little is known about the population dynamics of the turbot in Cumberland Sound or those in Davis Strait, with which they are managed as a single stock. Therefore it is difficult to

quantify the relationships briefly discussed above, However, assuming that the Schaefer fishery model is applicable to the Pangnirtung turbot fishery, certain predictions can be made regarding the dynamics of this new fishery. This is an important exercise in order to prepare Pangnirtung and its fishermen for reductions in CPUE that will inevitably occur as the turbot fishery matures. Since the stock has been fished for less than ten years (and has not yet reached the TAC as set by DFO), effort and yield are probably low relative to the MSY assumed by DFO. However, the TAC assumes that Cumberland Sound turbot are part of the Davis Strait stock. If Cumberland Sound turbot are instead a discrete stock, it is possible that yields may already be exceeding the MSY of the stock in the sound. In either case, because this concerns a new fishery, fishing effort will be reducing stock biomass from its initial maximum level. Yield from the Pangnirtung fishery could be made up of significant stock-biomass components, relative to net-growth components described by the logistic growth model in figure 4. Since CPUE is roughly proportional to the density of the stock, fishermen will be experiencing very high CPUE which is not sustainable because of decreasing stock density,

Yields which result from significant stock-biomass components (as opposed to net-growth components) are not sustainable yields at present levels of effort described by the Schaefer model in figure 5. Short-run yields, typical in a newly-exploited fishery (as is the Pangnirtung fishery), may be expected to exceed long-run sustainable yields. These short-run yields may even be large enough to exceed the MSY of the stock. There is no method to immediately determine this. The stock must be fished at a constant level of effort for a period of time until reductions in stock biomass cease and a long-run equilibrium is reached on the yield curve shown in the Schaefer fishery model. At this point yields will consist solely of net-growth components and these may be much lower than early yields from the fishery despite higher levels of effort.

In the interest of protecting the fish stock from over-fishing, and therefore protecting the fishing and fish processing jobs, it is suggested that fishery managers introduce some fishing effort regulations during this early stage in the fishery. While the appropriate level of fishing effort, based on bioeconomic relationships is unknown, introduction of effort regulations at some low level introduces and establishes fishery management regulations to fishermen and the fishery. At present no limitations exist and anyone can obtain an unrestricted licence at no cost. The danger in this is that each additional year the public has open access to the stock, the precedent of de facto right of open access becomes further entrenched.

Two restrictions are suggested to establish the right and responsibility of fishery managers to set regulations. First of all, a system of a limited number of licences should be introduced. All holders of licences in the previous season should be automatically issued licences under the new regulation. In future years, the number of new licences issued should be based on the number of active licenses in the previous season, and any new bioeconomic information which might have come to light. New licence applications should be reviewed and issued on the basis of other winter occupations of the applicant and previous licence and landings history. The objective is to limit part-time fishermen who maintain licences which can be used in a full-time manner to unexpectedly increase effort, confounding effort regulations. As stock dynamics become better understood, some rational number of licenses can be issued to ensure conservation of the stock and productivity of the fishery.

Secondly it is suggested that a gear restriction be applied to the fishery. At present, fishermen use up to two long-lines with up to about 130 hooks per line. Licenses should restrict holders from fishing in excess of that number of long-lines and hooks. As the fishery matures and CPUE declines, fishermen may wish to use additional long-lines and

hooks to maintain the high yields they have come to expect from the virgin-stock fishery. This suggested gear restriction will prevent fishermen from confounding effort regulations by fishing additional gear in order to maintain high yields. This suggested regulation also introduces an aspect of regulation to the fishery to establish the right and responsibility of fishery managers to set regulations before de *facto* open access becomes entrenched.

7.2.2 Access to Unemployment Benefits

The Pangnirtung winter turbot fishery has resulted in job and income generation in Pangnirtung which has increased access to UIC benefits. To some, including people in Pangnirtung, this is seen as a pure benefit, since eligible fishermen and fish plant workers can collect an income between fishery seasons while unemployed, and avoid the stigma associated with collecting social assistance. From a wider Canadian perspective, benefits may not exceed costs. While a societal cost benefit analysis is beyond the objectives of this study, it is useful to consider the long-term impact of increased access to UIC benefits from Pangnirtung's perspective.

Though eligible fishermen and fishery workers may see UIC benefits as earned benefits, it might also be said that UIC benefits are hidden social assistance. Workers may not seek employment or income earning opportunities between fishing seasons to further reduce their dependence on government. This is clearly seen in plant workers' mention of the fish plant/UIC cycle as being an attractive feature of fish plant work, allowing them to engage in traditional (or leisure) pursuits between fishing seasons. Without the initiative to pursue other employment between fishery seasons, fishery workers become dependent on the fishery and UIC benefits, and thus more prone to complete dependence on government if the fishery fails. This has been clearly seen in the current moratorium on the northern cod fishery in Newfoundland.

7.3 Evaluation of the Development Model

The legal ownership structure of CSFL was determined in 1988 by participants in the fishery and government officials of ED&T. It has been suggested the structure was chosen in haste and without due consideration of possible alternatives. It has also been mentioned that the community representatives involved in the decision did not have the experience to evaluate different possible legal entities for a commercial fishing business. Perhaps neither did the government officials, with little commercial fishery experience. However, considering the number of people consulted, perhaps sufficient time was not available to completely examine the alternatives and make the best choice for the community given the circumstances.

An evaluation of the development model is a useful exercise both for the Pangnirtung people involved in the decision, and for people in other eastern arctic communities. If commercially exploitable fish stocks are found close to other communities, and there is a desire to exploit these stocks, residents there could benefit greatly from the experience in Pangnirtung. Therefore the implications of the ownership structure and management of a commercial fishing business are discussed below under three general topics; local ownership and control, business legal structures, and board structure and size.

7.3.1 Local Ownership and Control

Local ownership of businesses in arctic communities imparts a sense of control and pride. It results in the community gaining a measure of control over its destiny through direct economic power. Local control of economic institutions in the community gives the community a direct say in how these organizations are run; the community can ensure that

decisions reflect the priorities of the community. In concert with knowledge of relevant factors affecting that type of organization (such as market conditions in the case of a business), it should be capable of achieving its mandate through goal-oriented planning.

CSFL did all these things. It was 100% locally owned and controlled. Legally, the board of directors had final authority on all matters. The board was being guided by different advisors whom they had no choice but to trust because of their limited experience. This led to financial difficulties in 1990 because of board inexperience and poor management. Despite recommendations to hire an experienced plant manager for the 1990 season, the board chose someone they knew and trusted but who did not have the proper qualifications, This was an expensive mistake for the company, but some of the board members learned a great deal from it.

In 1991, following the initial investment in CSFL by the NWTDC, the CSFL board retained control of the company and were provided with good advice from an experienced manager. " With that advice the board could make informed decisions on the management of the company. Some would say the depth of reasoning leading to decisions was beyond the capabilities of the board and therefore they were simply ratifying the decision of the manager. That is not an entirely fair statement, since board members varied in their degree of education, experience and interest in the management of the company, and therefore in their ability to understand the steps leading to a business decision. Clearly there were board members who could follow the arguments presented to them. While they may not have reached the same decision without the guidance of the manager, the process of informed decision making through expert advice is a critical component in the process of economic development. Through working with a trusted and appropriately-experienced advisor, and learning the process of business management, over time one gains these skills oneself.

Some ownership of the company was given up in 1991, when the NWTDC was issued preferred shares. However, as the CSFL board was aware, it retained decision making control. Further, the mandate of the NWTDC was clearly to divest itself of shares in companies in which it invested, once they became profitable and no longer needed the NWTDC's involvement. CSFL'S board was aware of this, and saw the NWTDC ownership as a temporary situation. Though it was never tested, it is possible that the CSFL manager, through the NWTDC, to whom he also had a reporting relationship, could have overruled board decisions which might jeopardize the business's best interests and the NWTDC's investment.

In the autumn of 1992, with a second investment in the Pangnirtung winter turbot fishery by the NWTDC, incorporated as Pangnirtung Fisheries Limited (PFL), majority ownership and control was removed from the community and was taken by the NWTDC. As with the previous NWTDC investment in CSFL, the community can buy back'the NWTDC shares in PFL once it is profitable. Directors of both CSFL and P&L Services Ltd. believe this will happen in about five years. While a board for PFL is to be established, at the start up of the 1993 turbot fishing season only one of the three community directors had been appointed. The PFL board had not yet met and there were no plans for a board meeting in the near future, This was in sharp contrast to previous years when there was a considerable amount of CSFL board activity as the fishery started and operated because the board was required to meet and make decisions on a regular basis. A weakness in the PFL structure and board is that if the lack of community involvement in management seen at the beginning of the 1993 season is any indication of the longer term PFL board activity, then board meetings could become infrequent and feigned, with the community having no real input. A forum for business education through practical board experience, of which the CSFL board was a successful example, will have been lost. It may well be lost until the NWTDC divests itself of interest in PFL. When that divestment occurs, will a local board be capable of assuming

management where the NWTDC management left off? Unfortunately, during the expected five years of NWTDC involvement, many years of practical directorship experience will have been lost.

Some would say that people in Pangnirtung simply want jobs and the resulting income. They do not care about the ownership of the organization, and do not necessarily want the responsibility of decision making. In the case of the turbot fishery, they are happy to let the NWTDC take effective control and majority ownership, because in exchange for control and ownership, a new fish plant will be constructed in Pangnirtung. A new plant would be capable of moving greater volumes of turbot and would allow PFL to diversify into other fisheries, resulting in more income to fishermen and plant workers. However, it would also mean that if and when the political climate changes such that support for the fishery or the NWTDC fades, the community may lose a lot. Rather than their only recourse being to blame government for the loss because they gave up control of the company in 1992, a skilled board with several years of experience in business management, and continuing to receive advice from an experienced manager, could recognize the change in times and make the necessary adjustments expected of an experienced board of directors. The business would then have better prospects of survival. The point of retaining or losing control and its relation to government dependence versus independence, is recognized by only a very few people, yet is such an important component of economic development.

7.3.2 Appropriateness of Business Structures

The business entity presented to and accepted by the community in 1988 to assume responsibility for the commercial aspect of the turbot fishery was a private limited company. As mentioned above, the community was not familiar with the advantages and disadvantages of various business structures, despite the existence in Pangnirtung of a

co-operative, several proprietorships and private limited companies, and a large corporation (the Hudson's Bay Company). Unfortunately, there was a lack of time to consider the pros and cons of these alternatives. Apparently the community accepted the suggestion of ED&T officials and CSFL was incorporated.

In retrospect, the explicit goal of a limited company to achieve profits, coupled with the 1989 profit of CSFL, set high expectations for the fishery to be a consistent profit generator. This is a troubling expectation given the reality of fishery dynamics as outlined in section 7.2.1. Fishery managers and business people should be very aware of the bioeconomics of exploited fish stocks and take appropriate actions to ensure that stocks are fished at sustainable and productive levels. In the case of a newly exploited stock, fishing effort and harvest should be conservative, at least until the specific dynamics of the stock are fully understood and incorporated into the fishery's management.

Reality would also indicate that on average, fish processing businesses are marginally profitable at best, even with government subsidies. At least part of the reason for this is the tendency to over-fish stocks. Goals of the Pangnirtung fishery have always been the creation of jobs, income and training opportunities. These are at least as important as generating a profit, yet they tend not to be reflected in the mandate of limited companies.

An alternative legal structure which better meets the criteria above, is a workers' or producers' co-operative. Many northern community co-operatives began as producers' co-ops to purchase carvings from the local carvers. Most later diversified into consumer co-operatives to supply their membership with store-bought goods. However, co-operatives have not always been successful in the north. There have been differences in priorities between the co-op movement in the eastern arctic and ED&T, which have made it difficult for the two organizations to work together. This may have led to the discounting of a

co-operative as a possible legal structure for the commercialization of the Pangnirtung winter turbot fishery.

A producer's co-operative may have retained the strengths of CSFL, but better addressed the issue of profit expectations and other commercial fishery objectives. The mandate could have been built on jobs, income, and training as well as profits. Fishermen and employees of the processing plant and its administration could have been required to purchase a co-op membership in order to work for the company or to land fish at the plant. The strength seen on the CSFL board by better educated members of the community not employed in fishing or processing, could still have been brought to a co-operative board through appointment for specific business and management skills. As a co-operative, without the overriding profit goal, perhaps fishermen and employees would be more willing to adjust their wages and income to the profitability of the business. At present the community expects the fishing company or government to subsidize the operation to maintain the jobs , and income.

Two other alternative models for the development of the fishery are worthy of brief mention. One of these is joint ventures, a good example of which is the offshore shrimp fishery in Davis Strait and the Labrador Sea. Regional Inuit birthright Corporations (Makivik Corporation in Northern Quebec and Qikiqtaaluk Corporation on Baffin Island) have gained access to shrimp licences through DFO'S policy of allocations based on adjacency to the resource. These corporations joint-venture with vessel owners to fish the allocations. This model is dependent on profitability so it would be difficult to attract joint venture partners without good possibilities of profit to balance the risk. Though they were unable to make arrangements in 1992, CSFL intends to joint-venture with a vessel owner to fish groundfish allocations from the 1993 Developmental Groundfish Program in NAFO division O.

Another possible model was considered by the CSFL board in 1991 before they decided to seek investment from the NWTDC. Two fish buyers, located in Ottawa and Montreal, were said to be prepared to provide the necessary cash to CSFL rather than have CSFL issue shares to the NWTDC. The involvement of one of these southern buyers could have taken the form of a majority share issue or an investment or loan contingent on the southern business getting a contract to manage the Pangnirtung operation. In both cases, the investor would probably have gained exclusive access to the product. CSFL would have lost control and perhaps majority ownership and some jobs if the investor chose to ship more whole product for processing in the south. CSFL'S board declined these offers in favour of the NWTDC offer, specifically because it knew that when the company was again profitable it could buy out the NWTDC's shares in CSFL. CSFL'S board was also aware of the NWTDC's commitment to the maintenance of jobs in the NWT.

7.3.3 Board Structure and Size

Several people who have sat on the board of CSFL readily mention that the board was too large. This made decision making difficult for two reasons. Some directors appointed by the Pangnirtung Hunters and Trappers Association (HTA) and the Pangnirtung Eskimo Co-operative Limited to represent their shares in CSFL were unable to contribute to the board because they lacked the skills to fully comprehend some issues and therefore to contribute to the meetings, While the HTA was issued shares in CSFL in part to recognize its role in the development of the fishery, their board had little to offer to a business entity. Other better-educated and business-experienced board members felt they themselves could adequately represent the interests of the HTA.

The Co-op was also issued shares in recognition of their support of fishery projects during the development phase. Additionally, because they operated a business, it was thought

they would to be able to contribute some business experience and services to the fishing company. If CSFL had been a small company, rather than immediately becoming such a large company by Pangnirtung standards, the co-op may have provided book keeping or supply ordering services. However, CSFL quickly became very large and took on these tasks themselves. In retrospect, the co-op has contributed little to the CSFL board. Some would say both the HTA and the co-op boards do not know their own mandates and goals; so how can they possibly appoint representatives to the CSFL board to bring their own memberships' interest and concerns to the CSFL board.

Boards in the eastern arctic tend to be larger than necessary and this ultimately slows and perhaps distorts decision making. Large size alone hinders consensus, and is exacerbated by representatives with unclear and inconsistent agendas. When organizations are being formed and boards being structured, more emphasis needs to be placed on the mandate of the organization and minimum representation of valid interests to achieve the mandate. Representation on boards and board size should be determined to reflect the mandate and not be based on an arbitrary number of seats,

Boards in the eastern arctic also tend not to take advantage of available expertise in certain areas or on specific issues. Term appointments as full or ex officio members, specifically to gain from available expertise, needs to be more seriously considered by boards. Concern may be expressed that such expertise does not reflect the community's aspirations or priorities. However, given a proper and clear orientation to the organization's mandate and goals and a clear role and position with the board, the appointment of such expertise should benefit local boards.

7.4. Conclusions

The Pangnirtung winter turbot fishery developed very quickly. This can be attributed to several factors including facilities for processing, favorable transportation links to markets, the presence of the necessary skills among participant's and their desire for work involving renewable resource harvesting. Perhaps the development occurred too quickly and led to problems that might otherwise have been avoided. This was best exemplified in 1990 when the lack of management skills resulted in near bankruptcy of CSFL.

The benefits created by the Pangnirtung turbot fishery are readily apparent in the large number of desirable jobs created and the income generated from both fishing and processing. The cost and earning study identified relatively low net returns to fishermen which questions the large number of fishermen and the rapid growth in their numbers since 1989. Two factors explain this anomaly. First of all, fishermen enjoy turbot fishing and are willing to fish for relatively low returns, especially when many of them would otherwise be unoccupied. Secondly, it appears that some earnings from the fishery are invested in snowmobiles. In addition to being essential equipment for turbot fishing, snowmobiles are essential equipment for winter and spring hunting. Since hunting remains a popular and important activity of Inuit men in Pangnirtung, the turbot fishery provides cash to defray some of the costs of snowmobiles.

It appears that the fishery does not have a negative impact on the traditional economy of harvesting country foods, though some changes in hunting patterns are apparent. Because many fishermen are also competent and consistent hunters, some of their fishing income is invested in hunting equipment. If the fishery causes a reduction in traditional activity during fishery months, it is an acceptable reduction because of the need to earn cash. This reduction may be ameliorated by increased hunting activity before and after the fishing

season. Similarly, plant workers accept a reduction in attention to their household duties during the fishing season, because the need to earn an income precedes household duties in importance.

The Pangnirtung turbot fishery clearly reduces social assistance payments in Pangnirtung during fishery months. It is also acknowledged that the crime rate decreases during fishery months, and this is attributed to the creation of fishing jobs.

Two potential future problems are identified. The first of these is the effect of fishing on the turbot stock. In the absence of fishery management which adequately regulates fishing effort, fish stocks tend to become over-fished and unable to support the historic levels of catch per unit of effort characteristic of a virgin fish stock. This is a result of the dynamics of populations and of fishermen behaviour. These must be understood and fishing behaviour regulated to maintain the productivity of the fishery. The second potential problem caused by the Pangnirtung winter turbot fishery is the access to UIC benefits it has created. This introduces a false sense of security since UIC benefits are considered to be earned benefits, rather than a form of social assistance. Dependence on government remains or may increase through access to a new source of government assistance.

Several lessons have been learned in the process of business development associated with the fishery. Local ownership and control are important components of economic development in the community. Local ownership imparts pride. Local control ensures that community priorities are reflected in development plans. Local control also provides the opportunity for business education.

Development of the turbot fishery in Pangnirtung was guided by a mandate to create jobs, income and training opportunities, as well as to generate profits. The limited company

formed to privatize the commercial aspect of the fishery did not adequately reflect this mandate, and consequently it may have contributed to financial difficulties. A workers' or producers' co-operative would have better reflected this multifaceted mandate and should be seriously considered in any future commercial fishery developments.

There is also a lesson to be learned regarding board size and structure. Generally the smaller the board, the easier to organize meetings and reach decisions. Boards should therefore only be as large as necessary to adequately represent members or shareholders. Boards in some Inuit communities tend not to utilize specific available expertise. More serious consideration must be made to appoint and take advantage of available expertise in areas where board skills are weak or lacking, or superior skills are available.

Many of the criteria critical to community economic development were in place in the operation of CSFL and have been identified. Weaknesses have also been identified. Generally, the Pangnirtung winter turbot fishery presents a good example and case study for the examination of renewable resource based economic development in aboriginal communities.

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ECONOMIC IMPACT OF COMMERCIAL FISHERIES DEVELOPMENT IN CANADA'S EASTERN ARCTIC: THE PANGNIRTUNG WINTER TURBOT FISHERY

by

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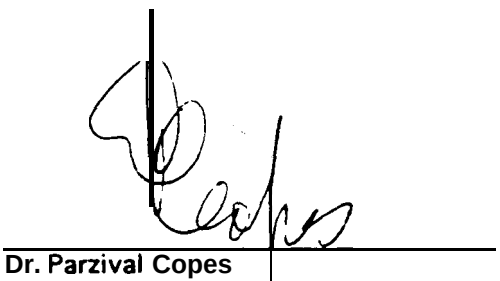

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Abstract

Since 1986, a commercial winter fishery for turbot (*Reinhardtius hippoglossoides*) has developed in the Inuit community of Pangnirtung, Northwest Territories, Canada. This fishery presents an example of commercial renewable resource development in an Inuit community which has generated jobs and income in the community.

The study attempts to determine direct benefits of the fishery. A cost and earning study of fishermen is also conducted. Opportunity costs of fishermen and plant workers are examined to determine what effect the fishery has on traditional pursuits of participants. Other socio-economic effects of the fishery are also considered. The commercial fishery development model is examined to evaluate its applicability to future commercial fishery development in Inuit communities.

Data were collected by examination of government and commercial fishing company records, and through interviews with fishermen, plant workers, fishing company managers and directors, and other people involved in the fishery's development.

The study documents the substantial number of fishing jobs and resulting income for residents of Pangnirtung. While the fishery income of processing plant workers and the gross income of fishermen has become large relative to the community personal income, this is overstated since costs of fishing are not considered. The cost and earning study identifies relatively high costs of fishing and hence a low net income from fishing, which questions the high participation in the fishery. The fishery does not appear to have a negative effect on traditional pursuits of participants. In fact, evidence suggests the fishery may support the traditional economy of subsistence hunting and fishing through provision of cash to hunters and through cost-sharing of snowmobiles.

A warning is issued to fishery participants and managers to be aware of turbot stock reductions and over-fishing caused by the fishery. Regulations to limit entry into the fishery and to place a restriction on gear are recommended to introduce controls to fishing effort.

Lessons learned during the development process are reviewed. Local ownership and control of the commercial fishing company is identified as a critical component in community economic development. A co-operative type of business might have served the mandate of the community better, rather than the private limited companies which have been established. Board size was considered to be too large as it included unnecessary representatives.

Dedication

This work is dedicated to the late Dr. Lawrence W. Copithorne, who died tragically on February 12, 1986. Dedicated teachers are long remembered.

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Disclaimer

During the research and writing of this project, the author was employed by the Department of Economic Development and Tourism of the Government of the Northwest Territories as the Economic Development Officer for Pangnirtung. All statements and conclusions expressed in this document are solely those of the author. Readers should be advised that these statements and conclusions may not reflect the position of the Department of Economic Development and Tourism or the Northwest Territories Development Corporation.

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ACRONYMS USED

CFCL	Canadian Fishery Consultants Limited
CPUE	catch per unit of effort
CSFL	Cumbedand Sound Fisheries Limited
DFO	Department of Fisheries and Oceans, Government of Canada
ED&T	Department of Economic Development and Tourism, Government of the Northwest Territories
GNWT	Government of the Northwest Territories
H&G	head off and gutted
HTA	Pangnirtung Hunters and Trappers Association
NAFO	Northwest Atlantic Fisheries Organization
NWT	Northwest Territories
NWTDC	Northwest Territories Development Corporation
MSY	maximum sustainable yield
P&L	P & L Services Limited
PFL	Pangnirtung Fisheries Limited
RCMP	Royal Canadian Mounted Police
SCONE	Special Committee on the Northern Economy
TAC	total allowable catch
UIC	Unemployment Insurance Commission

1.0 INTRODUCTION

Beginning in the 1970s with the Mackenzie Valley Pipeline Inquiry (Berger 1977), and continuing into the 1990s with several native land claim settlements (Anon. 1984, Anon. 1990) and other newsworthy events, aboriginal peoples' issues have become important in Canadian politics. One of the important issues of aboriginal peoples is that of economic self-sufficiency.

In small aboriginal communities where unemployment is high, it is recognized that economic development based on (biological) renewable resource industries offers promise for successful development (Simpson 1986, SCONE 1989, ED&T 1990). Such industries and their base of renewable resource harvesting are compatible with the lifestyles, aspirations, skill and education levels in smaller aboriginal communities.

Since 1986, a unique commercial fishery has developed in the Inuit community of Pangnirtung, Northwest Territories. During winter and spring, fishermen harvest turbot (*Reinhardtius hippoglossoides*) in deep water using long-lines fished from a platform of land-fast sea ice. The turbot is processed in Pangnirtung and the still-fresh product is shipped by air to markets in Canada and the United States. The fishery has created many jobs and considerable income which accrues almost entirely to Inuit residents of Pangnirtung.

The Pangnirtung winter turbot fishery presents a good example of the commercial development of renewable resources leading toward economic self-sufficiency of aboriginal people. This study describes the development of the fishery and examines the benefits and costs of the fishery to the community. The study also identifies some potential problems in the fishery's future, and discusses some of the lessons that have been learned from commercial fishery development in Pangnirtung.

In order to introduce the specific objectives of the study, the remainder of the introduction briefly describes Pangnirtung and its history, and some aspects of the economy in Inuit communities and of the Pangnirtung winter turbot fishery.

1.1 Pangnirtung and its History

Pangnirtung is a community of 1,135 people (NWT Bureau of Statistics 1992a) located on the east coast of Baffin Island in Canada's Northwest Territories. Its population consists predominantly of Inuit, many of whom, only 30 years ago, were living in traditional camps along the shores of Cumberland Sound.

Pangnirtung is located 40 kilometers south of the arctic circle. It is subject to harsh and prolonged winters and some months with days characterized by only a few hours of daylight. Winter temperatures drop to about minus 45°C. Arctic wind storms are common and can be destructive. Conversely, summers, though not warm by most Canadian standards, are characterized by about two months of 24-hour daylight. Summer temperatures rise to about 15oC and occasionally higher.

The history of Pangnirtung is perhaps more interesting than that of many other arctic communities. The word Pangnirtung (pronounced as it appears) is an English derivation of the Inuktitut (the Inuit language) word *Panniqtuuq*, meaning "the place of many bull caribou" (Hamilton 1993). The settlement originated in 1921 when the Hudson's Bay Company chose the site for their trading post in the Cumberland Sound area (Usher 1971; Duffy 1988). This occurred as the eastern Canadian arctic and Greenland commercial bowhead whale fishery was in the final stages of decline. Since the 1860s, Scottish and American whalers had over-wintered at Kekerten and Blacklead, two permanent shore

stations in Cumberland Sound, to get an early spring start to the whaling. The contact with the whalers became a significant force of change for Cumberland Sound and its people. The Inuit were actively involved in the commercial bowhead fishery; exchanging their labour in the fishery for manufactured goods supplied by the whaling stations. In 1894, the Anglican missionary, E.J. Peck, followed the whalers into Cumberland Sound. He introduced the syllabic writing system to the Inuit of Baffin Island. This Inuktitut writing system remains in common use throughout the eastern NWT and northern Quebec. It is also noteworthy that Franz Boaz spent 1883-84 at Blacklead. The Central Eskimo (Boaz 1964), resulted in part from this year of study in Cumberland Sound.

Following the closing of the Cumberland Sound whaling stations, and the establishment of the Hudson's Bay Company post at Pangnirtung, the RCMP set up a post in Pangnirtung in 1923, and the Anglican mission moved from Blacklead to Pangnirtung about 1925 (Stevenson & Associates 1990). An Anglican mission hospital was built in 1930 (Stevenson & Associates 1990) which served the entire eastern arctic until the establishment of Frobisher Bay (now Iqaluit) during the Second World War (Duffy 1988).

In the 1960s, two factors influenced the move of many Cumberland Sound Inuit into permanent residence in Pangnirtung. The first of these was' a distemper epidemic which killed many of the dogs which the Inuit used for winter and spring transportation. Unable to travel to hunting and fishing areas to provide food for themselves, they had little choice but to relocate to settlements where social assistance could be provided. Added to this was the desire of the federal government to move Inuit into settlements where the government could better attend to their educational, medical and social needs.

This relocation policy assumed that Inuit would adapt to living in settlements, abandon their nomadic ways and traditional ties to the land, and seek jobs. However, many traditional

ties to the land were not abandoned, perhaps because seal skin markets were strong and few Inuit had the skills and education required to take the jobs that were available in the settlements. Despite a generation of living in communities complete with many modern conveniences common in rural communities in southern Canada, Inuit retain strong ties to their traditional culture and land-based subsistence economy.

1,2 The Pangnirtung Economy and Fishery Development

The economy in most Inuit communities in Canada is described in Quigley & McBride (1 987) and Wenzel (1 991). It consists of two economies; the traditional (subsistence hunting and fishing) and the modern (wage employment). Wenzel (1 991) describes the economy in Inuit communities prior to the early 1980s when the sale of seal skins provided cash to hunters. These skins were derived from ringed seals, a staple in the eastern arctic Inuit diet, and from seasonally abundant harp seals. In effect, hunters earned cash for a by-product while they hunted a desired food. This cash income provided, among other things, the means to purchase and maintain hunting equipment and to purchase hunting supplies. However, the anti-sealing campaign broke the seal skin trade in the early 1980s and an important source of cash for Inuit disappeared. The result was a loss of self-esteem and much self-sufficiency on the part of eastern arctic Inuit, and a dramatic increase in social assistance payments in their communities.

Several studies (Usher 1976, Myers 1982, Quigley & McBride 1987, Smith & Wright 1989) point out the importance of country foods in Inuit communities. Country foods are traditional foods such as caribou, seal and char, usually distributed within the community through traditional means such as sharing. Imputed values of country foods are high, relative to the cost of imported food and with respect to the nutritional value of country foods. Therefore, the loss or lack of opportunities for hunters to earn cash to purchase and

maintain hunting equipment and to purchase supplies suggests the supply of country foods will decrease (Myers 1982, Quigley & McBride 1987). Over time, traditional skills may decrease, further eroding the supply of country foods.

These arguments challenge governments to create and support income opportunities in traditional aboriginal communities which support the traditional economy. Policies must be consistent with the aspirations and lifestyles of these communities, in order to retain traditions and to successfully utilize existing skills and education levels in these communities. Policies must also result in increased self-sufficiency through support of both income earning opportunities and subsistence hunting and fishing activities.

The Pangnirtung turbot fishery may support the traditional economy by providing cash to hunters. It may also create opportunities for younger men to learn traditional land skills while they are earning cash. Alternatively, the fishery may discourage subsistence activity since turbot are not a product of traditional hunting and are apparently sought primarily for cash. Therefore, one objective of this study is to examine opportunity costs associated with participating in the fishery; especially the effects of the fishery on country food harvesting, The study also examines the opportunity costs of fishery plant workers, with respect to the traditional activities of Inuit women.

The Pangnirtung winter turbot fishery has developed very rapidly since 1986. This fishery has been attractive to Inuit and does not require expensive or unfamiliar equipment nor the acquisition of many new skills. For the most part, this fishery is accessible to the average male resident of Pangnirtung through his ownership of a snowmobile and *qamutiik* (Inuit sled), and his arctic outdoor skills. Though the fishery has attracted many individuals, and apparently generates cash for its participants, the net monetary benefits of the fishery are unknown. Gross revenue of fishermen is commonly used as a measure of the economic

impact of the fishery and the benefits to fishermen, But there is a lack of information on fishermen's expenses owing to the unique harvesting technology and the lack of record keeping by fishermen. To a certain extent, fishermen are aware of these costs but because many of them have little if any formal education, and all come from a culture with oral rather than written traditions, record keeping is uncommon and the actual costs and net income of turbot fishing unknown. In order to better assess the impact of the fishery on its participants and the local economy, it is a second objective of this study to quantify the cost of turbot fishing to derive the net average income of turbot fishermen.

In addition to statistics of income generated by the fishery, other statistics have been used to identify the fishery's impact on the community. Therefore, a third objective of the study is to examine social assistance payments in Pangnirtung to determine if any changes have resulted which can be attributed to the turbot fishery.

The apparent success of the Pangnirtung turbot fishery has resulted in suggestions that commercial fishing provides an appropriate model of economic development for smaller communities in the Northwest Territories. Notwithstanding the presence of commercial fish stocks, markets for products and factors such as transportation links, success of this development model requires establishing and maintaining local control such that benefits, both monetary and otherwise, accrue to the community. To achieve effective local control and management, information and education on conditions relating to the fishery are needed by local decision makers. Therefore, a final objective of the study is to identify and discuss the positive and negative lessons learned during the development of the fishery. This will allow the development model to be assessed for appropriateness and desirability in other eastern arctic communities.

2.0 THE ECONOMY OF PANGNIRTUNG

This section describes the demographics and economy of Pangnirtung in order to establish the context within which the Pangnirtung winter turbot fishery has developed.

Pangnirtung is one of 29 communities in a region to become known as Nunavut (the eastern or Inuit part of the Northwest Territories). With a 1991 population of 1,135, it is one of seven Nunavut communities with populations over 1,000 (NWT Bureau of Statistics 1992a). Since 1986, Pangnirtung's population has grown by 13.0% for an annual average of 2.6%. For the same period this compares to an annual average growth rate of 2.1% for the Northwest Territories, and 1.6% for Canada (NWT Bureau of Statistics 1992a).

In 1991, Inuit made up 94.5% of Pangnirtung's population for which 41 .5% of the population was under 15 years of age and 62.6% under 25 years of age (NWT Bureau of Statistics 1992b).

Education levels are low in the eastern arctic. For the 58.8% of the Pangnirtung population 15 years of age and over in 1986, 61 .9% had less than a grade nine education (NWT Bureau of Statistics 1991). Only 11.0% of this group over 15 years of age had at least some post-secondary education (NWT Bureau of Statistics 1991), and many of these are transient government workers such as teachers, nurses and administrators.

In 1989, labour force participation in Pangnirtung was 63.4% and the unemployment rate was 32.1 % (NWT Bureau of Statistics 1989). Revenue Canada repotted 510 personal tax returns from Pangnirtung in 1990 totalling $9.2 million in personal income for an average income per return of $18,043 (NWT Bureau of Statistics 1992b). Based on the 1990

Table 1. Sources of income, Pangnirtung, 1982.

Wages		
Civil Service	$2,214,547	51.1%
Publicly funded agencies	83,795	1 .9%
Retail	379,007	8.7%
Construction	170,000	3.9%
Tourism	99,197	2.3%
Mining	93,754	2.2%
Other	5,000	0.1%
Arts and Crafts Production (estimate)	270,000	6.2%
Social Assistance	298,131	6.9%
Other Transfer Payments	472,819	10.9%
Renewable Resource Harvesting		
Fish Sales (estimate)	17,040	0.4%
Fur Sales (estimate)	158,950	3.7%
Ivory Sales (estimate)	71,828	1.7%
Total	$4,334,068	100.0%
Imputed value of country foods (1 981)	$3,151,979	

Adapted from Worrall (1 984).

Table 2. Sources of income, Pond Inlet, 1987.

Wages (except tourism related)	$4,200,454	80.4%
Tourism wages (estimate)	25,000	0.5%
Directors fees and stipends	41,535	0.8%
Carving	52,293	1.0%
Social Assistance	300,261	5.7%
Other Transfer Payments	583,387	11.2%
Fur Sales (estimate)	21.745	0.4%
Total Income	$5,224,675	100.0%

Adapted from Huestis (1989).

population estimate of 1,115 (NWT Bureau of Statistics 1992c), the average per capita income for Pangnirtung in 1990 was $8,253.

Income is derived to a large extent from the public sector. Table 1, adapted from Worrall (1 984), shows about 70% of income to be derived from employment with ail levels of government and government transfer payments. Results of a more recent study in Pond Inlet (Huestis 1989) are shown in table 2. Pond Inlet is another Baffin Island community slightly smaller than Pangnirtung, but with many similar characteristics. According to Huestis (1 989), 98.1% of income in Pond Inlet is derived from tax dollars. Only 1.9% is considered as "new wealth"; consisting of carving income, net tourism income and fur sales. Generally "new wealth" is described as income derived from non-public sources outside the Northwest Territories. It is used as a general measure of the strength of the community economy or its self-sufficiency. To use a similar analysis on Worrall's (1 984) income data for Pangnirtung in 1982, new wealth is calculated at 16.4%. This is certainly much more significant than Pond Inlet's 1.9%, however it should be noted that 1982 was the last year of significant fur (primarily seal skin) sales in the eastern arctic (Worrall 1984). The anti-sealing campaign had destroyed seal skin markets by 1983 (Wenzel 1991) and seal skin sales have never recovered.

The cost of living is very high in Nunavut. The federal government's isolated post, living cost differential for Pangnirtung in 1990 was 160-165 using a base of 100 for Montreal (NWT Bureau of Statistics 1992b). Pangnirtung's food price index in 1991 was 168 using a base of 100 in Yellowknife. The Yellowknife food price index in 1991 was 127 relative to a Montreal base of 100 (NWT Bureau of Statistics 1992b).

As in most communities in Nunavut, the major employer in Pangnirtung is the local government or hamlet, responsible for municipal services and often other services provided

under contract for some territorial and federal government departments. The territorial government is also a major employer in Pangnirtung, as it is in most Nunavut communities, where it is responsible for education, health, social services, economic development and other public services. In Pangnirtung, the federal government also employs several people at the Eastern Arctic District Parks Office, the main office for Auyuittuq and Ellesmere Island National Park Reserves. The main access point of Auyuittuq National Park Reserve is only 30 kilometers from Pangnirtung.

There are also several private sector employers of note in Pangnirtung; three general stores, a hotel, an artists' association operating two art studios and two commercial fishing companies.

As discussed above and outlined in tables 1 and 2, Pangnirtung appears to have a stronger economy than Pond Inlet based on the concept of new wealth as well as other factors. This can be attributed to the fine art studios, a stronger tourism industry than that of Pond Inlet's, and the commercial fishery.

In the late 1960s the federal government established a weave shop in Pangnirtung where Inuit women were trained to produce woven tapestries from images by local Inuit artists. The facility was transferred to the GNWT in 1969. Through support from government in the early 1970s, the Pangnirtung Eskimo Co-operative Ltd. opened a print shop where limited edition prints were produced. Both of these facilities operated throughout most or all of the 1970s and 1980s and have provided numerous jobs. In 1991, both facilities were transferred to a local artists' association which now operates both studios on behalf of the artists. These studios and the art created within them, have given a prominent place within Inuit art circles to a community not particularly well known for soapstone carvings, the much more common arctic art form.

Pangnirtung became known as a tourist destination in the 1960s and 1970s, owing to the fine arctic char sport fishing in the area and the establishment in 1972 of Auyuittuq National Park Reserve (then Baffin Island NPR). This reputation was augmented in the early 1980s when Pangnirtung was chosen by the GNWT and the Baffin Regional Council (of municipalities) for a pilot project on community-based tourism development. Two results of this initiative were the first visitor information and interpretive centre in the NWT, and the first territorial historic park. This development and the earlier tourism attraction of the national park reserve and char fishing camps have resulted in employment and income opportunities for the community which continue today.

There is a well established informal economy in arctic communities. Part of this is the cash sale of goods and services directly between producer and consumer. Much of this involves goods such as arts and crafts and country foods. The amount of this informal type of economic activity is difficult to estimate. Both Worrall (1 984) and Huestis (1 989) attempt to include it in their analyses, however none of this informal economic activity appears in income statistics from Revenue Canada.

Better documented is the activity and output of subsistence hunting and fishing (for country foods) which has been studied by Usher (1976), Myers (1 982), Quigley & McBride (1987) and Smith & Wright (1 989). Quigley & McBride (1987) analyzed the economy of Sanikiluaq, an Inuit community of 526 on the Belcher Islands in southern Hudson's Bay. For 1984 they calculated that the imputed value of country foods harvested by Sanikiluaq residents totaled $2.92 million and that total personal cash income in Sanikiluaq was $2.20 million. Worrall (1 984) estimated the imputed value of country foods in Pangnirtung in 1981 at $3.15 million. While Sanikiluaq is a community generally considered to be

traditional whereas Pangnirtung is not, the value of country food compared to cash income in both communities is significant.

Many studies (Myers 1982, Quigley & McBride 1987, Smith & Wright 1989, Stabler 1989, Wenzel 1991) have discussed the dual or mixed economy in northern Canadian communities consisting of traditional (harvesting of country foods) and modern (wage employment) sectors. The conventional wisdom regarding the dynamics of this mixed economy is that participation in the traditional sector is supported by cash transfers from the modern sector. These transfers provide cash to hunters who have limited access to cash resources for the purchase of hunting equipment and supplies and for equipment maintenance. Myers (1 982), Quigley & McBride (1 987), and Smith & Wright 1989, conclude that production from the traditional sector which provides significant amounts of food, is constrained by the availability of cash to hunters. They suggest government policies to support the subsistence economy.

The Pangnirtung economy can be summarized as being relatively well diversified compared to many eastern arctic communities. It has notable arts' and crafts, tourism and commercial fishing industries that account for many jobs in the community. However, the economy remains heavily dependent on government jobs and transfer payments. As in less developed communities in the eastern arctic, the traditional economy is visible and remains important for its production of country food.

3.0 DEVELOPMENT OF THE FISHERY

This section describes the development of the Pangnirtung winter turbot fishery from the first developmental efforts in 1986 through to the 1992 commercial fishery season. The description is important when discussing and evaluating the appropriateness to other communities of the fishery development model followed in Pangnirtung. The description is also useful in providing background for discussion of the lessons learned through fishery development.

In the mid 1980s the GNWT re-assessed its economic development priorities, One of the resulting changes was an emphasis on the renewable resource sector of the economy. Not only was this sector recognized as less susceptible to economic cycles, relative to sectors such as mining, and arts and crafts, but more compatible with the lifestyles and aspirations of aboriginal communities (Simpson 1986). These shifting priorities occurred at a time of increased awareness of marine resources in the Baffin region of the NWT, which may have resulted from the declining seal skin industry and a search for new opportunities to replace it. Because of geographical proximity and cultural similarities, Greenland's commercial fisheries were noteworthy as an example of successful development.

The first efforts to examine the potential of commercial fishing in the Baffin region was in Cumberland Sound in the summer of 1985 as described in MacKay (1986a). The objectives of the project were to determine the commercial fishery potential of Cumberland Sound using regional skills and resources, and to introduce methods and equipment used in commercial fisheries to Pangnirtung residents (MacKay 1986a). Achieving these objectives involved retrofitting an existing 46 foot Pangnirtung vessel for exploratory fishing, trial fishing for a few targeted species (including turbot) and on-board training. Three Pangnirtung residents and two government personnel also travelled to New Brunswick after

the trial fishing was complete. Fora week, they observed harvesting and processing in some New Brunswick fisheries, and toured several fishery facilities involved in gear manufacture, aquiculture and biological research.

3.1 The 1986 Fishing Projects

Turbot remains had been found by hunters in Cumbedand Sound near seal breathing holes in the sea ice and in seal stomachs. This suggested that turbot were present in Cumberland Sound. Therefore in March 1986, two Greenland fishermen were brought to Pangnirtung to demonstrate long-lining for turbot from the winter sea ice (ED&T 1987). This type of fishing had been done in Greenland for several years. The demonstration by the Greenlanders verified the presence, if not abundance of turbot in Cumberland Sound during winter months and verified that under-ice long-lining was a practical method of fishing in Cumberland Sound. The only detailed written record of this project appears to be reconstructed catch data of several line sets of two fishermen and a rough estimate of daily income for a two-fishermen team based on this reconstructed catch data. This record appears in a report of the summer 1986 fishing project (MacKay 1986b).

The objectives of the 1986 summer fishery project in Cumberland Sound did not change from the summer 1985 project objectives mentioned above. The efforts proved successful with the discovery of several beds of Icelandic scallops (*Chlamys islandicus*) very close to Pangnirtung. The report recommended privatization of this summer scallop fishery for the 1987 season (MacKay 1986b). Other species were encountered but not in commercially viable concentrations. Turbot catches from five long-line sets during the summer project produced poor results. MacKay (1986b) recommended that future development efforts be aimed at the winter turbot fishery and the summer scallop fishery.

3.2 The 1987 Winter Turbot Project

The positive results of winter exploratory fishing in 1986 led to further effort in 1987 as described in MacKay (1 987). Unlike the 1986 project which concentrated simply on determining the presence and availability of the stock, the 1987 season effort was more comprehensive with the aim of investigating commercial possibilities of a winter turbot fishery. A fisheries development consultant was hired to oversee the project.

3.2.1 Harvesting

As in 1986, Pangnirtung residents were introduced to the harvesting technology; this time by the students of the previous year who had picked up the technique quickly from the Greenlanders. At such an early stage in the development, all fishermen were paid by their time rather than by their landings. By the end of the project a total of fifteen fishermen had learned the ice platform long-lining technique. Twelve of them indicated they had a strong interest in continuing to fish turbot commercially (MacKay 1987).

Another aspect of harvesting which was addressed in 1987 was further exploration to locate other turbot fishing grounds in Cumberland Sound. In 1986 only one area was tested and it proved to be productive. During the 1987 project, effort was directed at three areas in Cumbedand Sound, including the area fished in 1986. Within these three areas were seven fishing stations, all of which were within 60 kilometers of Pangnirtung. Though"about 90% of the effort was targeted at the two stations closest to Pangnirtung, all seven stations recorded turbot catches (MacKay 1987), suggesting turbot were distributed throughout this area of Cumberland Sound.

When abrasion from Greenland sharks and rough bottom conditions caused large losses to Greenlandic ground lines, ground lines used in Atlantic Canada were substituted. These we're introduced to Cumberland Sound during the summer exploratory fishing in 1985 and 1986. Several types of hooks were tested, as were bait types and other terminal tackle. MacKay (1987) outlines these and the results which refined these simple but effective fishing technologies.

The 1987 fishery also introduced the use of insulated containers common in the seafood industry (MacKay 1986b, ED&T 1987). Stored inside these seawater-filled containers for up to a few days, the "reverse super-chill" resulted in the turbot arriving unfrozen at the processing plant and therefore retaining greater value and more options for processing. The sea-water also cushioned the turbot during transportation over rough sea ice between the fishing grounds and the processing plant. The high quality of these hook and line caught turbot was recognized early in the development of the fishery as an important factor in retaining high market value of the product which could offset factors working against commercial viability such as high freight rates.

3,2.2 Processing and Plant

The 1987 project included upgrading the community-owned processing plant, a 30 X 38 foot building consisting of a walk-in freezer and a food processing area. It was intended for processing and storing country foods, not commercial food processing. Consequently, it did not meet regulations set by DFO for a commercial fish processing plant capable of export (inter-provincial trade). However, recognizing the role that such a facility could play in the development of a commercial fishery in Pangnirtung, DFO agreed to grant the facility an interim licence. The interim licence would be conditional on some renovations to the

physical structure of the plant. Where renovations were not practical, staff training would be necessary to ensure that quality control standards were met.

There were also efforts in 1987 to train plant personnel in processing turbot, especially filleting (ED&T 1987). This followed from market information in 1986 suggesting limited Canadian demand for whole turbot (ED&T 1987), as well as a desire to add value to the product in order to create additional jobs and income in the community,

3.2.3 Marketing

The first market development efforts for Pangnirtung turbot were undertaken during the 1987 project. While it was known that fresh turbot was scarce in southern Canadian markets during winter months and hence fetched a high price, initial effort was directed at markets within the NWT. One of the reasons for this was the shortcomings of the Pangnirtung processing facility with respect to DFO plant licensing regulations. Until the facility was licensed, extra-territorial exports were not allowed. More importantly, regional distribution allowed for tests of more easily supplied regional markets, and development of a consistently high quality product before confronting proven and competitive products in southern markets. Therefore, most of the 12,000 pounds produced in 1987 was supplied to Iqaluit which was a conveniently close, albeit small market, Samples of fresh turbot were sent into Ottawa to introduce the product to brokers there. Interest in this fresh product was expressed by two seafood firms in southern Canada (ED&T 1987).

As the 1987 season progressed, southern Canadian market conditions were observed. These observations indicated intense competition from well established Greenlandic and eastern Canadian fisheries (MacKay 1987). However, Boston markets showed a less continuous supply of turbot, and therefore more potential (MacKay 1987). With respect to

potential markets for Pangnirtung turbot, MacKay (1 987) quoted the need for preferential freight rates and treatment to overcome some of the (extra-territorial) export problems.

3.2.4 Viability

MacKay (1987) also attempted to determine the viability of the fishery through an overall feasibility analysis (ED&T 1987). Though data were analyzed for different components of the fishery, it was acknowledged that many factors prevented proper analysis in 1987. Among these were unpredictable ice conditions which delayed by several weeks the start-up of fishing, a lack of experience on the part of staff, the testing of new procedures and techniques both in harvesting and processing, and a lack of market development. On the whole these factors could be summarized as a general lack of experience which would be expected in any new and developing industry.

Despite these shortcomings and problems, the 1987 season contributed to the knowledge base and to a positive momentum which continued to indicate potential for the fishery. This provided the necessary justification to continue and increase development effort the following year.

Among the more positive indicators of potential for the fishery, was the speed with which the fishermen picked up the technique of the type of fishing involved and the interest they showed in it. While it can be argued that the fishing technique is quite simple, it is nevertheless noteworthy that the Greenlanders' services were not required after the initial demonstration project in March of 1986. The students in 1986 became the instructors in 1987 (MacKay 1987). Fishermen's desire to fish has been attributed to a combination of a need for cash and an enjoyment of turbot fishing (Weihs 1989). Fishing provided cash for a harvesting activity to traditionally skilled men who did not always have the skills or desire

to enter the wage economy, but nonetheless needed cash in the changing community-based economy.

Unlike many contemporary fish harvesting technologies, the technology of the harvesting sector in this fishery was not capital intensive. Furthermore, snowmobiles are ubiquitous in Canadian arctic communities, as they are the major means of winter and spring transportation. Any able bodied man in the community who had access to a snowmobile, already had the major piece of equipment needed to enter the fishery. And he was already familiar with its maintenance and use. For a few hundred dollars he could equip himself with the additional gear needed to go winter turbot fishing.

The timing of the fishery in late winter and spring was another indicator of potential for the fishery. The competing turbot fishery in Quebec's Gaspé did not open until April. This meant market prices prior to April would be higher (ED&T 1987) and could help to offset high air freight costs associated with transposing the product to southern markets. Effective exploitation of this advantage would require the product's high quality being retained through to the marketplace. The introduction of the insulated containers and the "reverse super-chill" storage preserved the quality of the product at the fishing grounds and during transportation to the processing plant. Though no commercial shipments to southern Canada were made in 1987, it was known that daily flights to the regional transportation hub of Iqaluit, half of which connected within a few hours to flights to major eastern Canadian centres, would ensure rapid delivery of fresh processed product to large southern markets.

One more factor may have contributed to early success and optimism. The mid-eighties was a time when attention to healthy lifestyles and diet was in vogue. Fish was high on the list of healthy foods and as a result was much in demand. Further contributing to this

was the somewhat intangible factor of the pristine arctic environment from which the turbot was harvested.

3.3 The 1988 Project

The 1988 fishery was funded by the Canada/Northwest Territories Economic Development Agreement which afforded a more comprehensive approach than the 1987 project. It was the successes and other positive signs shown in 1987 that drew support for funding from this source. Large financial resources were now available to advance the project to a near-commercial scale.

A plant manager from Newfoundland was hired to oversee the processing and other plant functions including marketing (ED&T 1990). Canadian Fisheries Consultants Limited (CFCL) was contracted to assist the plant manager in developing and monitoring productivity measures and to undertake an economic assessment of the fishery.

3.3.1 Harvesting

As in 1987, unpredictable ice conditions delayed the start-up of fishing. The most popular fishing grounds were not accessible in 1988 (CFCL 1988), and fishermen were forced to fish less-favoured areas. This resulted in a delay until March 3 of the first landings. Over a seven-week season, and involving up to 14 fishermen, (CFCL 1988) 26,059 pounds of head off. and gutted (H&G) turbot were landed at the processing plant.

A decision had been made by the 1988 project coordinators to pay fishermen by the weight of their landings. In the previous two years, fishermen were paid a daily wage. Another change which affected fishermen was an arrangement whereby only non-fishermen would

be designated to transport turbot from the fishing grounds to the processing plant. This would force fishermen to concentrate on fishing and hopefully increase landings at the plant. Based on this arrangement, the price set for fishermen was $0.60 per pound H&G. They were paid no more if they delivered their catch to the plant. After the first week of fishing and lower landings than expected, a meeting with fishermen revealed they would prefer a price which included delivery to the plant, This was more convenient for the fishermen since they returned to Pangnirtung every few days for supplies and a rest from the work and cold weather. The plant manager supported this change which simplified administration. Thus the price paid to fishermen rose to $0.90 per pound H&G for the remainder of the season.

The season started with six fishermen working as three teams. When the season ended, about seven weeks later, there were fourteen fishermen involved. CFCL (1 988) considered the increase in fishermen to be an indication of good interest in the fishery since two non-fishing training courses were occurring in the community at the same time. The content of these courses was traditional men's activities; topics suspected to be of interest to potential fishermen.

As in previous years there was some testing of various types and sizes of hooks and lines. CFCL (1988) notes that despite circle hooks having better retention properties, fishermen preferred semi-circle hooks followed by "J" hooks as these were easier to bait, a relevant consideration in extreme sub-zero temperatures. CFCL (1 988) recommended that larger #3 and #2 "hooks be used because they expected that they would be preferred by fishermen.

ED&T had tendered a contract to develop a motorized, hydraulic long-line hauler intended to improve the productivity of fishermen. Prototypes were tested during the 1988 fishery though results were not stated. However, the viability assessment in CFCL (1988)

assumed fishermen used these haulers and included the capital and operating costs of the haulers in determining the costs of fishing.

The significant problem of Greenland sharks was briefly discussed in CFCL (1988). The extent of shark damage by gear loss and mutilation of catch reported in MacKay (1 987) continued in 1988,

The use of the insulated containers to hold the turbot at the fishing grounds and to transport product to the processing plant in Pangnirtung, continued to work well during 1988. CFCL (1988) noted the excellent quality of the turbot on arrival at the plant,

3.3.2 Processing and Plant

Based on the processing plant inspection and report completed by DFO in 1987, identified deficiencies were corrected in order that the facility could be licensed for inter-provincial . fish export. The plant was certified by DFO on 25 February 1988.

The newly recruited plant manager made a short trip to Pangnirtung in early January 1988 to assess and evaluate the physical plant. This assessment was discussed with CFCL and a list of equipment needs and other recommendations sent to ED&T in Iqaluit. Most of the items listed were to address general needs, quality control and productivity improvements in processing. Among these were a skinning machine and a larger ice crusher. Unfortunately the skinning machine was late in arriving and not installed prior to the completion of the season. A suitable ice crusher could not be ordered in time. Hence two major pieces of equipment, important to productivity improvements and quality control, were not introduced in the 1988 season. A small ice crusher continued to supply crushed ice in the plant.

Without the skinning machine, all processing was done by hand, and CFCL (1988) reported an increase in fillet yield to 48°A of H&G weight. This was considered good since some of the fish arrived partially frozen. CFCL (1988) predicted that had the skinning machine arrived, fillet yields would have reached 55% of H&G weight.

At the same time as these productivity increases were being achieved, the plant manager was emphasizing quality control. Since quality control began with the harvesting, factors affecting product quality before the fish reached the plant were discussed with fisherman. High quality of product was sought for the potential long-term benefit of identifying the product as unique, and the premium price this would fetch. Measures practiced during the 1988 season to achieve this result are listed in CFCL (1988).

Most of the production in 1988 went toward 12,000 pounds of fresh fillets, as market reports indicated these would fetch the best price. Lesser amounts of frozen fillets, and frozen and fresh whole dressed turbot were also produced.

3.3.3 Marketing

With the DFO interim licensing of the Pangnirtung plant granted in February 1988, the project was able to ship turbot to southern Canada. Since market inquiries were first made in 1987, turbot markets had softened. This was attributed to large offshore landings into American markets, and foreign vessel landings at under-utilized inshore plants in Newfoundland. The decline in turbot prices in southern Canada caused the Greenland winter turbot fishery to withdraw from the North American market which they had previously supplied via Iqaluit. This resulted in the new Pangnirtung product being the only fresh turbot available until the Gaspé fishery opened in early April. So while prices were

not as high as was hoped, there was nonetheless a strong demand for fresh fillets and to a lesser extent fresh whole dressed turbot. Despite a higher price in the Ottawa market ($3.00 per pound for fresh fillets), most of the fresh Product was supplied to Montreal at $2.70 per pound. Ottawa markets demanded limited quantities while demand in Montreal was much stronger.

Post-season evaluation and discussion with market watchers noted that the 1988 price was on average about one dollar per pound lower than a year previous and the current price was on the low side of what would be expected in a more stable market (CFCL 1988).

Turbot is also known as Greenland halibut. This alternative name was devised to help market turbot, since it is considered a coarse fish in southern Canadian markets. Halibut is considered a desirable fish and the price premium which could be gained though the use of the more desirable name is obvious. Unfortunately, DFO's inspections branch does not allow the use of the name Greenland halibut or halibut when marketing turbot in Canada. CFCL (1 988) made inquiries with DFO on the usage of alternate names such as Baffin Island halibut and noted that such a request would require a formal proposal to DFO. A consideration of alternate names began in hope of lifting the profile of the product above that known with some disdain in the south as turbot.

3.3.4 Economic Evaluation and Viability

CFCL (1'988) undertook an economic evaluation of both the harvesting and processing operations. The harvesting evaluation is presented and discussed in section 4. The economic evaluation of the processing operation considered two scenarios; continued use of the existing processing plant, and use of a new designated processing plant. Where possible, operating costs were collected during the season. Because of insufficient

landings, improper equipment and a lack of experience, productivity rates and yields were estimated. Existing government subsidies (plant utility costs and 30% of product air freight) were identified and assumed to remain constant. It was further assumed that in both scenarios, 100% of production went toward fresh fillets. Based on these conservative, mostly status *quo* assumptions in the existing processing plant, the per pound production cost of fillets delivered to market was $3.59, $2.90 and $2.18 in projected years 1, 2 and 3 respectively. A break-even analysis equated these production costs to $0.51, $0.71 and $1.00 per pound paid to fishermen for whole H&G turbot, This analysis indicated the existing processing plant would be profitable by year 3, assuming the current price of -$0.90 per pound H&G paid to fishermen held.

The second scenario assumed a new, 40 x 65 foot, designated processing plant was to be constructed at a capital cost of $743,000 (1988 dollars). Based on the same set of assumptions as the previous scenario, and with a 75% capital cost subsidy provided by government on the new plant, the per pound production cost of fillets delivered to market was stated to be $3.12, $2.00 and $2.03 in projected years 1, 2 and 3 respectively. With a 25% capital cost subsidy provided by government on the new plant, per pound production costs increased to $3.87, $3.04 and $2.44. The corresponding break-even per pound H&G whole price paid to fishermen was $0,39, $0.65 and $0.86 with a 75% capital cost subsidy and $0.05, $0.38 and $0.64 with a 25% subsidy for projected years 1, 2, and 3 respectively. In order for the fishery to be profitable in the proposed new processing facility under the prevailing conditions, the subsidy on the capital costs of the new facility would need to be in excess of 75%.

Despite a delay in the opening of the fishery because of late sea ice formation and some equipment supply problems, the 1988 turbot fishery added more information to the

knowledge base and continued the momentum of development and optimism about the fishery.

3.3.5 Recommendations of the 1988 Project

CFCL (1988) made several recommendations related to all aspects of the fishery. Because the price paid to fishermen was the greatest cost to the processing operation, some changes to the harvesting sector were suggested in hopes of reducing harvesting costs through increased productivity. It was suggested, that three-man teams fish a double-ended long-line through two holes in the ice. This change from two-man teams, fishing the conventional long-line technology, was expected to increase fisherman productivity, and thus allow a decrease in price paid to fishermen.

Recognizing the problem of Greenland sharks, CFCL (1988) recommended markets be sought for sharks. They also recommended an investigation of shark repellents/detractors, which were used in the Greenland winter turbot fishery to reduce shark by-catch. The development of a portable shelter within which most of the harvesting activity could occur, was also suggested.

Among CFCL's (1988) recommendations for the plant was a suggestion to supplement processing with arctic char filleting during periods of low turbot landings. This would enhance plant viability. They also suggested the price paid to fishermen for turbot should fluctuate with the market price. Lastly, they recommended an experienced manager operate the processing plant for the next two years.

3.4 1989- Cumberland Sound Fisheries Limited

Following the successes of the 1988 season, and in accordance with recommendations of MacKay (1 987) and the mandate of ED&T, government and community members involved in the Pangnirtung turbot fishery decided to incorporate a private sector company to take over the processing operations of the turbot fishery in Pangnirtung. Up to and including the 1988 season, turbot fishery projects were sponsored by the Pangnirtung Hunters and Trappers Association (HTA), a publicly elected board representing hunters. Sponsorship reflected funding program requirements though project decisions were made largely by government personnel responsible for fishery development. To encourage more community involvement through local decision making and to begin linking production to the market, it was necessary to establish a locally owned and controlled commercial entity. Further, as was learned in 1987 with the establishment of a commercial scallop fishing operation in Pangnirtung, a new commercial fishing entity should be broadly owned throughout the community. This would enable DFO to assign resource allocations to the commercial entity ' without seeking the community's input (through the HTA). In effect, the input would be implied through an overlap of ownership and community representation.

During the summer and autumn of 1988, community meetings and discussion toward the establishment of a commercial fishing entity occurred and in December 1988, Cumberland Sound Fisheries Limited (CSFL) was formed. It was a private company incorporated under the laws of the NWT. Among its shareholders were the Pangnirtung HTA, the Pangnirtung Eskimo Co-operative Ltd. and P & L Services Ltd., as well as 40 other individual residents of Pangnirtung. The co-operative operated a general store in the community and had been very interested in, and supportive of commercial fishery development. P & L Services Ltd. (P&L) was a local Inuit partnership that owned and operated a scallop dragger which had been fishing scallops in Cumberland Sound since 1987.

The 1989 turbot fishery began under the auspices of CSFL, with some government funding for start-up cash flow (Simpson 1990). Government also assisted by providing funds to hire the plant manager from the previous season.

Another major change to the fishery was the establishment of a new GNWT staff position of fishery development officer. This position was filled by a person with experience in the Atlantic Canada fishing industry. Shortly after the 1989 fishing season began, and immediately on starting his new position, the fishery development officer was sent to Pangnirtung. It was initially believed he would concentrate on harvesting and the supply of product to the plant by working with the fishermen. It was soon discovered that there was to be no shortage of product arriving at the plant from the fishing grounds (Simpson 1990). Therefore the fishery development officer assisted at the processing plant. However his approach to management was very different from that of the plant manager's, and conflict soon led to the manager's resignation. The fishery development officer took over management of the plant and processing, coordinating fresh shipments with the air carrier, and communicating and negotiating with buyers in the south. This was a crucial position because so much product was landed by fishermen that the processing plant became a bottleneck to production.

The 1989 fishery began on March 5 and continued 14 weeks until May 30. During that time 276,082 pounds of whole H&G turbot were landed at the plant by 43 licensed fishermen and their "helpers". This was a sharp increase over 1988 when 26,059 pounds of H&G turbot were landed in seven weeks by six to 14 fishermen and helpers (see table 4).

As recommended in CFCL (1 988) the price paid to fishermen in 1989 was adjusted during the season to reflect market prices. Fishermen were paid $0.80 per pound for H&G turbot at season start. Two downward adjustments to the price occurred during the season and at season's end the price was $0.60 per pound for a season average of $0.67 per pound. The average price in 1988 was $0.89 per pound.

As the season progressed and the temperature rose with approaching spring, and encouraged by the success of those already fishing, a stream of additional individuals joined the fishery. This increased the rate at which turbot was arriving at the plant. The first bottleneck affecting the increased supply was the processing capacity of the plant, as to physical size, extent of facilities, and human resource capabilities. Fortunately, experience gained as the season proceeded could be applied by staff to mitigate some of these constraints. Freight capacity, originally thought to be a strength with eight scheduled south bound flights per week, was taxed at times, especially when weather prevented the carrier from flying. This resulted in backlogs of finished product and a second bottleneck. . The carrier, while accustomed to regular northbound shipments of perishable goods, was not accustomed to regular south bound cargo, let alone perishables. This required constant monitoring to track each shipment through to its destination since almost every plane flying out of Pangnirtung carried a load of fresh turbot (Simpson 1990).

Additionally, because of the unexpected and unprecedented volumes being processed, the plant ran short of packaging materials. These had to be special ordered and air-lifted to Pangnirtung. Limited storage capacity prevented stockpiling of packaging materials, making regular monitoring a necessity. Running out of any critical item, would stop production until that item was air freighted to Pangnirtung.

Everyone involved in the processing operation was taxed to their limits with the exception of the fishermen, who continued to fish and supply product to the processing plant. However, the stresses and strains at the plant and the efforts of fishermen were rewarded by the new found jobs and income the fishing created. A few months later when CSFL's year-end audit was announced, a small but important $63,211 profit before taxes on sales of $438,894 was further reward and set expectations for the future very high.

3.5 The 1990 Season

In preparation for the 1990 fishery, the deficiencies identified in 1989 were addressed. Mainly these related to the lack of facilities in which to hold and process the fish, and in which to store packaging materials and finished product. CSFL applied for funding to expand the plant and to construct a small storage cooler at the Pangnirtung airport. This airport cooler would be for finished product awaiting incoming planes. Only the plant expansion funding was approved and in December 1989, construction began on a 750 square foot plant extension. It included a large addition to the processing area, a storage area on a second level and a small office. The work was completed just prior to the start up of the fishery in January 1990.

The single-minded goal of CSFL in the 1990 season was to land a million pounds of turbot or reach a million dollars in sales, This misguided goal, based on equating success with the high 1989 landings, was frequently mentioned by company management during the season. While the Baffin region ED&T management wished to have the fishery development officer focus his attention elsewhere, and hopefully begin developing commercial fisheries in other Baffin communities, the CSFL board of directors pressured ED&T to have the fishery development officer remain in Pangnirtung to manage CSFL. He was popular in the community and was a key figure in the 1989 success.

Unfortunately the fishery development officer had no organizational or administrative skills. Management and accounting systems suitable to the size of the operation, were never set up. Without proper systems in place, other weaknesses emerged as the season progressed. The fishery development officer's ability to work with the board of directors was limited. His approach was to tell the fishery- and business-inexperienced directors what to decide rather than providing them with information to make their own informed decisions. Although the business required quick decisions, not necessarily a reasonable expectation for an inexperienced board of directors, local decision making was considered critical for the new company to develop as an Inuit-owned and controlled business. While the board recognized the importance of the fishery development officer in the success of the 1989 season, they also credited other participants with a significant role in the success. They were therefore not always pleased when the fishery development officer made decisions without their input.

The season began with the price for fish set at $0.90 per pound H&G. This higher price was a result of the 1989 profit and a desire by the board of directors to pay the fishermen a better price. Although the price paid to fishermen dropped as the season progressed (to follow decreases in the market price for turbot), a stream of individuals continued to enter the fishery.

The capacity of the plant was again taxed; the inadequate working space was perhaps exacerbated by the lack of formally-established processing procedures. Plant workers were again required to work extensive overtime to process the fish being landed at the plant. Rather than close the fishery for a few days when required to clear up a backlog of fish, management kept the fishery open to achieve the single-minded goal. Air charters were

occasionally arranged to move large quantities of perishable product to Iqaluit or to fill an immediate need for packaging materials.

In late April 1990, the board and the fishery development officer had a disagreement resulting in the fishery development officer voluntarily leaving Pangnirtung. The fishery continued without a general manager since fishermen continued to fish and land product at the plant. The Montreal-based buyer encouraged continuation of the fishery by demanding all product that CSFL could produce. In early May, ED&T were concerned about the fishery continuing while market prices were falling, so they contracted a consultant to travel to Pangnirtung to do a quick assessment of gross margins. After a three-day examination of the company's production, revenue and operational expenses, the consultant concluded the processing plant was operating at a loss. The consultant recommended to the board of directors and ED&T that the fishery be shut down for the season. This advice was heeded. ED&T extended the consultant's contract by requesting a more thorough assessment of the processing operation. A comprehensive report by C-Mac Consultants (1990b) made recommendations to ED&T and the CSFL board on all aspects of the business.

After the season ended it was discovered that the buyer of essentially all the fish was controlling the price well after delivery, despite CSFL claims of previous verbal agreements of higher prices. Certain shipments were claimed, well after delivery, to be spoiled and these invoices were not paid. In general, invoices were extremely slow in being paid. Inadequate accounting systems probably resulted in few follow-ups on unpaid invoices and contributed to the problem.

In both 1989 and 1990, CSFL arranged with a local store to accept chits issued by CSFL to employees and to fishermen. These chits were for either a CSFL employee's wages or a fisherman's landings and were good for credit or cash at the store. On a regular basis the

store would invoice CSFL for the total chits issued. This worked well in 1989, but in 1990 these invoices were not paid regularly. This and other signs of financial trouble began surfacing shortly after closure of the fishery. The air carrier was also claiming a large account receivable from CSFL. Inadequate accounting systems resulted in little attention to and therefore an accumulation of accounts payable during the fishing season. Following the year-end audit, the company was found to have a large operating deficit and would require a major cash investment to avoid bankruptcy.

3.6 1991 - The NWT Development Corporation

Much discussion occurred over the summer and autumn of 1990 with respect to the future of CSFL. The CSFL board of directors had two choices for an investment partner to inject new cash equity into the company to pay creditors. One of these was the NWT Development Corporation (NWTDC), a newly-formed GNWT crown corporation whose mandate was to invest in job-creating business opportunities considered too risky for the private sector. The second potential investor/partner was CSFL's major buyer based in Montreal. The board decided in favour of the NWTDC because of its policy of divestment of shares following achievement of operating profits. Therefore local ownership and control could resume. However an investment by the NWTDC would require the preparation of a detailed business plan for review by the NWTDC's board of directors. On assurances from ED&T officials that accounts receivable would be paid, CSFL'S creditors agreed to wait-out the process. As unsecured creditors, this was to their benefit. Not only would they realize their account receivable with accumulated interest (an unlikely event if CSFL declared bankruptcy), but both major creditors were well aware of the positive impact the turbot fishery had on their businesses. The 1991 season did not begin until mid-February when the NWTDC funds became available to CSFL.

The business plan (C-Mac Consultants 1990a) identified the critical need for qualified management, and with the help of ED&T, CSFL hired a general manager with experience in fish processing and marketing. An experienced office manager was also hired.

The new manager made changes to the fish plant layout to increase processing efficiency and also had a small cooler constructed inside the plant's freezer to store fresh product ready for shipment. Because of difficulties with the Montreal buyer in 1990, new buyers were sought. The price paid to fishermen was lowered to $0.70 per pound H&G, where it remained until the fishery closed at the end of April.

Overall the company proceeded with caution in 1991 to stabilize the operation and begin recovery from the 1990 loss. Thus the first signs of decreasing market price, caused by the opening of the Gaspé fishery, signaled a close to the Pangnirtung fishery. This was not well received by fishermen and plant workers who had gotten used to the exuberant manner of the 1990 season and the increased income that resulted.

3.7 1992- Competition

The 1992 season began with an interesting twist. P & L Services Limited (P&L), a major shareholder in CSFL and the owner and operator of the commercial scallop dragger in Pangnirtung applied for and received from DFO its own allocation of turbot. P&L had formed an alliance with a small regional charter airline, the fishery's 1989 and 1990 Montreal fish buyer who had not been supplied turbot in 1991, and ED&T's ex-fishery development officer who had recently resigned from his government position. The result was competition between P&L and CSFL for fishermen and turbot. Consequently the price paid to fishermen for H&G turbot began at $0.90 per pound. The fishery opened in late January as soon as the sea ice was stable.

The P&L alliance had quickly constructed a small building in which they could package turbot. By DFO regulations, without a federally inspected fish plant they could not process fish for (inter-provincial) export. Instead they acted as the Montreal buyer's agent and assisted fishermen prepare their catch for shipment south.

CSFL had not been pleased with their 1991 buyer and marketing agent and began an arrangement with another agent.

As the season progressed the per pound price paid to fishermen dropped and rose on a few occasions as the two companies made adjustments. CSFL stopped purchasing turbot and shut down their processing plant in late May. P&L continued purchasing turbot into early June, when the deteriorating condition of the sea ice between the fishing grounds and Pangnirtung effectively closed the fishery.

Encouraged in part by competition between the two companies, as well as information gained through experience, fishermen were offered and chose to have unemployment insurance premiums deducted. Once they qualified for UIC benefits they could then receive a year-round income; from the fishery during the fishing season, and from UIC in the fishery off-season. While several of them qualified for unemployment benefits, very few completed the paper-work required to collect these benefits in the summer and autumn of 1992.

The results of the 1992 season, relative to previous seasons show another sharp increase in the fishery's output and local income (see table 4 and figures 1 and 2). The fishermen were pleased with the long season and relatively high prices. The high volume of turbot purchased by both companies was good for the community as to the income and

opportunity it provided. CSFL alone, could not have moved such volume through their plant, The high volume indicated that the removal of constraints such as the present plant capacity would result in a continued increase in the numbers of fishermen and landings. This suggested a new, higher capacity fish plant, which CSFL envisioned in their future, could probably be justified and utilized.

Based on recommendations by the CSFL general manager, during the summer of 1992 the NWTDC considered another major investment in the Pangnirtung turbot fishery. It would include the construction of a new fish plant, designed to address the unique characteristics of the Pangnirtung winter fishery. The investment would also include operating subsidies for the first five years, allowing the company to carry operating losses while it was implementing a new strategy to diversify. The P&L scallop dragger was available for purchase, and ownership of this vessel would enable access to the summer scallop fishery and expected exploratory fishing contracts to be funded by the Canada/Northwest Territories Economic Development Agreement over the next few years. In addition to entry in the inshore scallop fishery, the diversification would also include attention to the eastern NWT supply of arctic char, and entry into the Davis Strait commercial fishery. CSFL had applied for and been granted an allocation of the 1992 Groundfish Developmental Quota in NAFO division O, and they had plans to arrange a joint venture with an appropriate vessel to fish this allocation. The Pangnirtung fishery was rapidly becoming a player of note in the arctic seafood industry.

Despite's loss of local control through majority ownership and management by the NWTDC, the shareholders of CSFL agreed to the NWTDC plan requiring the incorporation of a new company; Pangnirtung Fisheries Limited (PFL). The share structure of the new company is legally complex, but in essence the NWTDC holds 51 % of controlling shares and appoints four of the seven directors to the board. CSFL will remain active though reduced in

visibility, and is a major shareholder of PFL. The continuation of CSFL is a means of accessing new stock allocations, as DFO is not expected to assign commercial fish allocations to a GNWT crown corporation when private sector companies are also requesting allocations.

4.0 COST AND EARNING STUDIES

As early as 1986 in MacKay (1986b), the financial viability of winter turbot fishing in Cumberland Sound was under scrutiny. Such an unusual and new method of commercial fishing, along with large distances to markets challenge the viability of the fishery. Since an objective of the present study is to conduct a cost and earning study on the harvesting sector of the fishery, this section reviews the three previous cost and earning studies done on Pangnirtung winter turbot fishing and their assumptions and results.

As one of the terms in their 1988 contract with ED&T, CFCL (1 988) projected the costs and revenue of turbot fishermen, Their analysis is shown in table 3. It is important to note that the terms of reference of the CFCL contract were to evaluate the feasibility of the fishery; both in harvesting and processing. At the time of their data collection, the fishery was in its infancy and while the fishermen participating were quickly gaining the skills of the new technique, they had certainly not yet applied the concept of maximizing their profits as an individual fisherman would. For example, in 1988, fishing occurred in teams, and to whatever extent costs and revenues to fishermen existed at that point in the government projects of test fishing, they shared those costs and revenues. It was therefore assumed that in a shift to commercialization of the fishery, fishermen would adopt partnerships and share all costs and revenues. However, beginning in 1989, the better fishermen began splitting their teams, with each partner employing a younger man as a "helper", to which he paid a per trip wage. This practice of employing a helper has become the predominant practice in the fishery. Partnerships remain, but usually they occur only when less experienced participants are learning the fishing technique together, or in a few cases where the younger partner is assisted by an older relative.

Table 3. Comparison of three previous harvesting cost and earning studies for the Pangnirtung winter turbot fishery.

	CFCL (1988)		Weihs (1989)	C-Mac Consult. (1990)
Season Length (wks)	12	12	13	16
Per pound turbot price	$0.90	$0.70	$0.67	$0.80
Gross Revenue	$22,500	$17,500	-$14,200	$14,818
Expenses				
Fuel	2,105	2,105	1,200	1,010
Food & Supplies	-	-	1,800	4,200
Cooking & Heating Fuel	-		-	1,428
Fishing Gear	716	716	1,002	1,770
Maintenance	1,464	1,464	600	1,429
Interest expense	1,040	1,040	-	
Depreciation	1,646	1,646	1,923	2,194
Total Expenses	6,971	6,971	6,525	12,031
Net Annual Income (two-man team)	15,529	10,529	7,674	785
Net Annual Income (per individual)	7,765	5,265	3,837	393
Weekly Income (per individual)	$647	$439	$295	$25

Much of the CFCL (1988) cost and earning study was based on estimates, owing to a lack of harder data at that time. Thus behaviour of individual fishermen was not considered. Ironically, one of the CFCL (1 988) recommendations, complete with a financial analysis to justify it, was a suggested different fishing technique requiring a three-man team and employing a double-ended long-line fished through two holes in the sea ice. This technique required use of a newly developed, self propelled under-ice homing device to initially set the line in both holes. While the technique was expected to increase catch through use of a longer ground line and therefore more hooks, it has never been further investigated. Fishermen adopted their own innovations.

For a 12 week season, CFCL (1 988) estimated fishermen capable of earning an average net income of $7,765 with an H&G turbot price set at $0.90 per pound. At $0.70 per pound for H&G turbot, average net income decreased to $5,265. These estimates assumed the two-man team was capable of landing 25,000 pounds during the 12 weeks.

Weihs (1 989) estimated turbot fishermen's monthly net income based on the 1989 season records of landings by those fishermen who began fishing within two weeks of the season start-up. Costs of fishing were estimated from interviews with fishermen. His analysis showed average monthly gross revenue to be $4,733 and average net income to be $2,558 for a two-man team, Over the course of the 1989 season of 13 weeks this resulted in an estimated average net revenue of $3,837 per participant. Details are also shown in table 3.

C-Mac Consultants (1 990) also estimated the revenue of fishermen through fishermen surveys, examination of CSFL records and local merchant price surveys. They surveyed fishermen representing 20 partnerships and "fisherman/helper" teams which were said to account for about 85°A of the turbot landings in 1990. Their analysis is also shown in

table 3 and shows a net revenue of $785 per fishing unit on average gross revenue of $12,818 for the 16 week season.

The summarized results of the three studies outlines substantial discrepancies owing at least in part to the differences in approach. The CFCL (1 988) study was a pro *forma* feasibility study, and estimated that a two-man team could land 25,000 pounds of turbot during a 12 week season, Two different prices to fishermen were evaluated and resulted in a $5,000 difference in estimated gross revenue. Weihs (1 989) examined actual information collected from the 1989 fishery. His calculation of the gross revenue figure was averaged from the landings of fishermen who began fishing during the first two weeks of the season. The C-Mac Consultants (1 990) study was based on 1990 fishery data. Their estimate of average landings is derived from twenty fishing teams which accounted for 85% of the 1990 landings.

Substantial discrepancies exist between the various costs. Most notable is the failure in some studies to include costs in their analysis which another study found to be a major expense. These resulted in large differences in net incomes. CFCL (1 988) predicted good returns for fishermen; up to an average of $647 per week. However, the two studies based on actual fishery data show more modest results; $295 and $25 per week average incomes (Weihs 1989, and C-Mac Consultants 1990 respectively). While $295 per week is better than minimum wage and likely to still attract participants, one questions why an individual would fish for only $25 per week.

An examination of the assumptions of these studies (when stated) offers suggestions why they have such different results. For example, CFCL (1988) assumed fishermen will fish five days per week not including time for travel, gear preparation, or equipment maintenance. In fact, fishermen may fish any number of days in a week, depending on

factors such as weather, the price of landed fish, the availability of "helpers", and the condition of their gear and equipment. C-Mac Consultants (1 990) assumed all fishing teams used a motorized long-line hauler at a capital cost of $2,600. As recent as the 1993 season, hand-operated haulers or "gurdies" were still more common than motorized haulers. C-Mac Consultants (1 990) also assumed insulated fish-holding containers valued at $1,250 were replaced every one to two years. Many fishermen continue to use home-made fish-holding containers constructed at low cost from scrap plywood, styrofoam insulation and plasticized tarps. Factory-built insulated containers have been shown to be quite durable, lasting about five years.

The manner in which at least two analyses attribute the depreciation of snowmobiles to the fishery is questionable. C-Mac Consultants (1 990) assume 57% of snowmobile cost is attributable to the fishery based on a four-month fishing season in 1990 and a seven-month snowmobile season. They also assume that all fishermen purchase a new snowmobile at a cost of $6,000, depreciated over two years after which there is a salvage value of $500, CFCL (19881 uses a similar formula for depreciation while Weihs' (1989) assumptions are not stated. Generally with respect to these studies, the stated assumptions about snowmobile depreciation and relative use attributable to the turbot fishery are too broad and not applicable to all participants.

Perhaps the best general explanation for the wide differences in these studies' results is the analyst's unfamiliarity with the fishery and hence an inability to properly determine the characteristics of the fishery and thus the relevant cost and revenue determinants. The most blatant of these is the absence of heating fuel in the CFCL (1 988) study.

5.0 COLLECTION OF DATA

In order to achieve the objectives of the study introduced in section 1.2, it was necessary to collect data from several original sources. The first of these sources was written records of a government department and the two commercial fishing companies in Pangnirtung. Secondly, data were obtained through personal interviews, questionnaires and discussions with fishery participants and residents of Pangnirtung. Each of these sources and the procedure of data collection is described in detail throughout the remainder of section 5.

5.1 Fishery Records

During the 1988 fishery project, records of fishermen landings and gear purchases were kept by the project manager. Since the fishery project was the only buyer of turbot and the only seller of the specialized long-line gear used by the fishermen, the records of the fishery project formed a complete set of earnings and fishing gear costs for individual fishermen. In 1989 and 1990, CSFL continued to keep detailed records of transactions with fishermen, As fishermen landed their catch, their revenue was recorded in receipt books. Because CSFL was required to supply the specialized long-line gear and other fishing gear not available in Pangnirtung or the Baffin region, sales of all fishing gear were also recorded, often detailing individual gear items. These records from 1988 through 1990, formed a valuable resource which was compiled into computer spreadsheet files for analysis. However, in 1991, with CSFL under new management, gear sales were turned over to one of the company's major shareholders, the Pangnirtung Eskimo Co-operative Ltd., which operated a general store. With this change, records of gear sales were no longer available because of simpler sales transactions at the co-op.

Records of fishermen landings for the 1988 through 1992 seasons were also compiled into computer files for analysis.

5.2 Personal Interviews and Questionnaires

Since the fishery records did not consist of a complete set of information to evaluate the impact of the fishery on Pangnirtung, further information was needed. An obvious source of this information was from participants in the fishery. For the years 1988 through 1991, individual fishermen landings, the number of trips per fishermen per year, and the frequency distribution of landings by fishermen were examined. The rules affecting fishermen qualifying for unemployment insurance benefits were also considered. From this information a sample of 20 fishermen was randomly chosen for which further information would be gathered during and following the 1992 fishing season.

In gathering and analyzing data from local residents, special attention was paid to several factors affecting the collection and interpretation of data.

The first difficulty associated with collecting information from fishery participants was that their first, and in most cases only language, was Inuktitut. This required the use of an interpreter for almost all interviews. Questionnaires also required translation into Inuktitut and the responses translated back into English. Two interpreter/translators were used for the research, both of whom have had recent experience translating and interpreting for academic research purposes. This need for the use of interpreters for so much of the primary data collection had a limiting effect on data quantity owing to financial and time constraints.

Other cultural differences also made data collection from fishery participants difficult. Traditionally, Inuit learn by observing and listening. Direct questioning is not always an effective means to gain information or answers, though it is becoming more commonly accepted. Another difficulty is the educational differences which exist between researchers and many Inuit adults. Most Inuit in Pangnirtung over 40 years of age and some younger have no formal education since day-schools were not established until the 1960s. Quantitative record keeping, both mental and written, can be uncommon in Inuit culture and can affect the collection of information through interview or questionnaire.

There is also a reluctance or skepticism in Inuit communities about researchers in general, perhaps owing to the regular occurrence of researchers in Inuit communities, and the cultural and educational differences that exist between the research community and the residents of an arctic community. Despite some researchers' efforts to explain the purpose of their research to the community and its utility to them, as well as the results and interpretations of the completed research, Inuit communities and their residents may have difficulty understanding academia and therefore contributing to and gaining from research.

5.2.1 Fishermen Interviews and Questionnaires

Two types of questionnaires were developed to gather information from fishermen. One of these was designed to gather fishing trip expenditures and is referred to as the trip questionnaire. The second questionnaire was designed to be used during a personal interview, and sought information on fishing expenses, capital costs, and opportunity costs associated with the turbot fishery, It is referred to as the comprehensive questionnaire. These questionnaires and their use are described below.

The intent of the trip questionnaire was to gather common expenditures and periodic maintenance and repair costs of equipment associated with each turbot fishing trip, from the random sample of fishermen in 1992. Owing to financial and time constraints, it was impractical to do personal interviews with each of these fishermen upon their return from each fishing trip. Therefore the questionnaire was designed to be completed by the fisherman and returned before his next fishing trip. The random group of fishermen were approached to determine their interest in participating in the research. Twelve agreed to complete the questionnaires and were given a supply of the one-page form. Five dollars was paid for the return of each trip questionnaire. Following translation of responses into English, the information was compiled into a computer file for analysis.

The comprehensive questionnaire was completed in a personal interview with the random sample of fishermen. In most cases these interviews required the assistance of an interpreter. On average the interviews were about one hour in length. The information gathered was also compiled into three computer files for analysis.

5.2.2 Plant Worker Interviews

A questionnaire was also developed to use in personal interviews with a small random sample of CSFL plant employees with at least three seasons of experience. These interviews usually required about 15 minutes, and except in one case, required the assistance of an interpreter. The questionnaire was designed to determine alternative types of employment of plant workers and opportunity costs of working at the fish plant. The questionnaire also tried to determine on what their income from work at the plant was spent. Responses were summarized and compiled in a computer file for analysis.

5.2.3 Manager Interviews

Several interviews were also done with persons involved in the development of the turbot fishery as well as the management of the commercial fishing companies. These included government personnel who played lead roles during the development phases, members of the CSFL board of directors, and the current managers of both Pangnirtung fishing companies. The interviews sought to explore the development phases of the fishery as well as current approaches to management, in order to evaluate from different perspectives, the success of the development model of CSFL.

5.3 Price Survey

During interviews with fishermen, some responses to questions on fishing costs did not quote the cost of items. For example, fuel was always referenced in gallons. In these cases, prices were gathered by visiting and phoning local suppliers and merchants.

5.4 Social Assistance Payments

Statistics on monthly social assistance payments in Pangnirtung were gathered from the GNWT Department of Social Services Minister's Reports (Social Services 1983 to 1992). These payments were compiled back to April 1983 when this information was first computerized. UIC benefits are not included.

Total monthly social assistance payments were averaged for each year. Payments for March and April were also averaged for each year since March and April are the only two months of each year since the fishery began commercial production in 1989, in which the fishery has operated throughout those two months. While in some years fishing started as

early as January or ended as late as June, this was not consistent for all years. Hence March and April are characterized as fishery months.

5.5 Personal Observation

It is significant to this study that the author has been a resident of Pangnirtung since April 1989. Living within a small community allows one to get a good understanding of the community and personal knowledge of at least some of its residents. To a certain extent, this allows a bridging of cultural differences.

Further, the author has been employed since 1989 until the present as the GNWT's economic development officer representing the Department of Economic Development and Tourism in Pangnirtung, the government department which has led the development of the turbot fishery. This meant the author was often privy to information and insights about the fishery which were not always common or public knowledge. These factors tended to ameliorate some of the difficulties conducting research described in section 5.2.

6.0 RESULTS

This section presents results of the data collection and analysis described in section 5. Discussion, interpretations, and the relevance of this information to the study objectives is presented in section 7.

6.1 General Statistics of the Fishery

Table 4 outlines general statistics of the Pangnirtung winter turbot fishery. Some of the statistics are also shown graphically in figures 1 and 2. Table 4 shows commercial landings have increased 171 % in three years from 276,082 pounds in 1989, to 748,480 pounds in 1992. A 195% increase in gross fishing income from $184,459 in 1989, to $544,822 in 1992 has also occurred. Licensed fishermen have increased in numbers from 43 in 1989, to 93 in 1992. Processing and packaging operations of CSFL between 1989 and 1992 and P&L in 1992 added between $70,572 and $203,967 in local annual income as outlined in table 4. Annual summation of processing income and gross fishing income is shown with annual landings in figure 2.

6.2 Cost and Earning Study

Of twelve fishermen who agreed to complete trip questionnaires during the 1992 fishing season, only five returned completed questionnaires. Of these five fishermen, only three returned more than two questionnaires. Examination of the responses on the completed questionnaires of the three fishermen left doubt about the usefulness of the information. Key responses were left blank in many instances. Owing to this poor participation rate, as well as the lack of complete information, the trip questionnaires were not used for any fishing cost analysis.

Table 4. Pangnirtung winter turbot fishery statistics 1988- 1992.

	1988	1989	1990	1991	1992
Landings (H&G pounds)	26,059	276,082	431,843	267,990	748,480
Season Length (weeks)	7	14	18	12	21
Number of Licensed Fishermen	9	43	77	61	93
Direct Local Income ($)	est. $32,182	$255,031	$550,602	$259,351	$697,969
Gross Fishing Revenue ($)	$23,282	$184,459	$346,635	$187,593	$544,822
Processing Income ($)	est. $8,900	$70,572	$203,967	$71,758	$153,147
Average Turbot Price ($/H&G pound)	$0.89	$0.67	$0.80	$0.70	$0.73

Figure 1. Pangnirtung winter turbot fishery, landings and gross fishing revenue, 1988-1992.

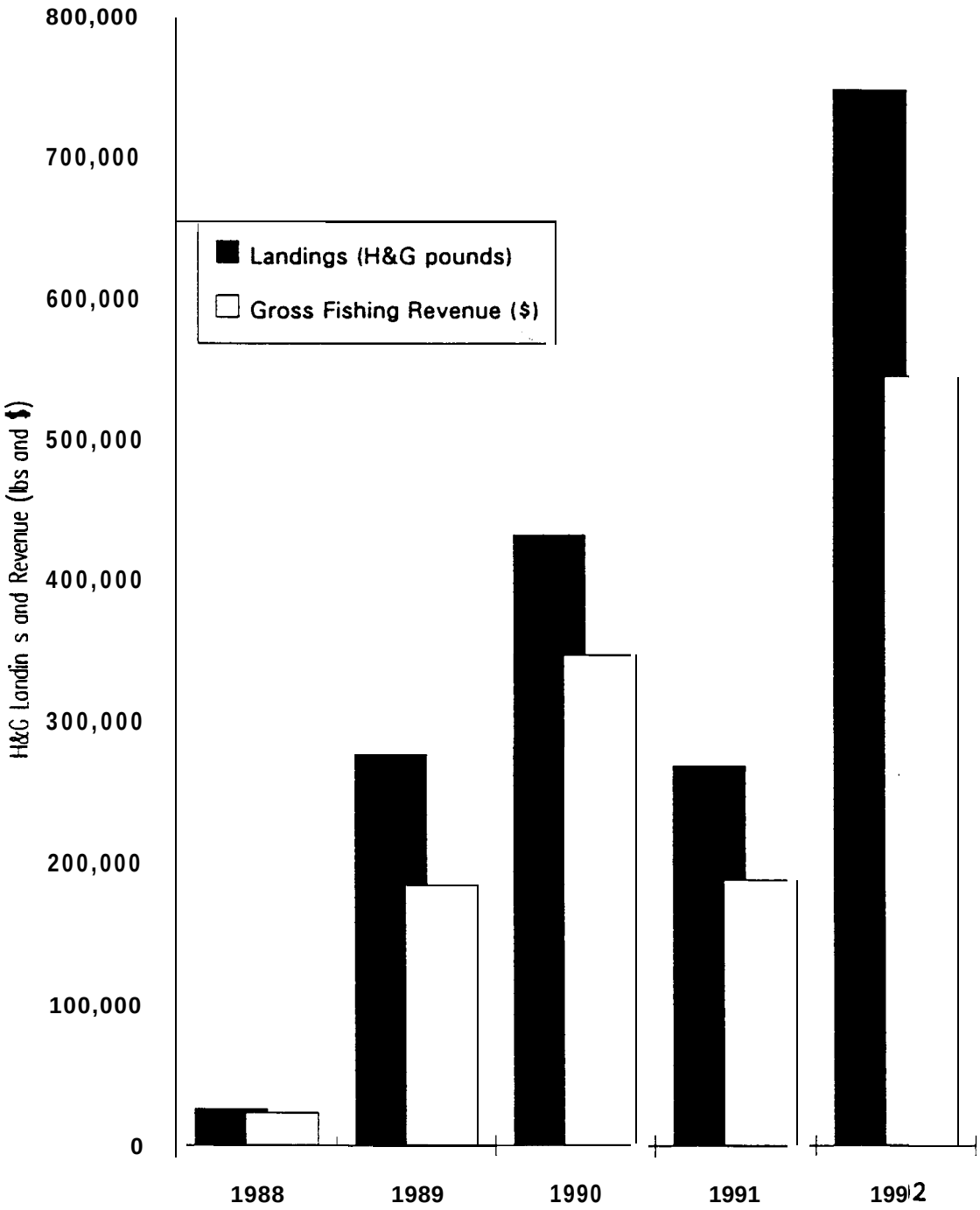
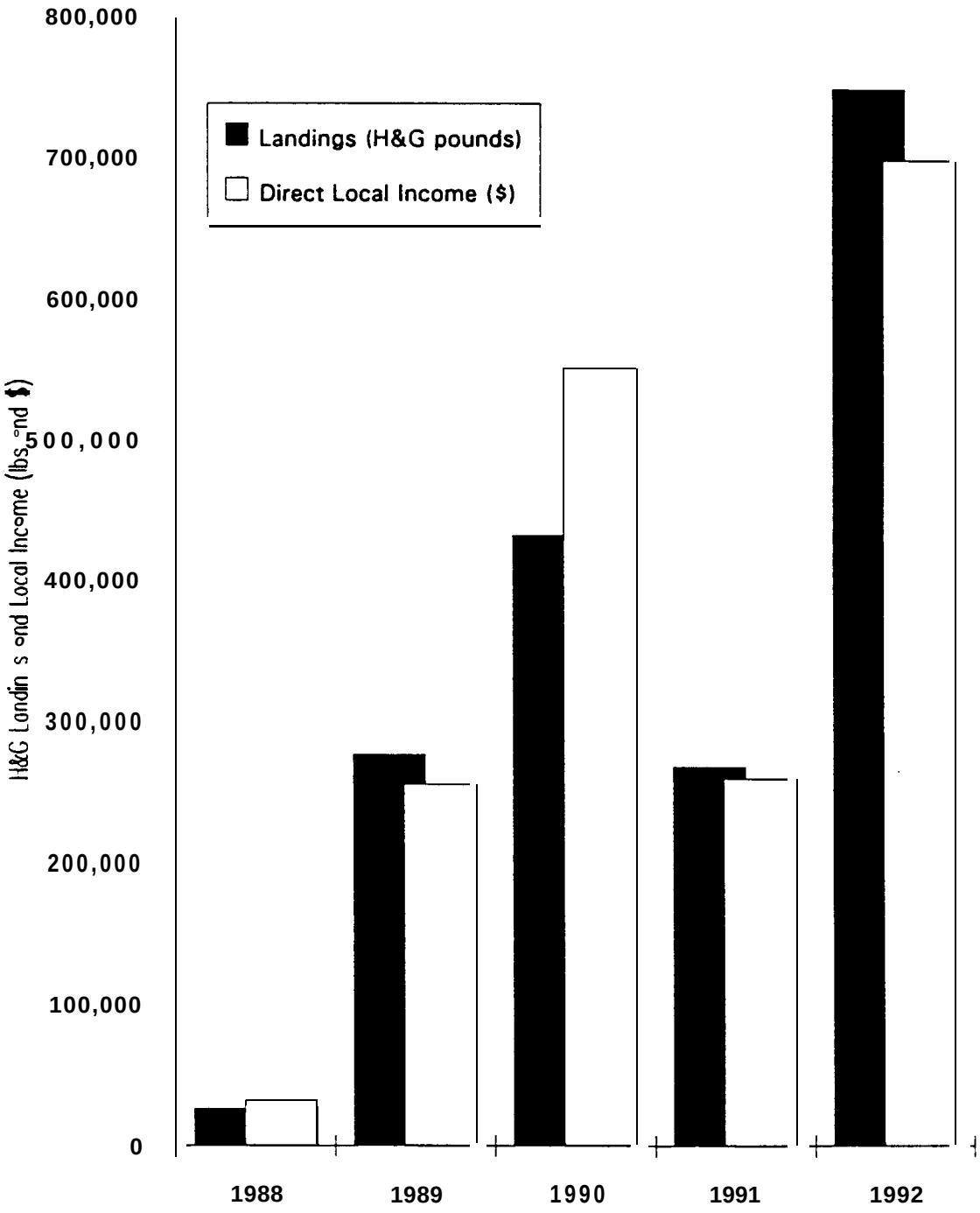


Figure 2. Pangnirtung winter turbot fishery, iandings and total direct local income, 1988-1992.



Interviews with two of the 20 randomly chosen fishermen could not be arranged. The random choice of fishermen was made prior to the start of the 1992 fishery and prior to complete analysis of fishermen landings in 1991. Consequently, the results of the interviews for two fishermen in 1992 and three in 1991 could not be used because they either did not fish in those years or their participation was very limited. Thus the 1991 cost and earning analysis consisted of 15 fishermen representing 49% of the fishery's production. For the 1992 cost and earning analysis, the sample consisted of 16 fishermen representing 44% of production, The results in tables 5 and 6 were drawn from personal interviews with fishermen, the landings records of CSFL and P&L, the fishing gear sales records of CSFL, and price surveys of local inputs.

From table 5 it can be seen that in 1991, the average net income to fishermen was $1,241 on an average landed value of $6,156. For the 1992 season shown in table 6, average net income was $4,316 on an average landed value of $15,030. Expenses are shown as a percent of gross income for both years which shows consistency in variable costs such as fuel and labour. However depreciation of equipment, while having increased absolutely from 1991 to 1992, is reduced as a percent of gross revenue.

6.3 Fishermen Opportunity Costs and Benefits

The subjective responses of fishermen to questions concerning opportunity costs of fishing are summarized in table 7. From this summary, it is evident that most turbot fishermen were primarily occupied with hunting in winter and spring, prior to the inception of the turbot fishery. It is also quite evident that the main reason they began turbot fishing was to earn cash income. While several mentioned they enjoy fishing because of its similarities to traditional Inuit men's work, they acknowledged the need for cash income. When asked for what this money was used, many mentioned household expenses without hesitation.

Table 5. Average costs and earnings of Pangnirtung turbot fishermen in 1991 (n= 15).

Gross Revenue	**$6,156**	**100%**
Expenses		
Fuel	618	10%
Food	883	14%
Labour	1,022	17%
Fishing Gear	520	8%
Repairs	170	3%
Depreciation		
Snowmobile(s)	1,055	17%
Capitalized Fishing Equipment	452	7%
Other	194	3%
Total Expenses	**4,915**	**80%**
Net Income	**$1,241**	**20%**

Average Weekly Income	**$103**
Fishing Season Length (weeks)	**12**
Average H&G Turbot Price ($/lb)	**$0.70**

Table 6. Average costs and earnings of Pangnirtung turbot fishermen in 1992 (n = 16).

Gross Revenue	**$15,030**	**100%**
Expenses		
Fuel	1,658	11%
Food	- 2 , 0 7 3	14%
Labour	2,746	18%
Fishing Gear	1,220	8%
Repairs	457	3%
Depreciation		
Snowmobile(s)	1,791	12%
Capitalized Fishing Equipment	503	3%
Other	265	2%
Total Expenses	**10,714**	**71%**
Net Income	**$4,316**	**29%**

Average Weekly Income	**$206**
Fishing Season Length (weeks)	**21**
Average H&G Turbot Price ($/lb)	**$0.73**

Table 7. Summary of responses of fishermen to questions not relating to direct costs of fishing (n = 18).

Questions	Responses and Frequency				
Previous winter activity before turbot fishery?	Hunting 13	Job 4	Carve 1	Nothing 1	
Reason for changing to turbot fishing?	Money 14	Enjoy Fishing 1		N/A 3	
Has turbot fishing affected how often you hunt during the turbot fishery?	Much Lass 8	Less 5	No Effect 2	N/A 3	
Do you hunt during turbot fishing trips?	Never 4	Sometimes 11	Oftan 2	N/A 1	
Has turbot fishing affected how often you hunt during sea ica months before and after the turbot fishery?	Mora 6	No Effect 5	Lase 3	N/A 4	
What do you buy with tha money you aarn from turbot fishing 7	Household Expenses 7	Fishing Equipment 5	Snowmobile 4	Gae 2	Outboard Motor 2
Why do you fish for turbot?	Money 12 ‘	Enjoy Fishing 5	Purchase snowmobile 3	Something to do 2	Fill Inuit Quota 1

N/A No answer or not applicable

Note: Rows with total responses greater than 18 caused by more than one response per question.

Another common response was re-investment in supplies and equipment, including snowmobiles, to continue turbot fishing.

With respect to the effect of the fishery on fishermen's hunting activities, almost all mentioned they hunted less or much less often during turbot fishing months than before there was a turbot fishery in Pangnirtung. However, responses indicate that most of the fishermen occasionally take short trips for seal, caribou and narwhal at appropriate times of the fishing season. This is possible in part, because these hunting grounds are closer to the fishing sites than is Pangnirtung. The effect on hunting activity of turbot fishermen in the early winter months prior to the turbot fishing season, and in the spring following the turbot fishing season, but before the sea ice breaks up, is not as strong as the change in activity within the turbot fishing season. About twice as many fishermen reported they hunted more often in the spring than in the early winter before the turbot fishery season begins. Almost one third reported no change.

6.4 Plant Worker Opportunity Costs and Benefits

Responses to the plant worker questionnaires are summarized in table 8. All but one plant worker was previously employed although some of the employment was in casual or irregular positions. Yet most also reported they would not be working if it were not for the fish plant jobs, Most of the women had virtually no formal education and therefore had job skills limiting them to janitorial and traditional types of work. Almost unanimous was the response that work at the fish plant resulted in less attention to traditional duties in their home, However, they noted that such duties could wait until the fishing season was over. Alternatively, if something was important, a relative would help out with the task. Half of the women felt this change in their activity from traditional women's duties to a job outside the home was a positive change because of the need to earn cash income. Women's

Table 8. Summarized responses of fish plant workers (n= 6).					
Questions	Responses and Frequency				
Previous employment?	Retail Clerk 1	Janitor/Maid 2	Sewing/Weaving 2	None 1	
Why change to fish plant?	More enjoyable 1	Regular hours 2	Laid off 1	N/A 2	
Where would you be working if there was no fish plant?	Janitor 1	Retail clerk 1	No 4		
For which other jobs are you qualified?	Retail Clerk 1	Janitor/Maid/Kitchen 3	Sewing/Weaving 2		
Are those jobs better than fish plant jobs?	Yes 1	No 2	Depends 2	N/A 1	
During turbot fishing season do you spend more or less time at traditional women's activities?	Less time 5	No change 1			
Is this change good or bad?	Good 3	N/A 3			
What do you buy with fish plant income?	Household Expenses	Furniture 2	Clothing 2	Food 2	Hunting Equip. and expenses

N/A No answer.

Note Rows with total responses greater than six caused by more than one response per question. Responses may not be mutually exclusive.

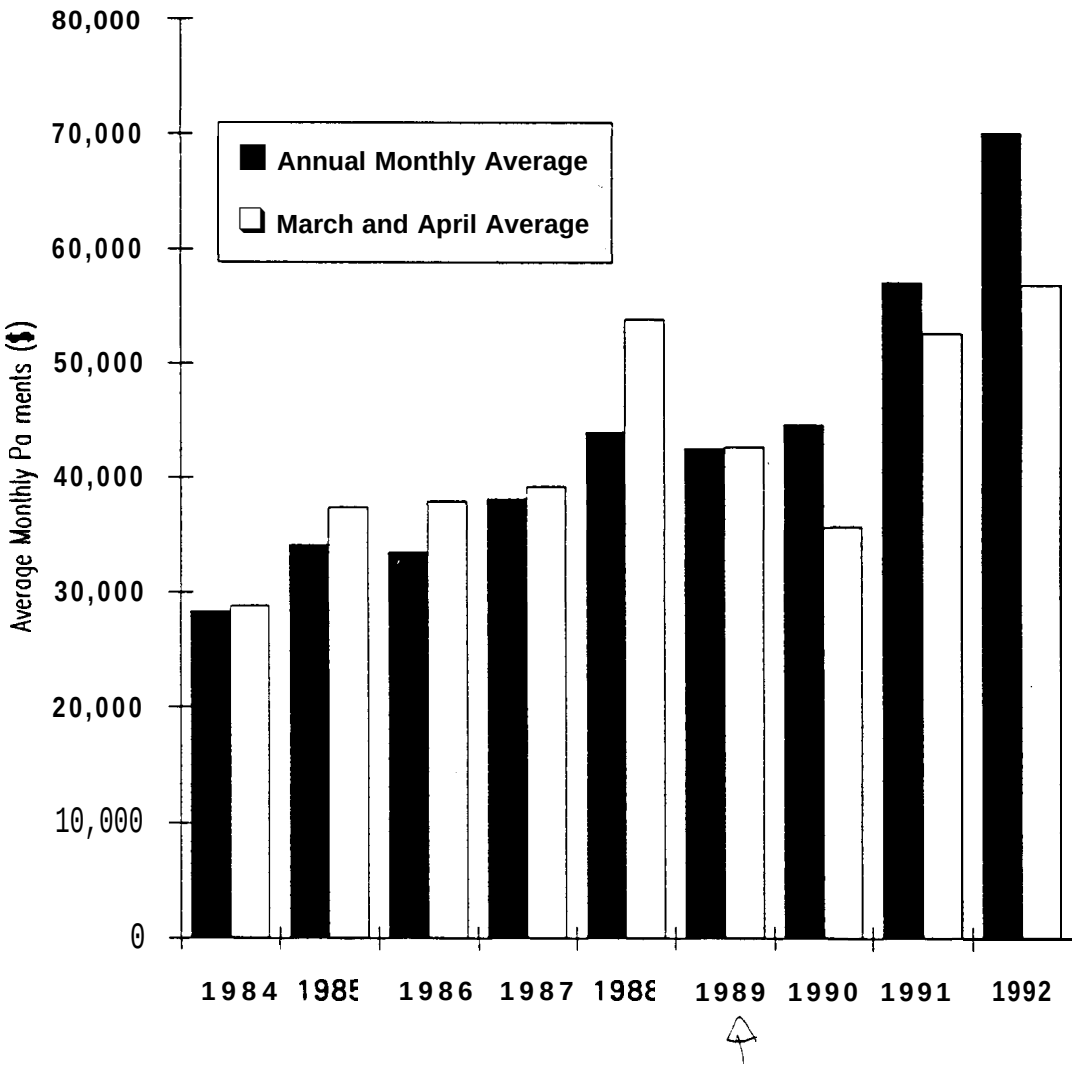
income from the fish plant tended to be spent on household expenses. Only one woman stated some of her money went to help purchase equipment and expenses for hunting.

It is also interesting to note that most women felt the seasonal nature of the fishery was positive since it provided them with at least ten weeks of annual employment. With ten weeks of employment they would qualify for unemployment insurance benefits in the remainder of the year, and would have ample free time to pursue other interests. Only one woman stated she would prefer a full-time, year-round job.

6.5 Social Assistance Payments

The effect of the Pangnirtung winter turbot fishery on social assistance payments in Pangnirtung is shown in figure 3. Beginning in 1989, the first year of commercial production in the fishery, March and April social assistance payments show a decline relative to average monthly payments for the entire year. Prior to 1989, March and April social assistance payments were higher than average monthly payments for the same year.

Figure 3. Total monthly social assistance payments in Pangnirtung (does not include UIC benefits), 1984-1992.



7.0 DISCUSSION

This final section discusses and interprets the results presented in section 6 with respect to the goals and objectives of the study. Three major themes are pursued. The first is the degree of success achieved by the Pangnirtung winter turbot fishery, as demonstrated by various indicators; the jobs and income that have resulted, the fishery's effect on traditional activities of participants, and its effect on social assistance payments and crime. The second theme is potential future problems created by the fishery. These should be recognized, discussed and addressed by managers of, and participants in the fishery. Lastly, the fishery development model is evaluated in the context of the long-term economic development of the community. Certain lessons, both positive and negative, have been learned in Pangnirtung through development of the fishery. They are useful lessons to share with others. The section ends with a few concluding paragraphs,

7.1 Success of the Fishery

The most visible impact of the turbot fishery on Pangnirtung is the income and jobs created as outlined in table 4. This income has grown to almost $700,000 in only 4 years of commercial production. Compared to the gross annual income in Pangnirtung ($9.2 million in 1990 (NWT Bureau of Statistics 1992b)), income directly from the fishery is becoming significant.

There has also been a large increase in the number of licensed fishermen; from nine in 1988, to 93 in 1992. These numbers represent only licensed fishermen and do not include the fishermen's helpers. There are three sources of new fishermen to account for the increase. Some individuals may start fishing without much direct practical experience. An annual, six-week commercial fishing course offered through Arctic College, which includes a

practical on-ice turbot fishing module, accounts for some of the entrants. Other entrants haye participated in the fishery for varying lengths of time as helpers and have now acquired the equipment and experience to become independent. Lastly, the fishery is drawing participants from two neighboring communities; Broughton Island to the north and Iqaluit to the south. These fishermen travel by snowmobile to Pangnirtung to take advantage of an opportunity not available in their own communities. Participation from other communities started in 1990, but involved only a few individuals in 1991 and 1992.

The length of the season is controlled by two independent factors. Fishery start-up depends on the readiness of the sea ice. Since the fishing grounds are 20 to 40 kilometers offshore, it takes one to two months for the floe-edge (transition of open ocean and sea ice) to move this distance from shore, Though the ice may be able to support sufficient weight earlier in the winter, fishermen must be reasonably confident that the ice is stable enough to remain in place during storms when winds may break free large ice pans and carry away the fishing platform and fish camps.

The close of the season is controlled by the market price of turbot. Because turbot from the Gaspé fishery appear in markets in April, the Pangnirtung fishery is under some pressure afterwards to drop its prices. As the Pangnirtung fishery becomes established, and depending on its success in reaching specialty markets, its price may stay high enough to continue production into May and June as it did in 1992. By mid-June the sea ice is becoming weak. It usually breaks up in early July. As has been seen between 1989 and 1992, the longer the season, the greater the landings and income generated. At 21 weeks, the 1992 season probably represented the longest possible fishing season. Any future increases in production will likely result from more participants and greater productivity on the part of individual fishermen. However, increased production must be considered in the context of the effect of fishing effort on the fish stock. This is discussed in section 7.2.1.

7.1.1 Cost and Earning Study

Tables 5 and 6 show that average net income of Pangnirtung turbot fishermen is considerably less than average gross income. Yet it has become common among government and industry to reference gross direct income when discussing the impact of the fishery. However, depending on the costs of fishing and related factors this may not be a fair surrogate to use as a measure of economic impact. Inputs to fishing, with the exception of labour, are not purchased locally, resulting in high leakage from the economy. Therefore, the use of gross fishing income as an indicator of the impact of the fishery should be replaced by or supplemented with the average net fishing income.

The initial intent of the study was that much of the information regarding fishing costs would be derived from the trip questionnaires. However, as stated in section 6.2, the trip questionnaires did not yield useful information. There are several reasons for the poor yield. " Many fishermen have little or no formal education. Thus they are not in the habit of writing and have limited writing and reading skills even in Inuktitut. The implications of this poor yield is not considered to have had a negative impact on the results since returned trip questionnaires showed rounded or estimated figures in many cases. This rounding or estimating occasionally occurred during the fishermen interviews. In these cases, as well as when a question or answer was not understood by either party, further discussion led to a more specific answer or clarification. This would not have occurred using the trip questionnaires.

Generally speaking the results of the fishermen interviews showed consistent responses to questions where this would be expected. Many fishermen remember exact prices (to the dollar) of equipment, supplies and replacement parts. The area of greatest variability is that

of capital equipment. It can be explained by different strategies of fishermen. Some fishermen purchase a new snowmobile each season. They have few repairs, fish often and tend to be highly productive. Others use a snowmobile for several seasons resulting in lower annual depreciation and higher repair and maintenance costs in later years. Fishermen's strategies also vary with respect to the use of one or two snowmobiles. Their helper may use a second machine or ride as a passenger on the fishermen's machine. Large differences in the capital costs and depreciation result from this variable.

Despite estimates of many expenses difficult to track, it is believed the cost and earning study presented is more accurate than previous studies. Some of the weaknesses of the previous studies are listed in section 4. One of the more serious of these is assuming a single or average strategy for snowmobile use. The present study collected actual details of snowmobile use and value from the fishermen sample, and calculated annual depreciation and relative use attributable to turbot fishing to arrive at an average 'depreciation. This is believed to be more accurate as shown in snowmobile depreciation differences between 1991 and 1992 (tables 5 and 6) reflecting the different lengths of fishing season in those years.

For comparison purposes of the cost and earning results of the Pangnirtung turbot fishery, table 9 presents results of costs and earnings of the smallest fleet sector of the Newfoundland fishery in NAFO division 3K (Newfoundland northeast shore). For the two years presented in table 9, total revenues at $15,558 and $10,368, producing net revenues of $6,395 and $4,051 respectively, are slightly better than the performance of the Pangnirtung turbot fishery. This fleet sector, of vessels under 25 feet in length overall, is comparable to the Pangnirtung turbot fishery with respect to several characteristics; total revenue, season length, and size of crew. There are also several differences, most notably the fishing platform. Many of the operations in the Newfoundland fishery employ more

Table 9, Results of costs and earnings studies of selected inshore fishing enterprises (less than 25 feet length overall) in NAFO division 3K (N. E. shore Newfoundland) in 1989 and 1990.

	1990	1989
Total Revenue	$15,558	$10,368
Fieh soles	15,463	10,368
Other	95	
Operating Costs	2.165	1,469
Fuel, Oil, Grease	1,602	1,167
Bait	96	61
Ice/Salt	79	64
Provisions	122	31
Non-fishing Labour	6	0
Othar	260	146
Repair and Maintenance Costs	431	209
Hull	131	8
Engina	148	61
Deck Equipment	36	15
Electronic Equipment	4	3
Facilities and Equipment	112	48
Net Gear Purchases	2.148	1,475
Nat Gaar Acquisitions	1,018	883
Gear Repairs	1,130	592
Fixed Costs	609	435
Insurance	61	55
Interest due	272	150
Wharf age	6	0
Storage	14	0
Faes	250	202
Other	6	28
Total Operating Costs	5.353	3,586
Labour costs	2,320	1,729
Depreciation	1,490	1,000
Return to Skippars and Boat owners	$6,395	$4,051
Season Length (weeks)	20.6	20.4
Per pound turbot price	$0.36	
Per pound groundfish price (average)	$0.26	$0.22
Par pound fish price (average)	$0.20	$0.27
Average siza of crew including skipper	1.3	1.6

Adapted from DFO (1 991a) and DFO (1991b).

than one type of gear and fish more than one species. Per pound prices tend to be lower in Newfoundland and the vessels land a much greater quantity of fish than does an average operation in the Pangnirtung turbot fishery. Nevertheless, the comparison is useful since it demonstrates the type and magnitude of costs for another fishery with comparable sales.

7.1.2 Fishermen Opportunity Costs and Benefits

Tables 5 and 6 show relatively low returns to fishermen for their effort and use of equipment. For only $100 to $200 per week, one wonders why the fishery is so attractive. There are several possible answers to this apparent anomaly which can be drawn from table 7.

It would appear that income from the fishery contributes to the cost of the fisherman's snowmobile which is also used for hunting and in-town transportation. Almost all Inuit men still hunt and supply at least some country food to their family and friends. As shown in table 7, 13 of 18 fishermen interviewed, considered themselves hunters prior to the inception of the fishery, All except one acknowledged they continue to hunt. However, the fishery has had an impact on their hunting activity.

Most of the fishermen stated that their hunting activity was reduced during the fishing season. However, most also stated they hunted during turbot fishing trips at least sometimes, which would tend to ameliorate the effect of reduced hunting trips during the fishing season. One third of fishermen interviewed, stated they hunted more often during winter and spring months prior to and following the turbot fishery, compared to before the inception of the fishery. For these individuals, this may support the argument that cash from the fishery is invested in equipment and expenses for subsistence hunting. In fact, these individuals agreed with that specific assertion on further questioning and discussion.

This assertion is not completely supported by the responses of fishermen to their uses of cash income from the fishery without further analysis. The most common response suggests cash is used for household expenses. Four of 18 respondents mentioned that cash from the fishery is used to buy snowmobiles. Five more respondents stated cash was used to purchase fishing equipment, which on further questioning was found to include snowmobiles. This totals half of the sample. It is suggested that income provided by the turbot fishery is used to purchase snowmobiles which, in addition to being the major capital item required for turbot fishing, are the major capital item required to hunt during winter and spring. This could imply the fishery does support the subsistence economy since cash earned in the fishery is used to help pay for hunting equipment. Without the additional income earned in the fishery, hunters might find it more difficult to purchase hunting equipment and supplies. Further, this income is paid to those with traditional skills more likely to utilize a greater portion of their cash for hunting activity.

Two interesting comments about the effect of the fishery on hunting patterns and perceptions were mentioned by a few fishermen. They said they learned through experience to hunt more frequently just prior to the fishery season. This allows them to "stock up" on country food. Once the sea ice is ready at the turbot fishing grounds and fishing begins, they would rather direct their efforts to the fishery. It was also noted that owing to the hard work and effort required of the turbot fishery, hunting activity following the season may drop. This is because some fishermen take the opportunity of relaxing after the fishing season, especially if their bills are paid and they have some savings from the fishing season.

Two fishermen reported that the turbot fishery, and the cash income that it generates, have caused them to be more aware of their lack of cash prior to the turbot fishing season. This

lack of cash in autumn and early winter has only recently become noticeable, as fishermen anticipate the coming of the fishing season and the cash it generates.

7.1.3 Plant Worker Opportunity Costs and Benefits

Table 8 summarizes the interview responses of plant workers and provides the information discussed below, Plant workers tend to be unilingual (in Inuktitut) women. Most of them were underemployed prior to the inception of the turbot fishery. Because they tend to lack skills gained through formal education, their employment opportunities are limited to jobs such as fish processing and sewing or weaving. There are also a limited number of janitorial jobs in Pangnirtung which are typically filled by unilingual women. While most stated they would be unemployed if the turbot fishery did not exist, on further questioning they stated they would probably return to the casual work they did prior to the inception of the fishery. The implication is that value-added jobs created by the fishery, are jobs for which the necessary skills are in ready supply in Pangnirtung. If job vacancies in casual or irregular non-fishing jobs result when people take jobs at the fish plant, these vacancies can be readily filled by unemployed workers in the community.

The Pangnirtung fish plant does, however have a definite effect on the activity of its employees. Almost all women stated they had less time during the turbot fishery to attend to their household responsibilities, especially at times during the season when they worked overtime. But with half of them considering this to be a positive change in their activity, while the other half did not respond to the question, one might imply opportunity costs appear to be well below the value to plant workers of the cash income they receive from work at the fish plant. Most commented that cash income was a necessity. Several also stated that despite their job at the fish plant interfering with their household responsibilities

during the turbot fishing season, these things could wait, or a relative or friend could assist in the interim.

Since the Pangnirtung turbot fishery began commercial operations, many fish plant workers have qualified for unemployment insurance benefits from their seasonal employment at the fish plant. The result of this is a further injection of cash into the local economy. Women, many of whom previously worked only casually and probably did not qualify for unemployment benefits now qualify and collect these benefits between fishing seasons. Most of the plant worker sample commented on the fish plant/UIC cycle, stating it was an attractive feature of fish plant work. Several noted this cycle allowed them to engage in traditional pursuits, with strong social or cultural returns during the rest of the year, despite these activities having small or negative economic returns. Only one respondent reported a preference for a full-time job over work at the fish plant and UIC benefits. She enjoyed keeping busy and work did not interfere with her household duties. These comments might be interpreted as implying the fishery supports cultural traditions to a very small extent. A future implication of the preference for collecting UIC benefits rather than seeking summer seasonal employment is briefly discussed in section 7.2.2.

7.1.4 Social Assistance Payments

As discussed in section 6.5 and shown in figure 3, the Pangnirtung turbot fishery has a significant effect on social assistance payments in Pangnirtung. Prior to 1989 and the inception of the fishery on a commercial basis, social assistance payments in March and April tended to be higher than the average monthly payments for the same year. After 1989, with the fishery operating at a scale large enough to impact many people, March and April social assistance payments began to decrease below the average monthly social assistance payments. Further, as seen in figure 3 and table 4, there appears to be a

relationship between this decrease in March and April payments and length of fishing season or 'monetary benefits in the same year. The longer the fishing season (for example 1990 or 1992), the greater the monetary benefits of the fishery, and the greater the decrease in , March and April social assistance payments relative to average monthly payments for that year. The relatively short fishing season of 1991 shows a much smaller decrease in March and April social assistance payments.

Beyond the obvious reduction in social assistance payments during the fishery, there are other significant impacts relating to social assistance payments. For example, until 1993 in Pangnirtung, social assistance payments could only be issued as a conditional cheque for credit at a local store toward certain purchases. Restrictions applied, especially on conversion to cash, to limit abuse. In the context of this study and the dynamics of the mixed economy, it would also limit the ability of recipients to use social assistance to invest in hunting or fishing equipment or expenditures such as gasoline. It" would also limit the ability of those social assistance recipients with a desire to turbot fish but without the cash resources, from purchasing the equipment or expendable inputs. The effect of the change in social assistance policy from restricted to discretionary use of social assistance, will take time to evaluate.

The opportunity for participants in the fishery to earn a cash income rather than having to rely on social assistance must also be considered in terms of the impact on the self-esteem of individuals. This could include UIC benefits collected between fishing seasons and considered by some as an earned benefit. This positive impact on self-esteem may be an explanation for the strong interest in turbot fishing when compared to the relatively low returns shown in tables 5 and 6. The opportunity of earning an income, even when the monetary returns are lower, may be preferable to collecting social assistance. This argument is strengthened when the job is desirable.

7.1..5 Other Social Impacts

A reduction in crime during months of the turbot fishery has been noted by the Pangnirtung RCMP (Cpl. W. Leil, personal communication) and some community leaders. It is attributed to the opportunities the turbot fishery creates and the constructive occupation of young men whom some would say otherwise have nothing to do and therefore break the law. One fisherman stated during an interview, that his helper may not be available in the coming season because he was scheduled to appear in court soon on charges dating to the turbot fishery off-season, and may be imprisoned. Because the fishermen believes that the turbot fishing keeps this individual constructively occupied and earning an income during the fishery, he plans to speak to the court on behalf of his helper to suggest that fishing in combination with retribution or community service, rather than imprisonment, might better serve justice.

7.2 Potential Future Problems

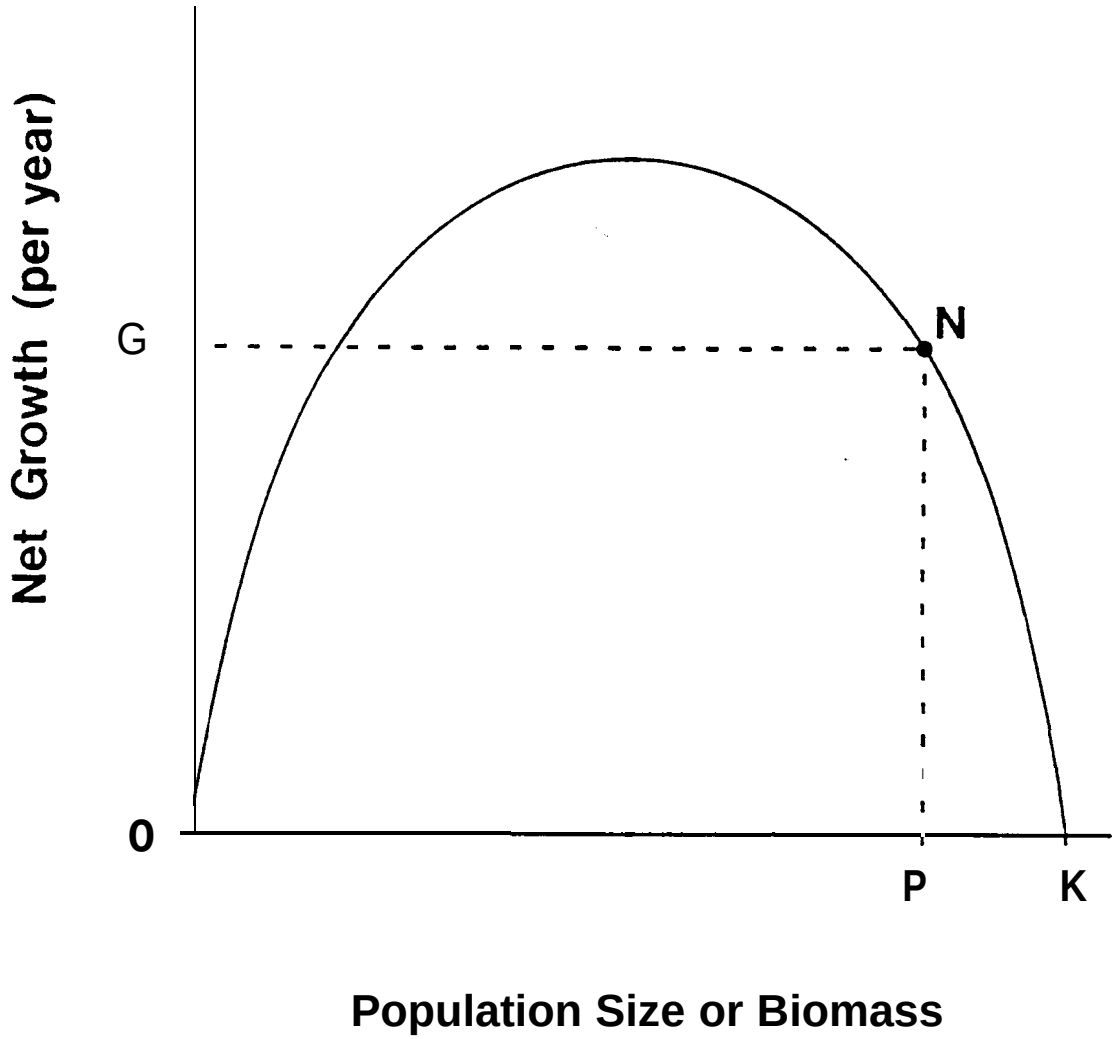
This sub-section is a warning to participants in the Pangnirtung turbot fishery, especially those who have come to rely on the fishery as an important source of income. It is also a reminder to fishery managers who tend to have difficulty controlling fishing effort, which too often leads to over-fished stocks that can no longer provide the income participants have come to expect from the fishery. Section 7.2.1 reviews a basic model of a fishery to outline how fisheries become over-fished. A suggestion is made to control effort in the Pangnirtung turbot fishery. Section 7.2.2 comments on access to UIC benefits created by the fishery and the potential danger this can cause to the economy.

7.2.1 Effect of Fishing Effort on the Turbot Stock

The impact of a fishery on the local economy must include consideration of the effect of fishing effort on the fish stock. This is especially true in a previously unexploited or under-utilized stock. The Cumberland Sound turbot stock is considered under-utilized. At present, Cumberland Sound turbot are managed by DFO as part of the NAFO division O (the west side of Baffin Bay and Davis Strait) stock (DFO 1991 c). While DFO research to learn more about the stock dynamics is underway, no definitive results have yet been published. For turbot in NAFO division O, the annual total allowable catch (TAC) is set at 12,50Q tonnes based on J.A. Gulland's principle of $F_{0.1}$ (see DFO 1991 c). $F_{0.1}$ is the level of fishing mortality (or catch in a fishery) set as one tenth the initial catch per unit of effort (CPUE) in a very lightly exploited fishery. Prior to 1992, part of the TAC has been held in reserve. But in 1992, this reserve was allocated to unassigned quota which became available to the groundfish developmental program, designed to harvest under-utilized species. Thus this stock, which was previously under-utilized, has in the past decade become exploited by two new fisheries; the (offshore) groundfish developmental program and the Pangnirtung winter fishery, This increased pressure on the stock calls for caution on the part of fishery managers, who should review regulation of the fishery,

Fisheries are managed using models which describe relationships between variables in the fishery. These models are used to predict the effect of certain variables on others. A very simple and useful model describing the relationship between (fish) population size or biomass and its net growth per time period (usually per year), is the logistic growth model shown in figure 4. It should be noted that not all fish stocks behave according to the relationship described by the logistic growth model. However, most groundfish stocks do behave according to this relationship and this model may therefore be useful in describing the Pangnirtung turbot fishery. At K, the population is at the environmental carrying

Figure 4. Logistic Growth Model



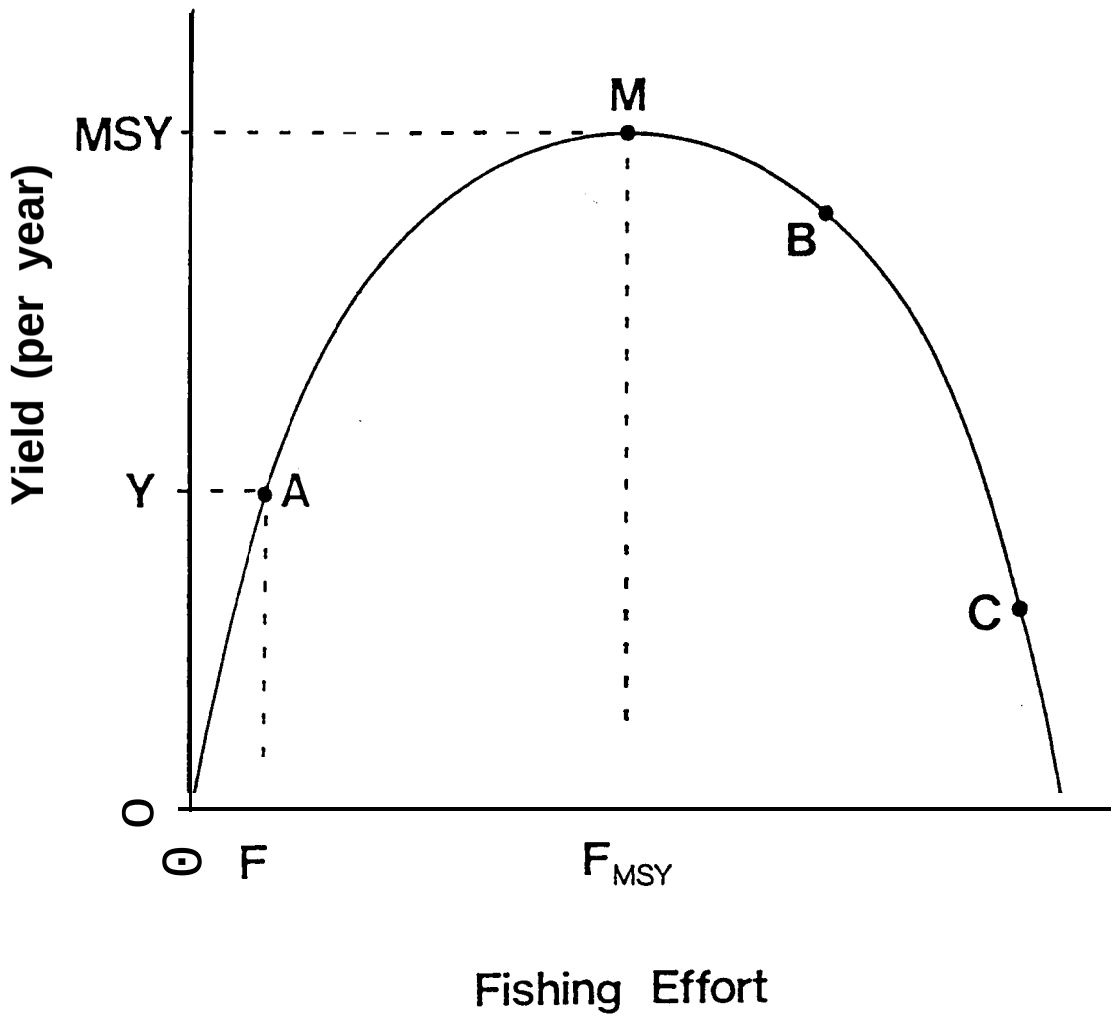
capacity and net growth is O. If the population has a reduced biomass, for example at P, the model describes the net growth of G that will occur. Eventually, net growth will return biomass to K.

The logistic growth model suggests a sustainable fishing strategy. If the biomass of a fish population is below K, then the net growth that will occur can be removed from the fish stock as a yield. The population will remain at that level of biomass. That same net growth can be removed on a sustainable basis. At N for example, net growth of G can be removed as a yield and biomass will remain at P. This same yield, equivalent to G can reoccur on a sustainable basis, since the population biomass will remain at P as described by the logistic growth model. A sustainable yield can occur at any point along the curve described by the logistic growth model.

Figure 5 shows a curve of long-run yield from a fishery as a function of fishing effort, It is known as the surplus yield or Schaefer fishery model (see Cunningham, Dunn & Whitmarsh 1985 and Pitcher & Hart 1982). This curve is a mirror image of the logistic growth model in figure 4 such that K in figure 4 corresponds to a fishing effort of zero in figure 5. High levels of fishing effort in figure 5 correspond to low levels of population size or biomass in figure 4. Each point on the curve in the Schaefer model represents a long-run equilibrium between yield and fishing effort and thus a corresponding level of biomass, such that the yield in figure 5 matches the net growth in figure 4. To achieve this equilibrium, fishing effort must settle at or around a stable level long enough for the biomass to adjust to a size corresponding to that effort level.

Fishing effort consists of two components. The first is the capacity of the fishing unit such as a fishing vessel or a long-line. The second component is the period of time that the unit

Figure 5. Schaefer Fishery Model



is fishing such as a day or an hour. Thus fishing effort is expressed as a vessel-day, or in the case of a long-line fishery, a skate-soak (the setting and retrieval of a long-line).

Increases in fishing effort occur in many ways. These can be obvious such as a longer fishing season, larger fishing boats or more fishermen. Increases in fishing effort can also be more subtle such as gains in experience of fishermen or technological innovations in their gear. The challenge for fishery managers is to be aware of these changing factors and to account for them in fishery regulations in order to control fishing effort. This has proved elusive in many fisheries.

A newly exploited or under-utilized fishery might have a sustainable effort and yield relationship at point A on figure 5. Yield is well below maximum sustainable yield (MSY); in fact MSY and F_{MSY} are probably unknown. As fishing effort increases, yield increases. However these increases in yield are gained not only by increased net growth described by the logistic growth model, but also by reductions in stock biomass since the Schaefer model relates increased fishing effort to decreased biomass. Fishermen come to expect high yields from the fishery for relatively low levels of effort. But while yield is increasing (until MSY), catch per unit of effort (CPUE) is decreasing. Because, fishermen are largely unaware of these dynamics, they tend to expect increased effort to result in increased yield. Decreases in CPUE can be hidden by experience gains and gear innovations. At M, further increases in effort (such as to points B or C on the curve) can no longer result in increased sustainable yields. To avoid over-fishing and depleting fish stocks as described above, fishery managers must regulate effort at conservative levels while the stock dynamics and MSY of new fisheries are being determined through study and monitoring of the fishery.

Little is known about the population dynamics of the turbot in Cumberland Sound or those in Davis Strait, with which they are managed as a single stock. Therefore it is difficult to

quantify the relationships briefly discussed above, However, assuming that the Schaefer fishery model is applicable to the Pangnirtung turbot fishery, certain predictions can be made regarding the dynamics of this new fishery. This is an important exercise in order to prepare Pangnirtung and its fishermen for reductions in CPUE that will inevitably occur as the turbot fishery matures. Since the stock has been fished for less than ten years (and has not yet reached the TAC as set by DFO), effort and yield are probably low relative to the MSY assumed by DFO. However, the TAC assumes that Cumberland Sound turbot are part of the Davis Strait stock. If Cumberland Sound turbot are instead a discrete stock, it is possible that yields may already be exceeding the MSY of the stock in the sound. In either case, because this concerns a new fishery, fishing effort will be reducing stock biomass from its initial maximum level. Yield from the Pangnirtung fishery could be made up of significant stock-biomass components, relative to net-growth components described by the logistic growth model in figure 4. Since CPUE is roughly proportional to the density of the stock, fishermen will be experiencing very high CPUE which is not sustainable because of decreasing stock density,

Yields which result from significant stock-biomass components (as opposed to net-growth components) are not sustainable yields at present levels of effort described by the Schaefer model in figure 5. Short-run yields, typical in a newly-exploited fishery (as is the Pangnirtung fishery), may be expected to exceed long-run sustainable yields. These short-run yields may even be large enough to exceed the MSY of the stock. There is no method to immediately determine this. The stock must be fished at a constant level of effort for a period of time until reductions in stock biomass cease and a long-run equilibrium is reached on the yield curve shown in the Schaefer fishery model. At this point yields will consist solely of net-growth components and these may be much lower than early yields from the fishery despite higher levels of effort.

In the interest of protecting the fish stock from over-fishing, and therefore protecting the fishing and fish processing jobs, it is suggested that fishery managers introduce some fishing effort regulations during this early stage in the fishery. While the appropriate level of fishing effort, based on bioeconomic relationships is unknown, introduction of effort regulations at some low level introduces and establishes fishery management regulations to fishermen and the fishery. At present no limitations exist and anyone can obtain an unrestricted licence at no cost. The danger in this is that each additional year the public has open access to the stock, the precedent of de facto right of open access becomes further entrenched.

Two restrictions are suggested to establish the right and responsibility of fishery managers to set regulations. First of all, a system of a limited number of licences should be introduced. All holders of licences in the previous season should be automatically issued licences under the new regulation. In future years, the number of new licences issued should be based on the number of active licenses in the previous season, and any new bioeconomic information which might have come to light. New licence applications should be reviewed and issued on the basis of other winter occupations of the applicant and previous licence and landings history. The objective is to limit part-time fishermen who maintain licences which can be used in a full-time manner to unexpectedly increase effort, confounding effort regulations. As stock dynamics become better understood, some rational number of licenses can be issued to ensure conservation of the stock and productivity of the fishery.

Secondly it is suggested that a gear restriction be applied to the fishery. At present, fishermen use up to two long-lines with up to about 130 hooks per line. Licenses should restrict holders from fishing in excess of that number of long-lines and hooks. As the fishery matures and CPUE declines, fishermen may wish to use additional long-lines and

hooks to maintain the high yields they have come to expect from the virgin-stock fishery. This suggested gear restriction will prevent fishermen from confounding effort regulations by fishing additional gear in order to maintain high yields. This suggested regulation also introduces an aspect of regulation to the fishery to establish the right and responsibility of fishery managers to set regulations before de *facto* open access becomes entrenched.

7.2.2 Access to Unemployment Benefits

The Pangnirtung winter turbot fishery has resulted in job and income generation in Pangnirtung which has increased access to UIC benefits. To some, including people in Pangnirtung, this is seen as a pure benefit, since eligible fishermen and fish plant workers can collect an income between fishery seasons while unemployed, and avoid the stigma associated with collecting social assistance. From a wider Canadian perspective, benefits may not exceed costs. While a societal cost benefit analysis is beyond the objectives of this study, it is useful to consider the long-term impact of increased access to UIC benefits from Pangnirtung's perspective.

Though eligible fishermen and fishery workers may see UIC benefits as earned benefits, it might also be said that UIC benefits are hidden social assistance. Workers may not seek employment or income earning opportunities between fishing seasons to further reduce their dependence on government. This is clearly seen in plant workers' mention of the fish plant/UIC cycle as being an attractive feature of fish plant work, allowing them to engage in traditional (or leisure) pursuits between fishing seasons. Without the initiative to pursue other employment between fishery seasons, fishery workers become dependent on the fishery and UIC benefits, and thus more prone to complete dependence on government if the fishery fails. This has been clearly seen in the current moratorium on the northern cod fishery in Newfoundland.

7.3 Evaluation of the Development Model

The legal ownership structure of CSFL was determined in 1988 by participants in the fishery and government officials of ED&T. It has been suggested the structure was chosen in haste and without due consideration of possible alternatives. It has also been mentioned that the community representatives involved in the decision did not have the experience to evaluate different possible legal entities for a commercial fishing business. Perhaps neither did the government officials, with little commercial fishery experience. However, considering the number of people consulted, perhaps sufficient time was not available to completely examine the alternatives and make the best choice for the community given the circumstances.

An evaluation of the development model is a useful exercise both for the Pangnirtung people involved in the decision, and for people in other eastern arctic communities. If commercially exploitable fish stocks are found close to other communities, and there is a desire to exploit these stocks, residents there could benefit greatly from the experience in Pangnirtung. Therefore the implications of the ownership structure and management of a commercial fishing business are discussed below under three general topics; local ownership and control, business legal structures, and board structure and size.

7.3.1 Local Ownership and Control

Local ownership of businesses in arctic communities imparts a sense of control and pride. It results in the community gaining a measure of control over its destiny through direct economic power. Local control of economic institutions in the community gives the community a direct say in how these organizations are run; the community can ensure that

decisions reflect the priorities of the community. In concert with knowledge of relevant factors affecting that type of organization (such as market conditions in the case of a business), it should be capable of achieving its mandate through goal-oriented planning.

CSFL did all these things. It was 100% locally owned and controlled. Legally, the board of directors had final authority on all matters. The board was being guided by different advisors whom they had no choice but to trust because of their limited experience. This led to financial difficulties in 1990 because of board inexperience and poor management. Despite recommendations to hire an experienced plant manager for the 1990 season, the board chose someone they knew and trusted but who did not have the proper qualifications, This was an expensive mistake for the company, but some of the board members learned a great deal from it.

In 1991, following the initial investment in CSFL by the NWTDC, the CSFL board retained control of the company and were provided with good advice from an experienced manager. " With that advice the board could make informed decisions on the management of the company. Some would say the depth of reasoning leading to decisions was beyond the capabilities of the board and therefore they were simply ratifying the decision of the manager. That is not an entirely fair statement, since board members varied in their degree of education, experience and interest in the management of the company, and therefore in their ability to understand the steps leading to a business decision. Clearly there were board members who could follow the arguments presented to them. While they may not have reached the same decision without the guidance of the manager, the process of informed decision making through expert advice is a critical component in the process of economic development. Through working with a trusted and appropriately-experienced advisor, and learning the process of business management, over time one gains these skills oneself.

Some ownership of the company was given up in 1991, when the NWTDC was issued preferred shares. However, as the CSFL board was aware, it retained decision making control. Further, the mandate of the NWTDC was clearly to divest itself of shares in companies in which it invested, once they became profitable and no longer needed the NWTDC's involvement. CSFL'S board was aware of this, and saw the NWTDC ownership as a temporary situation. Though it was never tested, it is possible that the CSFL manager, through the NWTDC, to whom he also had a reporting relationship, could have overruled board decisions which might jeopardize the business's best interests and the NWTDC's investment.

In the autumn of 1992, with a second investment in the Pangnirtung winter turbot fishery by the NWTDC, incorporated as Pangnirtung Fisheries Limited (PFL), majority ownership and control was removed from the community and was taken by the NWTDC. As with the previous NWTDC investment in CSFL, the community can buy back'the NWTDC shares in PFL once it is profitable. Directors of both CSFL and P&L Services Ltd. believe this will happen in about five years. While a board for PFL is to be established, at the start up of the 1993 turbot fishing season only one of the three community directors had been appointed. The PFL board had not yet met and there were no plans for a board meeting in the near future, This was in sharp contrast to previous years when there was a considerable amount of CSFL board activity as the fishery started and operated because the board was required to meet and make decisions on a regular basis. A weakness in the PFL structure and board is that if the lack of community involvement in management seen at the beginning of the 1993 season is any indication of the longer term PFL board activity, then board meetings could become infrequent and feigned, with the community having no real input. A forum for business education through practical board experience, of which the CSFL board was a successful example, will have been lost. It may well be lost until the NWTDC divests itself of interest in PFL. When that divestment occurs, will a local board be capable of assuming

management where the NWTDC management left off? Unfortunately, during the expected five years of NWTDC involvement, many years of practical directorship experience will have been lost.

Some would say that people in Pangnirtung simply want jobs and the resulting income. They do not care about the ownership of the organization, and do not necessarily want the responsibility of decision making. In the case of the turbot fishery, they are happy to let the NWTDC take effective control and majority ownership, because in exchange for control and ownership, a new fish plant will be constructed in Pangnirtung. A new plant would be capable of moving greater volumes of turbot and would allow PFL to diversify into other fisheries, resulting in more income to fishermen and plant workers. However, it would also mean that if and when the political climate changes such that support for the fishery or the NWTDC fades, the community may lose a lot. Rather than their only recourse being to blame government for the loss because they gave up control of the company in 1992, a skilled board with several years of experience in business management, and continuing to receive advice from an experienced manager, could recognize the change in times and make the necessary adjustments expected of an experienced board of directors. The business would then have better prospects of survival. The point of retaining or losing control and its relation to government dependence versus independence, is recognized by only a very few people, yet is such an important component of economic development.

7.3.2 Appropriateness of Business Structures

The business entity presented to and accepted by the community in 1988 to assume responsibility for the commercial aspect of the turbot fishery was a private limited company. As mentioned above, the community was not familiar with the advantages and disadvantages of various business structures, despite the existence in Pangnirtung of a

co-operative, several proprietorships and private limited companies, and a large corporation (the Hudson's Bay Company). Unfortunately, there was a lack of time to consider the pros and cons of these alternatives. Apparently the community accepted the suggestion of ED&T officials and CSFL was incorporated.

In retrospect, the explicit goal of a limited company to achieve profits, coupled with the 1989 profit of CSFL, set high expectations for the fishery to be a consistent profit generator. This is a troubling expectation given the reality of fishery dynamics as outlined in section 7.2.1. Fishery managers and business people should be very aware of the bioeconomics of exploited fish stocks and take appropriate actions to ensure that stocks are fished at sustainable and productive levels. In the case of a newly exploited stock, fishing effort and harvest should be conservative, at least until the specific dynamics of the stock are fully understood and incorporated into the fishery's management.

Reality would also indicate that on average, fish processing businesses are marginally profitable at best, even with government subsidies. At least part of the reason for this is the tendency to over-fish stocks. Goals of the Pangnirtung fishery have always been the creation of jobs, income and training opportunities. These are at least as important as generating a profit, yet they tend not to be reflected in the mandate of limited companies.

An alternative legal structure which better meets the criteria above, is a workers' or producers' co-operative. Many northern community co-operatives began as producers' co-ops to purchase carvings from the local carvers. Most later diversified into consumer co-operatives to supply their membership with store-bought goods. However, co-operatives have not always been successful in the north. There have been differences in priorities between the co-op movement in the eastern arctic and ED&T, which have made it difficult for the two organizations to work together. This may have led to the discounting of a

co-operative as a possible legal structure for the commercialization of the Pangnirtung winter turbot fishery.

A producer's co-operative may have retained the strengths of CSFL, but better addressed the issue of profit expectations and other commercial fishery objectives. The mandate could have been built on jobs, income, and training as well as profits. Fishermen and employees of the processing plant and its administration could have been required to purchase a co-op membership in order to work for the company or to land fish at the plant. The strength seen on the CSFL board by better educated members of the community not employed in fishing or processing, could still have been brought to a co-operative board through appointment for specific business and management skills. As a co-operative, without the overriding profit goal, perhaps fishermen and employees would be more willing to adjust their wages and income to the profitability of the business. At present the community expects the fishing company or government to subsidize the operation to maintain the jobs , and income.

Two other alternative models for the development of the fishery are worthy of brief mention. One of these is joint ventures, a good example of which is the offshore shrimp fishery in Davis Strait and the Labrador Sea. Regional Inuit birthright Corporations (Makivik Corporation in Northern Quebec and Qikiqtaaluk Corporation on Baffin Island) have gained access to shrimp licences through DFO'S policy of allocations based on adjacency to the resource. These corporations joint-venture with vessel owners to fish the allocations. This model is dependent on profitability so it would be difficult to attract joint venture partners without good possibilities of profit to balance the risk. Though they were unable to make arrangements in 1992, CSFL intends to joint-venture with a vessel owner to fish groundfish allocations from the 1993 Developmental Groundfish Program in NAFO division O.

Another possible model was considered by the CSFL board in 1991 before they decided to seek investment from the NWTDC. Two fish buyers, located in Ottawa and Montreal, were said to be prepared to provide the necessary cash to CSFL rather than have CSFL issue shares to the NWTDC. The involvement of one of these southern buyers could have taken the form of a majority share issue or an investment or loan contingent on the southern business getting a contract to manage the Pangnirtung operation. In both cases, the investor would probably have gained exclusive access to the product. CSFL would have lost control and perhaps majority ownership and some jobs if the investor chose to ship more whole product for processing in the south. CSFL'S board declined these offers in favour of the NWTDC offer, specifically because it knew that when the company was again profitable it could buy out the NWTDC's shares in CSFL. CSFL'S board was also aware of the NWTDC's commitment to the maintenance of jobs in the NWT.

7.3.3 Board Structure and Size

Several people who have sat on the board of CSFL readily mention that the board was too large. This made decision making difficult for two reasons. Some directors appointed by the Pangnirtung Hunters and Trappers Association (HTA) and the Pangnirtung Eskimo Co-operative Limited to represent their shares in CSFL were unable to contribute to the board because they lacked the skills to fully comprehend some issues and therefore to contribute to the meetings, While the HTA was issued shares in CSFL in part to recognize its role in the development of the fishery, their board had little to offer to a business entity. Other better-educated and business-experienced board members felt they themselves could adequately represent the interests of the HTA.

The Co-op was also issued shares in recognition of their support of fishery projects during the development phase. Additionally, because they operated a business, it was thought

they would to be able to contribute some business experience and services to the fishing company. If CSFL had been a small company, rather than immediately becoming such a large company by Pangnirtung standards, the co-op may have provided book keeping or supply ordering services. However, CSFL quickly became very large and took on these tasks themselves. In retrospect, the co-op has contributed little to the CSFL board. Some would say both the HTA and the co-op boards do not know their own mandates and goals; so how can they possibly appoint representatives to the CSFL board to bring their own memberships' interest and concerns to the CSFL board.

Boards in the eastern arctic tend to be larger than necessary and this ultimately slows and perhaps distorts decision making. Large size alone hinders consensus, and is exacerbated by representatives with unclear and inconsistent agendas. When organizations are being formed and boards being structured, more emphasis needs to be placed on the mandate of the organization and minimum representation of valid interests to achieve the mandate. Representation on boards and board size should be determined to reflect the mandate and not be based on an arbitrary number of seats,

Boards in the eastern arctic also tend not to take advantage of available expertise in certain areas or on specific issues. Term appointments as full or ex officio members, specifically to gain from available expertise, needs to be more seriously considered by boards. Concern may be expressed that such expertise does not reflect the community's aspirations or priorities. However, given a proper and clear orientation to the organization's mandate and goals and a clear role and position with the board, the appointment of such expertise should benefit local boards.

7.4. Conclusions

The Pangnirtung winter turbot fishery developed very quickly. This can be attributed to several factors including facilities for processing, favorable transportation links to markets, the presence of the necessary skills among participant's and their desire for work involving renewable resource harvesting. Perhaps the development occurred too quickly and led to problems that might otherwise have been avoided. This was best exemplified in 1990 when the lack of management skills resulted in near bankruptcy of CSFL.

The benefits created by the Pangnirtung turbot fishery are readily apparent in the large number of desirable jobs created and the income generated from both fishing and processing. The cost and earning study identified relatively low net returns to fishermen which questions the large number of fishermen and the rapid growth in their numbers since 1989. Two factors explain this anomaly. First of all, fishermen enjoy turbot fishing and are willing to fish for relatively low returns, especially when many of them would otherwise be unoccupied. Secondly, it appears that some earnings from the fishery are invested in snowmobiles. In addition to being essential equipment for turbot fishing, snowmobiles are essential equipment for winter and spring hunting. Since hunting remains a popular and important activity of Inuit men in Pangnirtung, the turbot fishery provides cash to defray some of the costs of snowmobiles.

It appears that the fishery does not have a negative impact on the traditional economy of harvesting country foods, though some changes in hunting patterns are apparent. Because many fishermen are also competent and consistent hunters, some of their fishing income is invested in hunting equipment. If the fishery causes a reduction in traditional activity during fishery months, it is an acceptable reduction because of the need to earn cash. This reduction may be ameliorated by increased hunting activity before and after the fishing

season. Similarly, plant workers accept a reduction in attention to their household duties during the fishing season, because the need to earn an income precedes household duties in importance.

The Pangnirtung turbot fishery clearly reduces social assistance payments in Pangnirtung during fishery months. It is also acknowledged that the crime rate decreases during fishery months, and this is attributed to the creation of fishing jobs.

Two potential future problems are identified. The first of these is the effect of fishing on the turbot stock. In the absence of fishery management which adequately regulates fishing effort, fish stocks tend to become over-fished and unable to support the historic levels of catch per unit of effort characteristic of a virgin fish stock. This is a result of the dynamics of populations and of fishermen behaviour. These must be understood and fishing behaviour regulated to maintain the productivity of the fishery. The second potential problem caused by the Pangnirtung winter turbot fishery is the access to UIC benefits it has created. This introduces a false sense of security since UIC benefits are considered to be earned benefits, rather than a form of social assistance. Dependence on government remains or may increase through access to a new source of government assistance.

Several lessons have been learned in the process of business development associated with the fishery. Local ownership and control are important components of economic development in the community. Local ownership imparts pride. Local control ensures that community priorities are reflected in development plans. Local control also provides the opportunity for business education.

Development of the turbot fishery in Pangnirtung was guided by a mandate to create jobs, income and training opportunities, as well as to generate profits. The limited company

formed to privatize the commercial aspect of the fishery did not adequately reflect this mandate, and consequently it may have contributed to financial difficulties. A workers' or producers' co-operative would have better reflected this multifaceted mandate and should be seriously considered in any future commercial fishery developments.

There is also a lesson to be learned regarding board size and structure. Generally the smaller the board, the easier to organize meetings and reach decisions. Boards should therefore only be as large as necessary to adequately represent members or shareholders. Boards in some Inuit communities tend not to utilize specific available expertise. More serious consideration must be made to appoint and take advantage of available expertise in areas where board skills are weak or lacking, or superior skills are available.

Many of the criteria critical to community economic development were in place in the operation of CSFL and have been identified. Weaknesses have also been identified. Generally, the Pangnirtung winter turbot fishery presents a good example and case study for the examination of renewable resource based economic development in aboriginal communities.

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