# ECONOMIC PERFORMANCE OF THE SUMMER COMMERCIAL FISHERY OF SOUTHERN INDIAN LAKE, MANITOBA

by

Murray W. Wagner

A Practicum Submitted
in Partial Fulfillment of the
Requirements for the Degree,
Master of Natural Resources Management

Natural Resources Institute
The University of Manitoba
Winnipeg, Manitoba, Canada
December, 1981

## ABSTRACT

During the summer of 1980 economic performance of 24 fishing enterprises operating on Southern Indian Lake was analyzed. Without the inclusion of two large income supplements in the accounts of the fishing enterprises, the enterprises operated in a marginal economic fashion. The average variable cost of fishing was $0.246/lb ($0.542/kg). Average total cost was $0.344/lb ($0.759/kg). These figures compare to an average revenue of $0.324/lb ($0.714/kg). The 24 enterprises generated $143,328 in gross revenue and had an aggregate cash flow of $29,797. Only 33% of the enterprises generated sufficient revenue to achieve long run economic viability. An additional 33% were viable only in the short term.

Inclusion of the two income supplements, a provincial freight subsidy and Manitoba Hydro compensation, in the analysis, made the fishery economically viable, from the viewpoint of the private accounts of fishing enterprises. Ninety-two per cent of enterprises were economically viable in the long run. An additional 4% were viable only in the short run.

While successive Manitoba Hydro compensation programs have each addressed compensation more effectively, in 1980 compensation was inadequate on the basis of Pareto optimality. This inadequacy was caused by narrowness of scope of the compensation program and by the difficulty involved in updating compensation to the continually deteriorating state of fish stocks.

Most enterprises did not fish in the intensive manner found necessary for unsubsidized economic viability. The somewhat casual attitude toward fishing displayed by some enterprises may have been caused by the perception, by the Indian and Metis fishermen, of fishing as part of a traditional lifestyle, and not only as an entrepreneurial activity.

Enterprises' revenues were limited by the total number of enterprises, the lake quota, and the mean number of nets set each day. The future of the unsubsidized and uncompensated fishery depends largely on future changes in fish populations, due to impoundment of the lake. The total number of enterprises which will be able to operate with economic viability depends largely on future compensation programs operated by Manitoba Hydro.

ACKNOWLEDGEMENTS

I extend my appreciation to the members of my committee, Dr. Wayne Everett (Manitoba Hydro), Dr. Bob Hecky (Fisheries and Oceans), and Mr. Peter Thompson (Fisheries and Oceans), for their constructive stimulating criticisms of my work.

Dr. Drew Bodaly (Fisheries and Oceans) extended to me the opportunity to proceed with this study, for which I am grateful.

I thank the people of the Department of Fisheries and Oceans research camp at Southern Indian Lake for their support, advice, and cooperation during the field work of this study. Mr. Noah Soulier, manager of the Loon Narrows landing station, and his wife Janet provided invaluable cooperation, information, and amenities during the study which I greatly appreciated. And I especially thank Mr. Timothy Johnson for his many unique contributions during the field work of this study.

This study would have been impossible to perform without the cooperation of the following Southern Indian Lake fishermen: Robert Baker, Paul Bird, Bill Clee, Billy Clee Jr., Lloyd Clee, Murdo Clee, Alfred Dumas, Rod Dumas, Don Dysart, Gerald Dysart, Louis Dysart, Marshall Dysart, Robert Dysart, Bill Linklater, Derek Linklater, Horace Linklater, Lawrence Linklater, Ray Linklater, Willard Linklater, Ken McLeod, Morris Michelle, Bob Moose, David Moose, Dougal Moose, Edward Moose, Ernest Moose, George Moose, Gilbert Moose, James Moose, Joe G. Moose, Joe S. Moose, John B. Moose, John W. Moose, Randy Moose, Riley Moose, Roy Moose, Wellington R. Moose, Willie Moose, Abel Spence, Adam Spence, Angus Spence, Johnny Spence, Martin Spence, Paul Spence, Ralph Spence,

Tommy Spence, Sam Thomas, and Thomas Wood. My thanks to them all.

The graphics in this report were kindly drawn by the Environmental Services Department of Manitoba Hydro. Karen Mann accommodated the very irregular demands of typing the manuscript.

Funding for the field work of this study was provided by a grant from Manitoba Hydro. In addition to administering this grant, the Federal Department of Fisheries and Oceans provided considerate logistic support. Additional funding was provided by the Manitoba Department of Natural Resources.

CONTENTS

Chapter Page

Chapter Page

Chapter Page

Chapter Page

TABLES

FIGURES

# Chapter 1

# BACKGROUND AND PROBLEM STATEMENT

## 1.1 Introduction

Remote inland fisheries often operate with marginal economic viability. A number of factors such as large numbers of fishermen relative to sizes of fish populations, high costs of transporting the product to market, and maintaining quality of the catch during transport contribute to marginal viabilities. In the case of Southern Indian Lake, factors influencing economic viability of its commercial fishery have, since 1976, been modified by impoundment and diversion of the lake as part of Manitoba's hydroelectric development. The new physical and biological base of the commercial fishery which has resulted from impoundment appears to have lessened the fishery's economic viability and has caused concern among fishermen and government agencies alike.

This report is an assessment of the economic performance of the Southern Indian Lake summer commercial fishery and the factors contributing to its performance. Net economic returns to fishing enterprises are the main parameter by which this performance is measured. This measure is viewed with a perspective on both the traditional native lifestyle and the post-impoundment limnological conditions.

## 1.2 Scope and Magnitude of the Commercial Fishery

### 1.2.1 Location

Southern Indian Lake (Figures 1 and 2) is located in north-central Manitoba (approximately 56°45' to 57°40'N; 98°10' to 99°30'W). It is the fourth largest lake in the province with a total pre-flooding surface area of 734 $mi^2$ (1930 $km^2$). Post-flooding surface area is 977 $mi^2$ (2530 $km^2$). Pre-flooding mean depth was 30 ft. (9 m) with a maximum depth of 121 ft. (37 m). Post-flooding mean depth is 33 ft. (10 m) (Bodaly et al. 1980, Cleugh et al. 1974).

### 1.2.2 History and Infrastructure

Commercial fishing began on Southern Indian Lake in the winter of 1941-42. The summer fishery did not begin until 1950. During the first three decades of the fishery, a number of fish buyers had landing stations on the lake, for varying lengths of time. At these stations fish were bought from fishermen and packed for further transport. Some stations were owned locally. Others were operated by companies based in the south. During summer, fish were flown to the railhead at Lynn Lake. Fish from the winter fishery were shipped by Bombardier or plane to Lynn Lake, Wabowden, or Sherridon (Weagle and Baxter 1973). From these points fish were shipped to Winnipeg.

In the early 1970's a fish packing plant was built at the new town of Leaf Rapids. Fish began to be transported to this plant by boat in summer and by snowmobile in winter. From there they were trucked to Lynn Lake.

Since 1969 the only buyer of fish in Manitoba has been the Freshwater Fish Marketing Corporation (FFMC), a federal crown corporation. The FFMC operates the packing plant at Leaf Rapids and two landing sta-

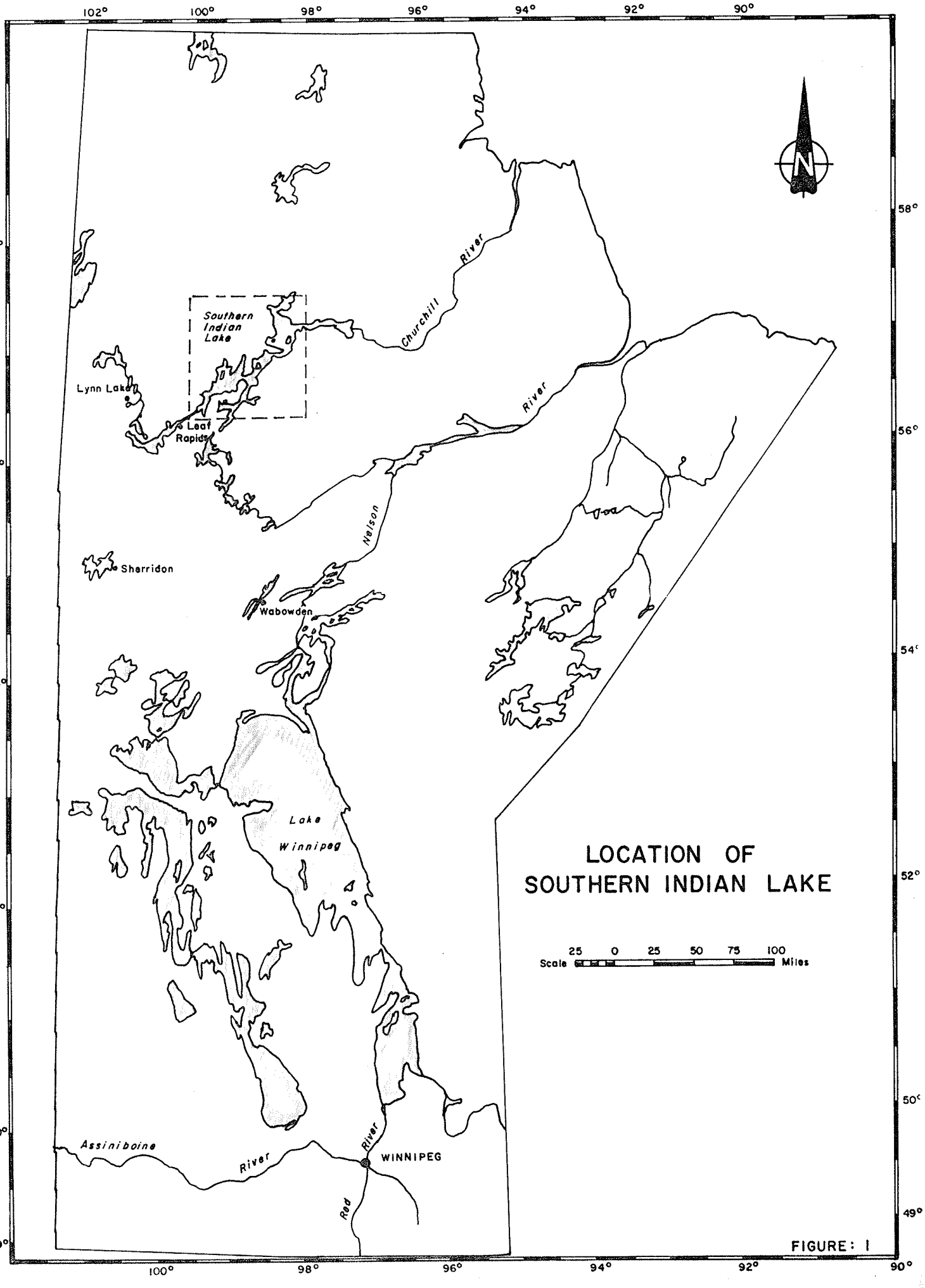

102°
100°
98°
96°
94°
92°
90°
58°
56°
54°
52°
50°
49°
N
Southern Indian Lake
Churchill River
Lynn Lake
Leaf Rapids
Nelson River
Sherridon
Wabowden
Lake Winnipeg
Assiniboine River
Red River
WINNIPEG
LOCATION OF SOUTHERN INDIAN LAKE
25 0 25 50 75 100
Scale
Miles

FIGURE: 1

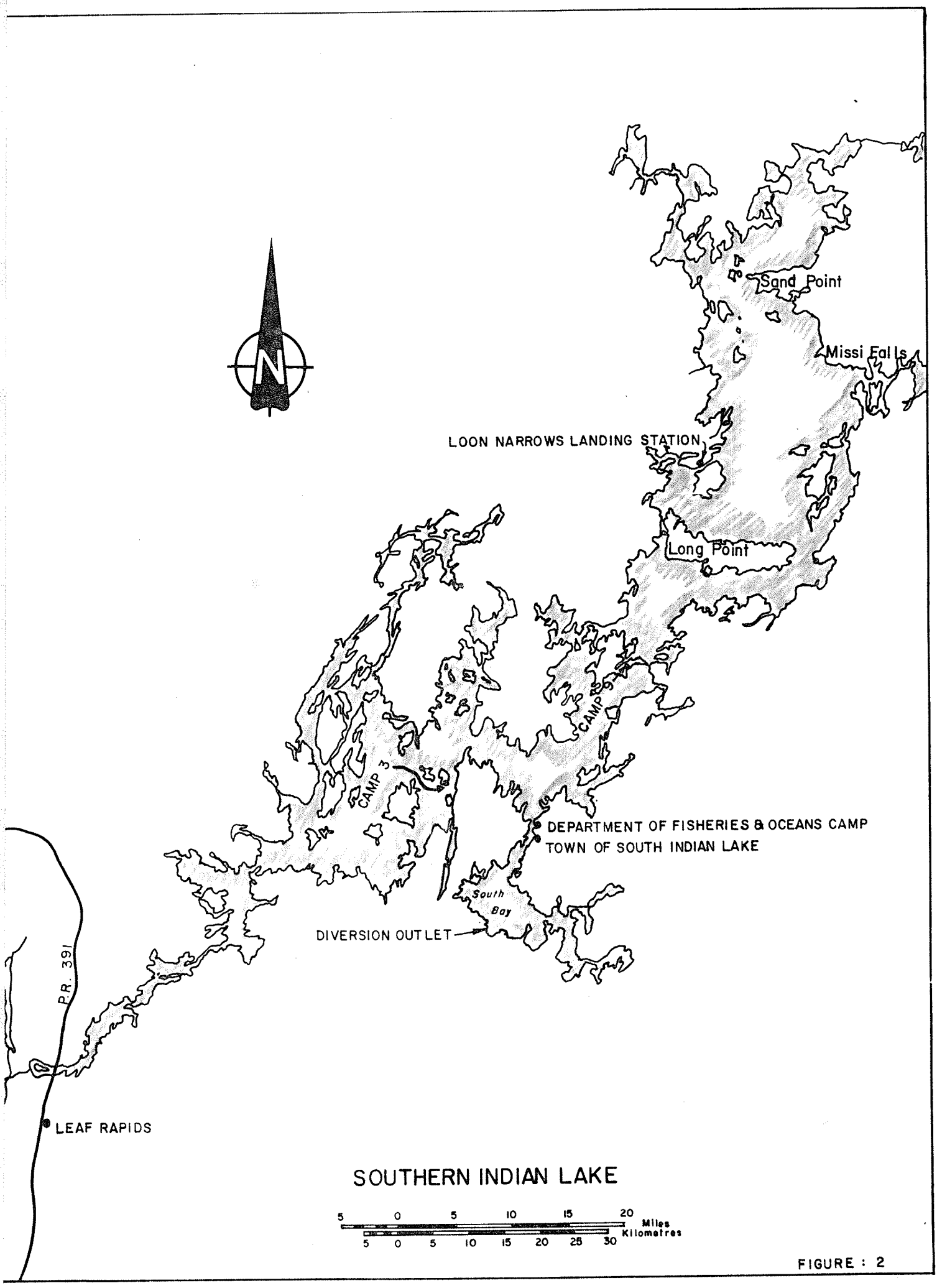
tions on Southern Indian Lake, Camp 3 and Loon Narrows. A third station, Camp 9, has not operated in recent years. Approximately 80-85% of all fish caught on the lake are landed at Loon Narrows. Payments to fishermen are made f.o.b. Leaf Rapids.

Fishermen deliver their catches to either Camp 3 or Loon Narrows where the fish are weighed and repacked on ice, awaiting arrival of a freight boat. The FFMC operates two freight boats to transport fish from Loon Narrows and Camp 3 to the packing plant at Leaf Rapids. Each boat has a cargo capacity of approximately 18,000 lb (approximately 8 metric tons). Fishermen who work in South Bay have their catch trucked directly to Leaf Rapids. Since completion of Provincial Road 391 to Leaf Rapids in 1974, fish have been trucked directly from there to the FFMC plant in Winnipeg.

Landing stations, freight boats, and the Winnipeg plant compose what is termed the secondary sector of a fishing industry. This sector is concerned with gathering fish at delivery points and with processing fish for market.

### 1.2.3 Fishing Operations

Fishing operations comprise the primary sector of a fishing industry. A typical Southern Indian Lake summer fishing operation consists of two men working a 20 ft. (6 m) fiberglass skiff (locally termed a yawl) powered by an outboard motor. The motors typically range from 20-50 hp. Fish are caught with gill nets, usually 100 yards (91 m) long. Each licensed fisherman is permitted 1500 yards (1372 m) of gill nets in the water at any one time. The most common mesh size used in 5¼ inch (13 cm) diagonal stretched mesh, though some fishermen




SOUTHERN INDIAN LAKE

FIGURE : 2

occasionally use 4¼ inch (11 cm) mesh.

Fishermen pick their nets every day, almost without exception. Fish are dressed in the boat and packed in ice. Guts and rough fish are thrown on shore. Then the fish are delivered to a landing station.

### 1.2.4 Biological Productivity

Prior to impoundment, the commercial fishery was very productive, producing 2.5 lb. of fish per acre (2.8 kg/ha). This productivity is higher than would be predicted from the climatic regime, the local Precambrian Shield drainage basin, and the large size of the lake (Lake Winnipeg, Churchill and Nelson Rivers Study Board (LWCNRSB) 1975). This high productivity is attributed to the influence of the Churchill River which contributes about 90% of the flow to the lake. The river carries in and disperses nutrients and other substances, inputs heat, mixes the lake, and, prior to diversion, carried away locally-induced turbidity.

Lake whitefish (Coregonus clupeaformis (Mitchill)), hereafter referred to as whitefish, is the most important commercial species in the lake. It comprised 83% by weight, of the total catch from 1970 to 1978. It is also the most economically important species, comprising 87% ($288,000) of payments to fishermen in the 1980 summer fishery (from FFMC data). Walleye (Stizostedion vitreum (Mitchill)) and northern pike (Esox lucius Linnaeus) are other commercially important species. Cisco, also known as tullibee, (Coregonus artedii Lesur) is also frequently caught. Because of the low price fishermen receive for cisco, many fishermen do not bother delivering them to landing stations.

Three species of rough fish are caught by fishermen in the

following descending order of frequency, longnose (sturgeon) sucker (Catostomus catostomus (Foster)), white sucker (Catostomus commersoni (Lacepede)), and burbot (Lota lota (Linnaeus)). Southern Indian Lake fishermen have no market for these fish, although suckers are commonly consumed domestically.

### 1.2.5 Whitefish Grades and Traditional Fishing Grounds

Whitefish are divided into four commercial grades. The more desirable grades have fewer cysts of the tapeworm parasite Triaenophorus crassus. In addition, whitefish are classed either as dark or light, based on their external coloring. The flesh of dark whitefish is less attractive to the market as well as having a higher average cyst count. There is a greater range of the level of infestation in dark whitefish. Some darks have as low a cyst count as lights.

The four commercial grades of whitefish are:

1) Cutter whitefish - whitefish with infestation levels in excess of 80 cysts/100 lb. (45 kg). These fish cannot be marketed without further processing due to the high infestation level of Triaenophorus crassus.

2) Continental whitefish - levels of infestation between 40 and 80 cysts/100 lb. (45 kg). These fish can be marketed within Canada, but cannot be exported to the United States, the principal market for whitefish, without further processing.

3) Export whitefish - levels of infestation less than 40 cysts/100 lb. (45 kg). Dark whitefish are not graded export, regardless of cyst count. Export whitefish command a better market price than continental and cutter grades.

4) Smoker whitefish - export grade fish with a high fat content which facilitates their use in producing smoked products. Smokers usually command the highest price of all grades of whitefish.

There are specific areas of the lake which historically produced more fish of export quality than other areas. The area around Camp 3 and the North Basin, adjacent to Loon Narrows, are two areas traditionally fished for high quantities of export grade whitefish.

South Bay, perhaps only because it is close to town, is also fished. The catch here was traditionally, and continues to be, mainly continental grade.

### 1.2.6 Economic and Social Importance

Ninety-six per cent (FFMC records) of commercial fishermen who fished Southern Indian Lake in the 1980 summer season lived in the town of South Indian Lake. The town currently has a population of about 800. Its residents are a mix of Swampy Cree and Metis. The Cree people are a mixture of treaty and non-treaty Indians.

In the fiscal year 1978-79 the Southern Indian Lake commercial fishery accounted for 4% of the total payments made to commercial fishermen in Manitoba and for 12% of the amount paid for whitefish (from FFMC data). In that year total payments to fishermen were $368,057, the largest revenue earned by any commercial fishery in northern Manitoba. In the 1978-79 fiscal year there were 104 licensed commercial fishermen operating on the lake. The average gross income from commercial fishing was $3,539. The maximum income was $14,713 and the minimum $28.

The winter fishery is of substantially less importance than the

summer fishery. In the 1978-79 fiscal year, the winter fishery accounted for 13% of the total payments made to the fishermen.

Commercial fishing is the largest single source of gross income within the community of South Indian Lake. Collinson et al. (1973) found that fishing accounted for 43% of community income. The next highest source of income was government transfer payments, at 28%. Trapping accounted for 4%, hunting 8%, and forest activities 3% of community income. These figures are percentages of combined wage income and income from traditional activities. A post-impoundment analysis of community income has not been performed.

In summary, commercial fishing at Southern Indian Lake is an economically important feature of the community. There is a sound market for products of the fishery. Traditionally reliable fishing grounds and the established landing stations and fish camps away from town have promoted fishing activities becoming ingrained into community lifestyle over the past four decades.

## 1.3 The Churchill River Diversion

In 1963 and 1964 the governments of Manitoba and Canada entered into agreements for joint studies to investigate the hydroelectric potential of the Nelson River. One of the recommendations of these studies was that works be undertaken to enable diversion of substantial flows from the Churchill River into the Nelson River to increase the generating potential of the latter.

As a result of this recommendation it was decided in 1968 that the flow of the Churchill River at Southern Indian Lake be diverted by:

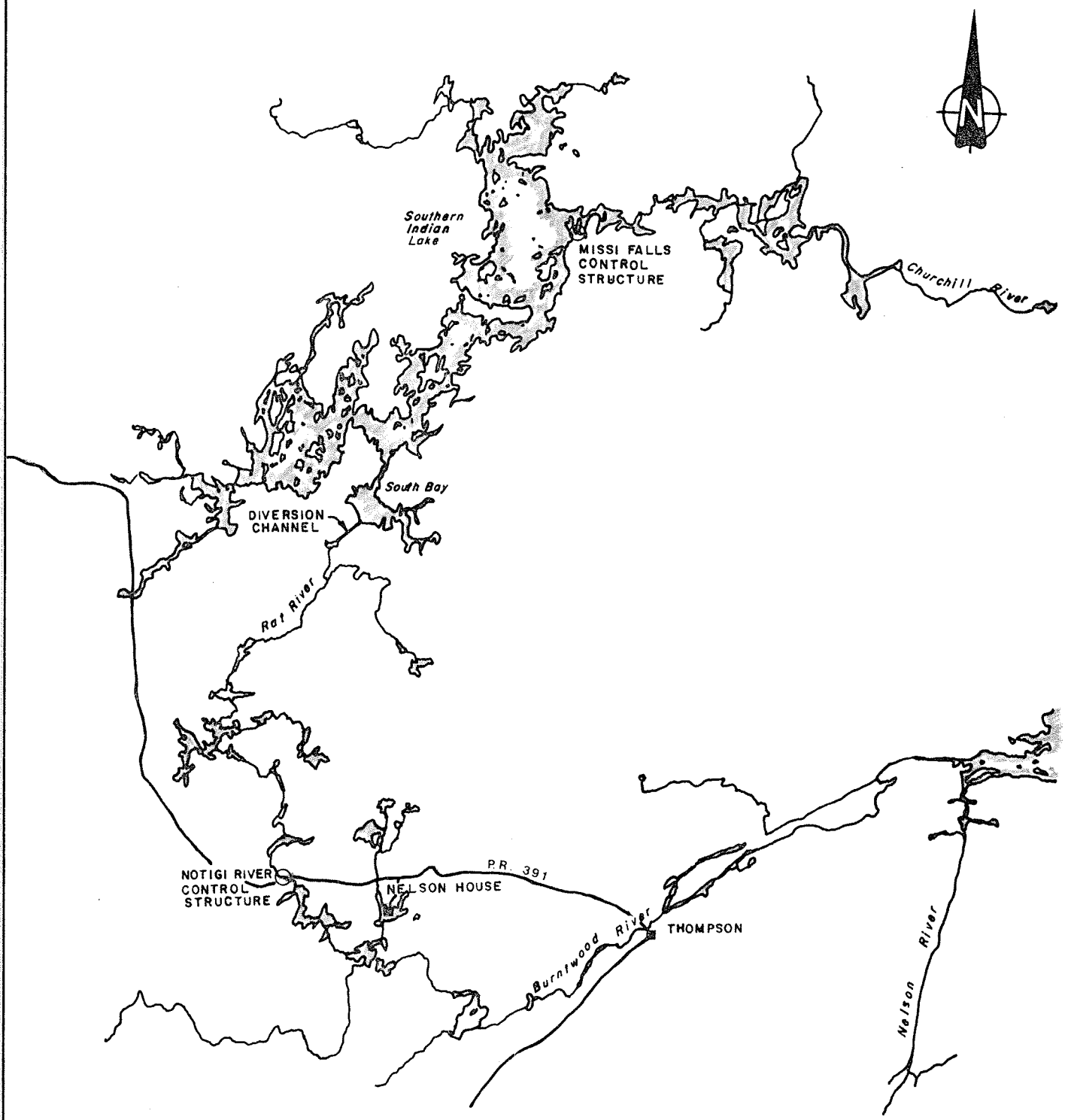
1) constructing a control structure at Missi Falls, the natural

outflow point of the lake, raising the level of the lake, and

2) diverting outflow through a man-made channel from South Bay into the Rat River, and thence to the Burntwood and Nelson Rivers. See Figure 3.

Consequently, Manitoba Hydro announced a plan to raise the level of the lake by approximately 11.5 m (35 ft.). Strong criticism of this plan, termed the high-level diversion plan, was voiced at public meetings held in South Indian Lake and Winnipeg. The government of Manitoba concluded that the high water levels proposed in this plan for Southern Indian Lake were socially unacceptable (LWCNRSB 1975).

Further engineering studies were undertaken. A Manitoba Hydro task force concluded that by combining the regulation of Lake Winnipeg with a plan for diversion from the Churchill River, Manitoba's demand for electrical energy could be accommodated satisfactorily. The level of Southern Indian Lake under this plan would only be raised 3 m (10 ft.) instead of the originally planned 11.5 m. The provincial government approved this plan. In December 1972, the government issued an interim license to Manitoba Hydro authorizing the construction of works associated with the diversion from the Churchill River. In May 1973 another license was issued which permitted commencement of construction of the control structure at Missi Falls. The diversion became operable in the summer of 1976.




# SOUTHERN INDIAN LAKE DIVERSION ROUTE

Scale 10 0 25 Miles

FIGURE : 3

## 1.4 Effects of Nelson River Hydroelectric Development

### 1.4.1 General

Manitoba Hydro's northern hydraulic projects have had the effect of introducing aspects of the southern industrial economy into areas which previously had not experienced that scale of similar activity. These projects have enhanced the possibilities for future industrial development. As in the south this sort of activity forced new circumstances upon and offered new opportunities to the residents of these areas. And also as in the south disturbances have occurred to the natural environment.

Hydroelectric development contributed to acceleration of construction of northern Manitoba infrastructure, in particular transportation facilities. Road, airstrip, and boat dock construction reduced the isolation of a number of communities. For instance during construction of the diversion channel, a permanent road was built to South Bay. This road has increased tremendously accessibility of the people of South Indian Lake to Leaf Rapids and to the provincial highway system.

Development created social stress, principally in native communities. Collinson et al. (1973) describe changes in social structure among the residents of South Indian Lake which occurred as they prepared for flooding. Pre-existing communities were forced to deal with new outside factors. For example, a consequence of increased accessibiltiy to Leaf Rapids has been increased accessibility to the pub and liquor outlets in that town (South Indian Lake has no liquor outlets).

A major impact of hydroelectic development on the people of

South Indian Lake was the relocation of their town. Prior to impoundment of the lake the town was spread out over approximately three miles on both sides of the northern end of the channel connecting South Bay with the rest of the lake (Manitoba North n.d.). See Figure 2. The present townsite, built largely with Manitoba Hydro funds, is located on the east side of the channel. School, nursing station, and grocery store are located adjacent to one another in a town center. Houses are no longer as spread out. Many are arranged next to each other along drives typical of southern suburbia.

Economic impact of hydroelectric development was felt by the fur industry. Effects on the fur industry have been mitigated in the past by Manitoba Hydro, through its Registered Trapline Program. From its start in 1975 to the end of the 1978-79 fiscal year total compensation from this program approached $300,000 (K. Koenig, Manitoba Hydro, personal communication).

### 1.4.2 The Fishery

The most significant effects of Nelson River hydroelectric development on commercial fishing have been felt at Southern Indian Lake. Impoundment and diversion preceded a deterioration in the quality of the summer fishery. The diminished quality of the fishery is composed of (Bodaly et al. 1980):

1) A decrease in catch per unit of effort, measured on a lb/net/night basis.

2) An increased frequency of net relocation.

3) An increase in the proportion of dark whitefish in the commercial catch.

4) An increase in overall Triaenophorus crassus infestation levels in the commercial catch, due mainly to the greater number of dark whitefish being caught. In the past Southern Indian Lake has been classified as an export lake. This meant that all whitefish from the lake were automatically graded as export fish, unless proved to be of lesser quality. Since impoundment, the proportion of fish which have been downgraded to continental grade has increased (FFMC, minutes of meeting with Manitoba Hydro and the South Indian Lake Fishermen's Association). The lake retained its export status during 1980. It was downgraded to continental status on July 4, 1981 (S. Barrett, FFMC, personal communication).

5) An increase in mercury levels in walleye and northern pike between 1975 and 1978 to levels which exceeded the 0.5 ppm Canadian marketing limit. A slight decrease in mercury levels was noted in 1979. A lesser increase was observed in whitefish (Bodaly and Hecky 1979).

## 1.5 Past Research at Southern Indian Lake

Extensive research programs were first conducted at Southern Indian Lake in 1972. These studies were part of the activities of the LWCNRSB and were conducted by the federal Department of Fisheries and Oceans, then called the Fisheries and Marine Service. Since then the Department has established programs to monitor the hydrologic, limnologic, benthic, and fisheries changes that are occurring in the lake as a result of impoundment and diversion. These programs are based at a research camp that the Department has established approximately two miles north of the town of South Indian Lake. The findings of a number of studies concerning the lake are discussed in the next chapter.

Economic surveys of the commercial fishery took place in 1973 and 1977. These studies were not extensive nor were the results of these studies strictly comparable. The need for an economic analysis of the changed state of the fishery was expressed by scientists of the Department of Fisheries and Oceans who are studying the impacts of impoundment of the lake.

Bodaly et al. (1980) document shifts in areas fished and decreases in catch per unit effort since impoundment. Their analysis is expressed purely in terms of physical effort, no economic anlysis is attempted. The present report is similar to Bodaly et al. (1980) inasmuch as it quantifies, in economic terms, the same type of activities as is described by these authors.

## 1.6 Objectives

This study is a step toward determination of the total cost curve for the Southern Indian Lake summer commercial fishery (see section 2.4). It was neither extensive enough in scope nor was long enough in duration to permit an entire total cost curve to be determined. Likewise, sufficient biological data are not yet available to permit an accurate forecast of harvest per unit of fishing effort. This prevents formulation of a total revenue curve for the fishery.

With neither total cost nor total revenue curves known, determination of the level of fishing effort which will maximize aggregate net returns to fishing enterprises is not yet possible.

### 1.6.1 Specific Objectives

Changes which have occurred in Southern Indian Lake have resulted

in deterioration in the quality of the commercial fishery as described in section 1.4.2. This deterioration in quality has placed the economic status of the commercial fishery in question.

Manitoba Hydro as well as both Manitoba and federal governments subsidize the fishery. But there is currently no complete picture of the economic dynamics of the fishery which can be used in planning such subsidy payments or in evaluating other mitigation or management measures.

This study describes the economic performance of the commercial fishery of Southern Indian Lake in the summer of 1980. The principal criteria used to evaluate the fishery are net economic returns to fishing enterprises.

The specific objectives of this study were:

1) To determine aggregate costs and revenues both to the aggregate fishery and to individual fishing enterprises.

2) To determine the unit cost of fishing, that is the average expenditure per pound of catch, in both aggregate and individual cases.

3) To describe in detail the activities of a sample of fishermen.

4) To review the adequacy of compensation programs to date.

5) To assess prospects for viability of the fishery and to suggest possible improvements which would increase returns to fishermen.

## 1.7 Limitations

Post-impoundment studies of physical and biological changes in large reservoirs are few in number. As a result predictions of future changes in fish populations of Southern Indian Lake are largely speculative. This includes economic features of populations, such as the catch per unit effort.

When one superimposes onto this uncertainty, the vagaries of a commercial fishing industry, including changing prices and markets, and the attitudes of fishermen, future economic predictability is restricted further. A major limitation of this study then may be the certainty with which its findings can be extrapolated into the future.

Manitoba Hydro compensation payments comprised a significant part of fishing income in the summer of 1980. Currently compensation payments are agreed upon on an annual basis. These annual arrangements varied markedly in the 1979, 1980, and 1981 summer fisheries. The present value of future compensated cash flows as described in this report may be imprecise as regards exact dollar values. The general magnitude of assistance with which Manitoba Hydro compensation supplies the fishery can be considered with confidence.

This report is an analysis of summer fishing operations. Its findings are not applicable to the winter fishery.

Chapter 2

# REVIEW OF RELATED LITERATURE

The recent history of the Southern Indian Lake commercial fishery is a multi-faceted one. Impoundment and diversion of the lake was preceded, and has been followed by, much discussion, study, and analysis.

Related literature is discussed under the following topics:

2.1) Churchill River Diversion

2.2) Biological Studies

2.3) Traditional Economy

2.4) Profit Maximization

2.5) Compensation

2.6) Social Change

## 2.1 Churchill River Diversion

While not essential to an understanding of the findings of this report, a general knowledge of Manitoba Hydro's hydroelectric development of the Nelson River and consequent Churchill River Diversion is helpful. Such knowledge serves to place the present condition of the Southern Indian Lake fishery in recent historic context.

### 2.1.1 Pre-Impoundment Studies

The original hydroelectric development plan for Southern Indian Lake called for what was termed the high-level diversion of Churchill River water. This would have involved flooding Southern Indian Lake to

a level of 35 ft. (11.5 m) above its historic level. This plan met with opposition from various interested groups. Cass-Beggs (1969) in The Proposed Churchill River Diversion and Associated Problems reviews options that were open to Hydro with the demise of the high level diversion plan. He concludes "...there are satisfactory alternatives to the high level diversion that are not significantly different in present or ultimate cost...". His analyses include use of thermal generating capacity and the low level diversion as alternative to the high level diversion. The low level diversion involved flooding Southern Indian Lake 10 ft. (3 m). This is the level to which the lake was flooded in 1976.

In planning Nelson River power development Manitoba Hydro chose among a number of alternate Churchill River Diversion plans. Some of these plans are discussed in Churchill River Diversion: Study of Alternative Diversions by Underwood McLellan & Associates Limited (1970). This report is accompanied by two multi-volume appendices entitled Engineering Investigations and Resource Investigations. This report found a combination of Southern Indian Lake as a storage site with a gravity fed diversion via South Bay to Rat Lake to be the most economical Diversion plan. It recognized the social costs which would occur because of adverse physical impacts on natural resources, of which the commercial fishery was the most significant. The social costs arising from impacts on certain other resources and other communities though, were consciously omitted from the analysis. These costs arose from social disruption, archeological site inundation, lost potential mineral development etc. This report is criticized by Schramm (1976) (see below) for narrowness of economic analysis.

Gillespie et al. (1972) report on the question of shoreline

clearing in Southern Indian Lake and along the Diversion route and on resource losses which would occur from the project. This report was intended as an outside look, by experts, to assess the validity of Manitoba Hydro's plans to that date. The report is titled The Clearing Program for Southern Indian Lake and The Diversion Channel from South Bay to Notigi. The purpose of this report was not to recommend a path of action but to review the options which could be pursued. Gillespie et al. favor the alternative of impoundment and gravity diversion of Southern Indian Lake with selective clearing and environmental mitigation measures such as prepartion of new spawning beds for whitefish. They describe this option as minimizing environmental effects while achieving some financial economies.

Most of the quantitative information Gillespie et al. needed to make recommendations was not going to be available until shortly before the time Diversion water would have to be delivered to the Nelson River to maintain Hydro's schedule for power development. Gillespie et al. express the hope that this would be the last time in Manitoba that major engineering endavours were undertaken without a proper environomental impact study having been completed. They feel such information is essential to proper political decision making.

Chief among the agencies who published work on the Diversion is the LWCNSB. The Technical Report (LWCNSB 1975) and eight accompanying appendices were commissioned by a federal-provincial agreement to study the effects of Nelson River development and to formulate conclusions and recommendations regarding these effects. These volumes contain reports which discuss geology, hydrology, property, recreation, biota, and economic and social aspects of the area and its residents. They discuss all

geographic areas affected by works of Nelson River power development. Several reports deal specifically with Southern Indian Lake. Recommendations made by the Board which are pertinent to this report are:

1) That a body with broad representation be established, one on the functions of which, would be to advise on patterns of regulation for flows from Southern Indian Lake taking into consideration all resources and recognizing the regulation licenses granted to Manitoba Hydro. This recommendation has not been followed. Presently Manitoba Hydro is required only to receive permission from the Minister of Natural Resources in order to alter flows from Southern Indian Lake which would exceed the limits of its license.

2) That a flow forecasting program be developed from which projections of inflows to Southern Indian Lake can be made. This is done by Manitoba Hydro.

3) That Manitoba Hydro and other resource developers provide just compensation or mitigation for all damages resulting directly from the developments. Manitoba Hydro has been making compensation payments and taking mitigation measures since prior to commencement of diversion. Compensation payments specifically for the fishery commenced in 1978, two years after commencement of diversion.

4) That a mechanism be established to deal with social and related economic issues including mitigation and compensation issues. This function is normally handled by community councils, fishermen's associations, or similar community representatives who negotiate with Manitoba Hydro representatives.

5) That debris control programs be developed and implemented

where required in consultation with local community representatives. There is currently a debris control program at the town of South Indian Lake.

Specifically regarding Southern Indian Lake:

6) That fish populations and biological productivity be monitored until populations have stabilized after the diversion project has been implemented, and that the necessary minimum annual discharge at Missi Falls be determined to maintain fish populations and productivity at an acceptable level in the northern portion of the lake. The Federal Department of Fisheries and Oceans currently conducts research into changes occurring in the ecology of the lake. There has been no study which analyzes the potential consequences of different rates of discharge at Missi Falls on biological productivity in the lake. Rather, a major restriction on the minimum allowed level of discharge continues to be the terms of the license issued to Manitoba Hydro. These terms have not been altered since they were first written.

7) That the all-weather road from Ruttan Lake to South Bay be maintained and a means of year-round access be provided from that road to the community of South Indian Lake. This has been done, as was mentioned in the preceding chapter.

### 2.1.2 Analysis of Decision-Making

Planning for the Diversion began in the early 1960's, though the Diversion did not become operable until 1976. Schramm (1976) in Analyzing Opportunity Costs: The Nelson River Development gives a concise history of the project as part of an economic evaluation of the major planning phases of Nelson River development. His analysis

concerns itself overall with arguments that were used for economic justification of the Diversion and locally with the estimate of damages at Southern Indian Lake.

Schramm (1976) is very critical of the economic justification of Nelson River development. He considers the cost-benefit analyses, which were performed, to be far too narrow in scope, particularily regarding alternative power developments. As well he states that the original assessments of the value of resources which would be damaged by Nelson River development were vast underestimates.

An extensive historic record of Nelson River power development is contained in the Final Report of the Commission of Inquiry into Manitoba Hydro, by Tritschler (1979). This document is the report of an inquiry into the planning and decision making processes of Manitoba Hydro regarding development of the Nelson River. Tritschler concluded that regarding "its generation expansion program since 1970, Hydro has not followed its mandate to promote economy and efficiency in the supply and use of electrical power". This report illuminates some pitfalls to be avoided in the planning and decision-making processes of large scale public projects.

Related to the subject of this report, Tritschler recommended that Hydro should;

1) "recognize the essential equivalence of engineering, financial, socioeconomic and environmental aspects in the process of defining objective criteria and design parameters for its projects and programs;"

2) "seek the advice of Government in determining appropriate policies and criteria to be reflected in preparing its evaluations of the socioeconomic implications and the environmental impacts of its projects

and expansion plans..."

3) "...ensure that it retains competence in the area of environmental assessment and management and that it is seen to be adopting a positive attitude towards this vitally important aspect of development."

Much planning and analysis, and revision of planning, went into Manitoba Hydro's Nelson River Developments and associated works. The plan finally implemented was considered the most cost effective. Technical and social recommendations that were made prior to Churchill River diversion have been followed to varying degrees. In retrospect, Manitoba Hydro has been criticized for narrowness of analysis during the planning stages of Nelson River hydroelectric developments.

## 2.2 Biological Studies

Past studies describe the plankton, benthos, and fish populations of Southern Indian Lake. A number of these studies may be found in one document, Volume 1 of Fisheries and Limnology, Appendix 5 of LWCNRSB Technical Report. This discussion will limit itself to consideration of fish.

### 2.2.1 Pre-Impoundment

Most icthyological work has been related to commercial aspects of the lake's fishery. There was little biological research performed in Southern Indian Lake prior to the advent of the Churchill River Diversion. MacTavish (1952) in A Biological Investigation of Southern Indian Lake, Summer 1952 presents an early investigation. He reports excellent fishing grounds north of Long Point (pre-impoundment "traditional" fishing grounds referred to in Bodaly et al. (1980)). The area north

of Sand Point produced whitefish with a higher T. crassus cyst count than the North Basin between Sand and Long Points.

Ayles and Koshinsky (1974) in the Fisheries of Southern Indian Lake: Present Conditions and Implications of Hydroelectric Development discuss 11 of 19 known fish species in the lake. Regarding whitefish, they state that there was a change in year class structure of sampled whitefish populations between 1952 and 1972, accompanied by decreases in mean lengths and weights of fish caught. Although these changes are characteristic of overfished populations, the authors attribute these changes to other causes.

Firstly, the summer fishery was only beginning around 1952. Unexploited fish populations tend to "stock pile" fish of many year classes all at the same size. These fish crowd gillnets, biasing results toward one length class. After regular commercial exploitation over a number of years, this "stock pile" would be depleted. Gillnets of different mesh sizes would show a larger variation of length frequencies.

Secondly, in 1952 nylon gillnets were made of much thicker, stronger, twine. A given size mesh of the thicker twine could hold a larger fish than the thinner twine used in 1972.

The authors conclude that commercial fishing could account for the apparent decrease in size of whitefish caught in 1952 and 1972, but that there was no evidence to suggest that over-exploitation of whitefish stocks was occurring.

These authors found movement connected with whitefish populations in the North Basin. They suggest that impoundment and the diversion of Churchill River water from the North Basin might disrupt migration

patterns. They also predict that whitefish populations would initially decrease after impoundment. This would be followed by an increase as inundated areas released nutrients into the lake, and then a final stabilization of population sizes slightly lower than pre-impoundment levels. They state that this pattern of change was typical of other northern reservoirs.

Lake Whitefish in Southern Indian Lake, Manitoba (Ayles 1976) points out differences in productivity of various parts of the lake reflected by differences in the pre-impoundment catch per unit effort of fishermen in corresponding areas of the lake. Areas with the highest catch per unit effort were those exposed to the nutrients which accompanied the flow of Churchill River water through the lake.

### 2.2.2 Post-Impoundment

Research on the lake has continued since impoundment in an attempt to document changes which are occurring. A straightforward presentation of data, with no interpretation of results, is given in Pre- and Post-Impoundment Experimental Fish Catches, Southern Indian Lake, Manitoba, 1972-1979 by Bodaly et al. (1980a).

Analysis of post-impoundment information has, of course, taken place. An event which was unforseen by pre-impoundment studies was an increase in the concentraion of mercury in fish species. Bodaly and Hecky (1979) in Post-Impoundment Increases in Fish Mercury Levels in the Southern Indian Lake Reservoir, Manitoba document increased mercury concentrations in whitefish, northern pike, and walleye since impoundment. They hypothesize that erosion and leaching of inundated shorelines caused increased concentrations of mercury in the lake water, in solution and

as exchangeable ions carried on clay particles. They state that if increased fish mercury concentrations occur with a high probability in boreal reservoirs, it must come to be included in the socio-environmental impact assessment of this type of project.

Since the report of Bodaly and Hecky (1979) fish mercury concentrations have not increased further (Hecky personal communication). During the 1981 summer season the FFMC refused to buy pike over 4 lb (1.8 kg) because of the possibility of high mercury concentrations. High mercury concentrations still pose a possible threat to the fishery.

Another change in the character of the fishery has been an increase in infestation levels of the cestode parasite T. crassus in commercial catches. Sunde (1964) in South Indian Lake Whitefish Infestation Test concluded that very few shipments of whitefish would be downgraded from export to continental grades on the basis of cyst count. He used a higher standard for export grade whitefish, 30 cysts per 100 lb (30 cysts per 45 kg), than is used currently. Based on a rather small sample size of dark whitefish (31) he concluded that there was no significant difference in infestation between dark and light fish. It is currently believed though that dark whitefish have a higher mean level of infestation than do lights.

James F. MacLaren Ltd. (1978) in Report to Manitoba Hydro on Changes in Quality of Whitefish Fishery on Southern Indian Lake partially attributes the rise in infestation levels of commercial catches to shifts in the geographic distribution of whitefish populations, caused by new turbidity conditions of impoundment. Ayles and Koshinsky (1974) also predict such shifts, but attribute them to changes in patterns

of water flow. These populations are hypothesized to have moved into traditional fishing grounds from areas which were not frequently fished in the past, because of the poorer quality of the catch. Hence the infestation level of the catch could increase, without an actual increase in infestation of whitefish populations in the lake. James F. MacLaren (1978) is sometimes ambiguous regarding different levels of infestation of dark and light whitefish populations. Bodaly et al. (1980) state that the pre-impoundment geographic range of dark whitefish was not precisely known. Any statement like that of James F. MacLaren Ltd. (1978) regarding shifts in dark whitefish poplations will remain hypothetical.

Bodaly et al. (1980) agree with James F. MacLaren Ltd. (1978) regarding the idea that changed light penetration as a result of increased turbidity caused changes in the movement patterns of whitefish populations. Alder (1979) in An Application of Analysis of Variance to Environmental Observations on Southern Indian Lake (1974-1978) Before and After Impoundment found vertical light extinction pre- and post-impoundment to be significantly different ($p<.05$).

An increase in the infestation level of marketable size fish is predicted by Watson (1977) in Metazoan Parasites from Whitefish, Cisco, and Pike from Southern Indian Lake, Manitoba: A Preimpoundment and Diversion Analysis. Watson forecasts this change based on similar occurrences in other studies. In these situations changed environmental conditions led to relative increases in the population sizes of intermediate hosts (copepods) which vector T. crassus to whitefish. Increases in populations of intermediate hosts would affect infestation levels in both dark and light whitefish.

Not enough time has yet elapsed since impoundment for the mechanisms of Watson's (1977) prediction to account for the observed increase in infestation. Nonetheless Bodaly et al. (unpublished work) reported that 52% of light whitefish shipments from Southern Indian Lake in the summer of 1980 were rejected as export grade upon inspection at the FFMC Winnipeg plant because of high cyst counts of T. crassus. This appears to be a very drastic change in the state of the fishery. The authors recommend further investigation to verify this change.

Bodaly et al. (1980) discuss deterioration of commercial fishery on two bases. Firstly they discuss the increase in the proportion of dark whitefish caught. In Post-Impoundment Changes in Commercial Fishing Patterns and Catch of Lake Whitefish in Southern Indian Lake, Manitoba these authors state that since grade problems occurred immediately after impoundment these problems are most likely due to shifts in the distribution and/or behavior of fish stocks. Since whitefish of catchable size are 6-13 years old there had been no chance for genetic changes in populations caused by impoundment to manifest themselves.

The exact taxonomic relationship between light and dark whitefish is unknown. The uncertain state of whitefish family (Coregonid) taxonomy is discussed, with other topics, in both Bodaly (1977) Evolutionary Divergence Between Currently Sympatric Lake Whitefish, In the Yukon Territory and Lindsey and Woods (1970) Biology of Coregonid Fishes.

Bodaly et al. (1980) also indicate that the increase in the proportion of dark whitefish in the catch in the summer of 1979 was due to the action of fishermen. Because of poor fishing in the North Basin, a large amount of fishing effort shifted to the area north of

Sand Point, an area which traditionally produced dark whitefish.

Also as a result of decreased catch per unit effort on traditional fishing grounds, fishermen now set their nets close to shore more frequently than they did before impoundment (Bodaly personal communication). Dark whitefish are caught closer to shore more frequently than are lights.

Secondly, Bodaly et al. (1980) discuss deterioration of the summer commercial fishery on the basis of decreases in catch per unit effort. They found that catch per unit effort, measured on a pounds per net per night basis, had decreased approximately 39%, from 51 lb/net/night (23 kg/net/night) in 1972 to 31 lb/net/night (14 kg/net/night) in 1979. The cause of the decrease was said to be changes in movement patterns of whitefish populations, and not overfishing.

Though a decrease in catch per unit effort is a characteristic symptom of overfished populations, Bodaly et al. (1980) do not believe Southern Indian Lake whitefish populations were overfished. They state that from 1952 to 1976, total catch for the lake was largely related to fishing effort, measured by the total number of fishermen. Up until 1976 there was no decrease in catch per unit effort. The decrease was coincidental with impoundment.

Generally, the production of the entire lake's commercial fishery from 1952 to 1976 was well below theoretical fish yields, suggesting that populations were not being overfished. Traditional fishing areas in the North Basin, having accounted for 80% of total lake production, have been producing whitefish in excess of theoretical yields since the late 1950's. However, in 1972, mortality rates for sampled populations in the North Basin were not particularily high as

compared to exploited populations elsewhere. Even with the lower post-impoundment catch per unit effort measured in the North Basin in 1979, catch per unit effort values were not distinctly lower than the same values for other central Canadian Lakes, which further suggests that overfishing did not occur.

Bodaly et al. (unpublished data) report the mean age of a random sample of whitefish taken at the Loon Narrows landing station in 1972 was 9.10 years (n=650) while the mean age of a 1979 sample was 9.13 years (n=191). If overfishing had occurred between 1972 and 1979, one would expect the mean age of fish caught to decrease.

Aside from a decrease in numbers of jumbo commercial sized fish caught, during the early years of the summer fishery (Ayles and Koshinsky 1974), there has been no reported decrease in the mean size of fish caught, which is another characteristic of overfished stocks.

The lack of evidence indicative of overfishing and the coincidence of the measured decrease in catch per unit effort with impoundment and diversion of the lake suggest that this decrease is related to hydro-electric development. Changes in the patterns of fish movement due to increased turbidity and/or changes in the pattern of water flow (Ayles and Koshinsky 1974, Bodaly et al. 1980, James F. MacLaren Ltd. 1978) are possible causes of the decrease in catch per unit effort.

In summary, three main biological problems appear to be affecting commercial populations. They are:

1) A decrease in catch per unit effort in traditionally fished areas of the lake.

2) An increase in the proportion of dark whitefish caught, caused

largely by movement of fishing effort away from traditionally fished areas, because of the decreased catch per unit effort.

3) An increase in the infestation level of T. crassus in light whitefish population.

## 2.3 Traditional Economy

Economic activities of the type most vigorously pursued by residents of South Indian Lake are usually termed a traditional or land-based economy. In such an economy there is litte entrepreneurial endeavor or industrial activity. Most activity is concerned with extracting commodities from the land, for commercial sale or domestic consumption.

Relevant studies are of two general types, a general economic community profile and descriptions of traditional economic activities, at South Indian Lake and elsewhere. This report discusses traditional activities only related to fishing.

### 2.3.1 Community Economic Profile

Social and Economic Impact of the Nelson River Hydro Development (with emphasis on South Indian Lake) by Collinson et al. (1973) describes the community prior to impoundment and as the people prepared for flooding. It is the most complete single work on this subject. Topics discussed are social structure, sources of community income, the fishery in particular, and discussions of similar situations elsewhere. Community income from fishing activities is presented, from 1969 to 1973. Data on fishing income were provided to the authors by the Manitoba Department of Mines, Resources, and Environmental Management and differ, sometimes

markedly, from the FFMC income records used in the present report. For this reason the data are not presented. FFMC records of payments to fishermen are probably the more accurate since it is the FFMC which make the actual payments.

Pertinent details of Collinson et al. (1973) were discussed in section 1.2.6.

### 2.3.2 Traditional Economic Activities

Topolniski, in an appendix to Weagle and Baxter (1973), The Fisheries of Southern Indian Lake: Exploitation and Reproduction, presents a revenue-expenditure analysis of selected fishing operations. For the summer fishery, Topolniski found a direct relationship between the number of deliveries per fisherman, and gross revenue. He defines the breakeven point as that level of production at which total revenue equals total cost, where total cost of production is the sum of fixed and variable costs. He finds the breakeven point for fishing operations to differ substantially (30%) depending on the number of individuals involved in an operation. Lone operators had the lowest breakeven point. The breakeven point increased with the number of individuals involved in an enterprise.

In Final Report 25 of the Churchill River Study, Socio-Economic (Saskatchewan), Stabler et al. (1975) analyze fishing operations. They establish two modes of summer fishing. Inland fishing (using a freighter canoe) and open water fishing (using a skiff). They analyze fixed and variable costs of both modes of fishing. They provide lists of equipment required in both types of operations and the 1974 prices of these. They

conclude that the average net return from fishing alone was below both the poverty line and the subsistence income level as defined by the Canadian Senate.

When reading evaluations of the dollar income of activities in remote native communities, as the one immediately above, two factors must be remembered. Firstly, particular activities, such as commercial fishing, are carried out only for part of the year. During the remainder other sources of income are pursued, such as trapping or wage employment. Secondly, income-in-kind from the land decreases the need for cash income. A consideration of only one income source leads to a vast underestimation of the welfare of a community. For instance, Peters and Wall in the Manitoba Fisheries Fact Book estimate annual domestic consumption of fish at Southern Indian Lake to be 31,858 lb. (14,451 kg), or about 40 lb. (18 kg) per person. This source of goods is in no way accounted for by statements of the gross revenues of the community, such as FFMC records of payments to fishermen. In a traditional economic setting a financial statement of income will underestimate economic welfare. The Federation of Saskatchewan Indians (1976) in Aski-Puko (The Land Alone) gives a detailed description of the modern traditional economy along the Churchill River and its tributaries.

Returning to evaluation methods for cash income for commercial fisheries, Collinson et al. (1973) outline a framework for analysis of the commercial fishery. This analysis addresses itself largely to the difficulties of the now defunct South Indian Lake Fishermen's Co-operative. The analytical framework is quite thorough. It includes topics ranging from biological production potential to market analysis.

The completed analysis takes the form of a computer simulation by Framingham et al. (1974) titled Simulation of Alternatives for the South Indian Lake Commercial Fishery. This study presents a number of findings relevant to the present report. Firstly, that losses to overall fishing operations decreased as catch increased. Secondly, that one-man skiff operations generated a higher net income per fisherman than two-man operations. This agrees with Topolniski's finding that one man enterprises had the lowest breakeven point. Thirdly, that halving cullage decreased Co-operative losses by $17,000 ($ 1974). And fourthly, that harvesting of rough fish with a price to fishermen of 3¢/lb improved income of fishermen by an average of $125 in the summer season.

Gislason presents relevant information not restricted to South Indian Lake. In Socio-Economic Characteristics of Selected Manitoba Commercial Fishermen, 1974-75 he describes the training, operations, equipment, income, and expenses of 60 fishermen from four communities in Manitoba. His information is presented with little analysis, but is a fairly complete economic and social description of the individuals interviewed. Gislason defines cash flow as gross fishing revenue (FFMC payments) minus operating expenses. Net fishing income is defined as gross fishing revenue minus operating expenses minus depreciation.

To summarize, though commercial fishing enterprises may be analyzed using financial techniques, in northern Manitoba Indian communities they occur in a traditional economic setting. Community and individual incomes are diversified, commercial fishing being only one income source. Substantial income-in-kind may be derived from the land. A financial statement of income will underestimate economic welfare by ignoring non-monetary income sources.

## 2.4 Profit Maximization

The assumption that firms, in this case fishing enterprises, operate in a manner which maximizes profits underlies much of economic analysis. Anderson (1977) in The Economics of Fisheries Management presents a model which, for an aggregate fishery, allows determination of the level of fishing effort which maximizes profits. In order to determine this level of fishing effort, certain information is required.

First, it is necessary to know the quantity of fish that will be caught for any level of fishing effort. From this knowledge can be calculated a function termed the sustained yield curve. Formulation of this curve requires information such as fish population size and growth rates. Once a yield function has been specified, the role of fishery biologists, a total revenue function can be specified, given a market price for fish. The revenue function is monotonically related to the yield function by the price. It indicates the gross revenue that will accrue to the fish harvesting sector for any given level of fishing effort.

Second, it is necessary to know total costs of any level of fishing effort. When both total revenue and total cost are known for any level of fishing effort, it is possible to decide what level of fishing effort will maximize aggregate private profits in a fishery. A generalized representation of total revenue and total cost curves may be seen in Figure 4. The total revenue curve is typically concave in relation to the x-axis. The highest point on the curve is the point of biological maximum sustainable yield (point A). Fishing effort in excess of the level corresponding to maximum sustainable yield results in decreased

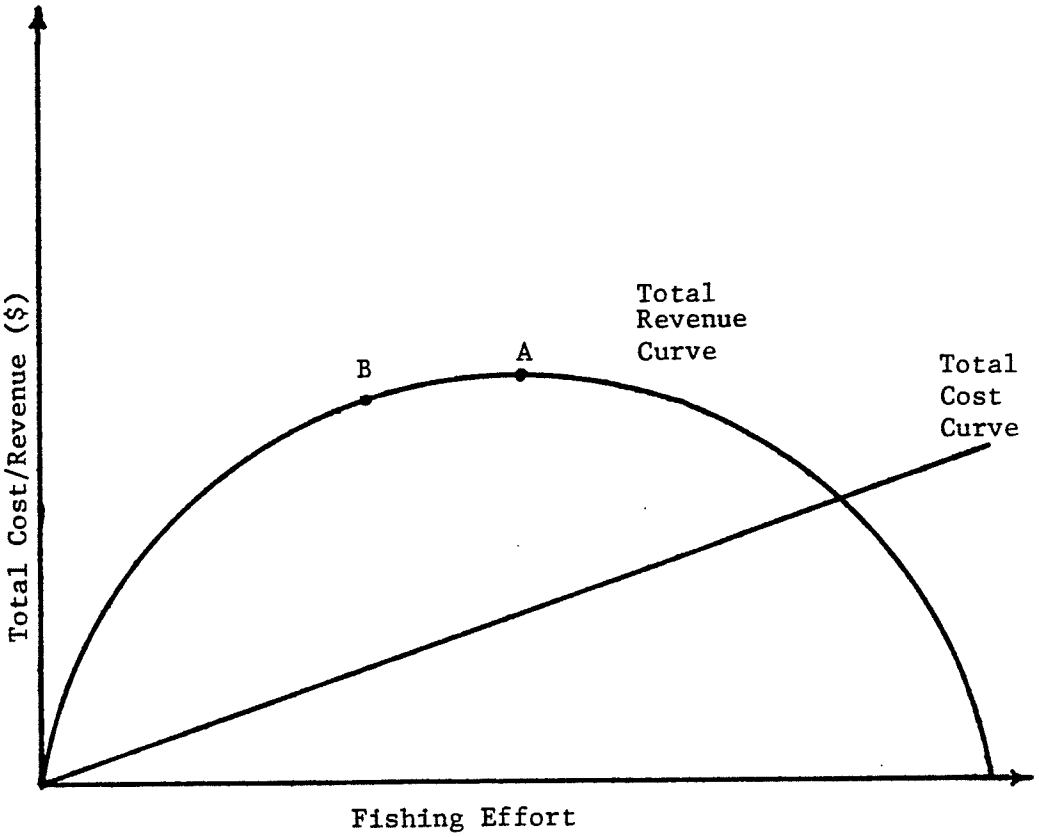



Figure 4

MAXIMUM ECONOMIC YIELD

catches and gross revenues. The total cost curve is typically linear or nearly so, increasing in direct proportion to the level of fishing effort.

The point of maximum economic yield typically occurs slightly to the left of the point of biological maximum sustained yield (point B). In Figure 4 this corresponds to the level of fishing effort where total cost and total revenue curves run parallel. Here the distance between the two curves (profits) is greatest. Though total revenue is less than at point A, total costs have decreased even more than revenues, so that profits are greater than at A.

## 2.5 Compensation

### 2.5.1 Theory

As in the case of Southern Indian Lake, compensation payments frequently accrue to individuals whose rights or incomes have been reduced as a result of government policy change or as a result of a government or private investment project. As such, compensation payments attempt to maintain the economic welfare of affected individuals by altering the redistribution of income which was caused by government or private action.

One criterion of judging welfare changes in society is the Pareto improvement criterion, discussed by Dasgapta and Pearce (1972) in Cost-Benefit Analysis: Theory and Practice. The Pareto improvement criterion states that a project or policy change is desirable, or Pareto optimal, only if everyone affected by its implementation is made better off, or is at least as well off as they were prior to the change. No one may be made worse off by its implementation.

Quinn and Trebilcock (1981) in Compensation, Transition Cost, and Regulatory Change restate this criterion by saying that a project is desirable only if it can win unanimous approval from all individuals who are affected. In otherwords, all affected people are at least indifferent to the project. Some may prefer the post-project state of affairs. Affected people perceive the utility they would derive from the post-project situation to be at least as much as what they drive from the pre-project situation.

It might be expected that individuals whose welfare is decreased by a project would consider any compensation payments made to them to be adequate only if the payments increased their welfare to at least what it had been prior to the prject. This hypothetical arguement is alluded to by the compensation crierion, also called the Kaldor-Hicks principle (Dasgupta and Pearce 1972). The Kaldor-Hicks principle recognizes that there can be both losers and gainers from the implementation of a project. It states that a project should only be undertaken if those who gain by the project can compensate the losers so that the losers become at least as well off as what they were before the projects. If compensation is paid and there is still a net increase in the welfare of society (on the part of the gainers) Pareto optimality is preserved since in the end no one is made worse off by the project. There is also a net increase in the economic efficiency of society. In otherwords, the size of the economic pie is increased and no one is made worse off than they were prior to the increase.

The Kaldor-Hicks principle does not state that compensation must be paid. It states only that if compensation were paid and there was still a net increase in the welfare of society, on the part of the

gainers, the project should proceed.

If compensation is paid, the question of the size of the payments immediately arises. If a project results in changes such as a decrease in the market value of real property or a decrease in the productivity of a factor of production (decrease in catch per unit effort) the size of compensation payments required to maintain Pareto optimality may be calculated in a straightforward financial fashion. For example, for a decrease in the market value of real property Pareto optimal compensation would equal the decrease in market value. The manner in which this principle was applied to decreased catch per unit effort is discussed in section 5.3.2.

Calculation of non-market changes in welfare is more difficult. Consumers' surpluses are one of these values. A consumer's surplus is the amount of utility which an individual derives from a commodity in excess of the level of utility indicated by a commodity's market price. Dasgupta and Pearce (1972) discuss a benefit-cost analysis for construction of London, England's third airport in which consumers' surplus was included in compensation payment calculations. In the case discussed by these authors, householders were asked in a questionnaire, "...what price would be just high enough to compensate you for leaving this house and moving to another area?". The difference between this value and the assessed market value of the house was the consumer's surplus.

As residents of the South Indian Lake community, fishermen may well have been involved in a situation where the concept of consumers' surplus would have applied, when the town was relocated and new houses built for its residents. As entrepreneurs operating fishing enterprises,

a closely related concept applies to fishermen, that of producers' surplus. Consumers' surplus is the quantity of money a consumer is willing to pay for a commodity in excess of its price. Producers' surplus is the revenue which producers earn in excess of costs of production, that is, in excess of the costs of labor and capital.

Graphically, producers' surplus is shown in Figure 5. Given a constant price for fish, set by the FFMC, and a fixed quota (Q), total possible aggregate revenue for the summer fishery totals area ADQG. Prior to diversion, as the quantity of fish caught increased, the (marginal) cost of fishing increased. In a case as this the marginal cost curve is the same as the aggregate supply curve. This curve is represented by the hypothetical line $S_o$. (There is insufficient pre-impoundment data to determine whether line $S_o$ should cross the price line to the right or left of point G. For the purposes of this discussion, it does not matter.) The area ACE is the producers' surplus of the pre-impoundment situation.

After impoundment, decreased catch per unit effort and the necessity of moving nets more frequently increased costs, shifting the cost curve say, to $S_1$. More costs were incurred in landing a given sized catch. Producers' surplus was reduced to area ABF. Pareto optimal compensation would equal area BCEF.

Dasgupta and Pearce (1972) set forth two conditions necessary for payment of compensation. First, the compensation must be paid out of the gains of the beneficiaries. In the present case, this would be Manitoba Hydro revenues.

Second, they state that payment should be in the form of lump sums, so as to leave incentives to work unaffected. This statement may or may not be true in individual cases. If it is assumed that an

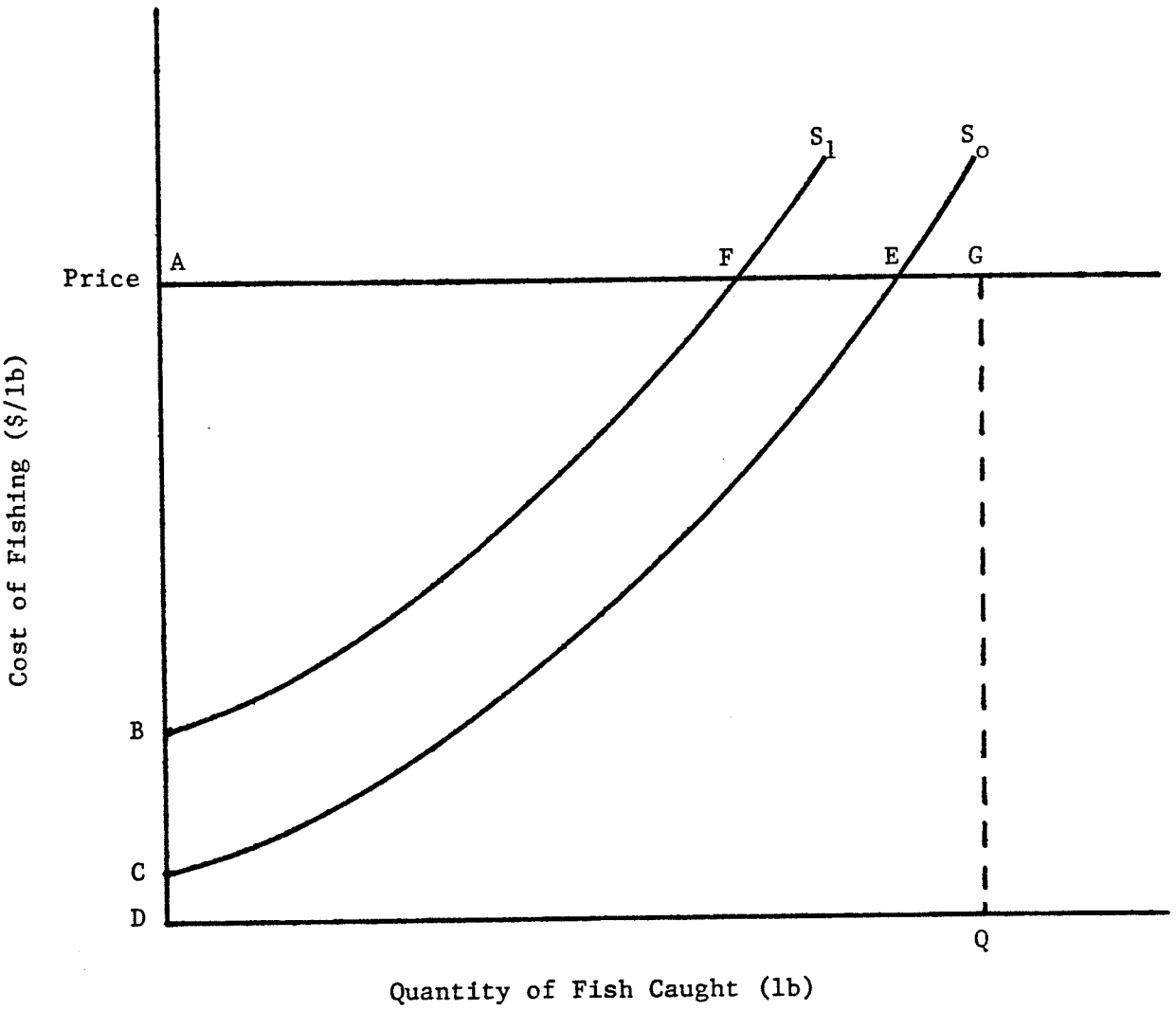



Figure 5

PRODUCERS' SURPLUS

individual expects to achieve a given total income, or level of welfare, from fishing operations, any method of compensation may cause the individual to work less but still be able to attain his desired level of income. If an individual is an income maximizer, he would fish as much as possible, regardless of the amount of compensation. Nor would the method of administering compensation, in a lump sum, or on a daily catch basis as is the case at Southern Indian Lake, affect the number of days an income maximizer would spend fishing.

Quinn and Trebilcock (1972) make extensive criticisms regarding details of compensation payment programs. Pertinent comments are:

1) Compensation payments determined by third party adjudication using market data will not necessarily reflect true welfare losses because of the possibility of non-market changes in the welfare of individuals involved, job satisfaction, for example.

2) Transaction costs of attempting to administer compensation payments on an individual basis will often be prohibitive.

3) To accurately reflect real welfare losses, compensation payments must be determined by negotiation between gaining and losing parties.

4) Compensation programs should not be constructed so that they provide disincentives for efficient adaptation to change. Rather, they should improve the rapidity or appropriateness of adjustments to new conditions by prospective losers.

5) Compensation schemes should be based on proof of actual loss. Otherwise they are likely to systematically over or undercompensate losers.

In summation, determination of the size of compensation payments

made to individuals whose economic welfare is decreased by a government or private project or policy change can be guided by rules of welfare economics such as Pareto optimality and the Kaldor-Hicks principle. In addition to market values, compensation payments must cover all other social costs incurred by losers in order to maintain the utility they derive from the post-project situation at the same level as the pre-project situation.

The correct size of compensation payments are best arrived at by negotiation between losers and developers. In the case of hydro-electric impoundments, post-impoundment monitoring may be required to determine exact changes in resource productivity.

### 2.5.2 Hydroelectric Developments

Environmental impacts of hydroelectric developments, such as the decrease in catch per unit effort observed at Southern Indian Lake, are technical externalities of economic decision-making and as such are beyond the scope of a financial appraisal of project viabiltiy. Financial assessments of large capital projects deal only with direct costs. Revenues accruing to other sectors of society are not addressed by a financial analysis. Benefit-cost analyses are necessary to evaluate total social costs and benefits of investment projects. They incorporate the more narrow financial appraisal of a project as part of their calculations. Peterson (n.d.) in Benefit/Cost Analysis as a Basis for Compensation and Mitigation Decisions for Hydroelectric Projects discusses compensation payments for non-marketed environmental resources. Peterson discusses compensation on the bases of equity and efficiency.

Regarding efficiency, Peterson states that a developer should make payment to the Crown to cover the cost of resources used or damaged by a development. Such a payment:

1) Would ensure that benefits from a project would cover all costs.

2) Would provide incentive to examine design alternatives to reduce or eliminate the effects at a lower cost than full compensation.

3) Would be reflected in the price of the project's product and thus would include full social costs.

Regarding equity, payments would have two characteristics. They would be made:

1) When a community or region suffers relative to a province as a whole.

2) To government agencies for the purpose of making compensating investments in the region. Adopting this idea as standard practice would needlessly involve a third party, which would add additional costs to the transfer of compensation.

Where affected resources could be evaluated, equity payments would be guided by the value of the resource. Where intangible resources are at issue, payments would have to be negotiated and sanctioned by appropriate political or judicial processes.

It is becoming common practice that prior to commencement of construction of hydroelectric projects, impact analyses of the projects are performed. An objective of this type of study is determination of the value of loss of resources which already exist in areas which will be flooded. Inaccuracies in calculated decreases in the welfare of residents of affected areas may occur if these decreases in welfare are determined

only by pre-impoundment studies. Inaccuracies in estimated welfare changes will result in inaccurately sized compensation payments. Precise impacts on pre-existing resource may sometimes only be determined by post-impoundment studies.

The need for post-impoundment studies is evident when one examines some of the post-impoundment work which has occurred to date. Manitoba Hydro completed construction of its generating site at Grand Rapids in 1964. This development involved damming the Saskatchewan River below Cedar Lake and the consequent flooding of Cedar Lake and the Saskatchewan and Summerberry River deltas. A pre-impoundment forecast of environmental changes, titled Grand Rapids Hydroelectric Project, Saskatchewan River, Manitoba: A Report of Fish and Wildlife Resources was completed in 1961 by the U.S. Fish and Wildlife Service in cooperation with the Manitoba Department of Mines and Natural Resources. This report was limited by a lack of data concerning the areas to be flooded. Nevertheless enough information was available for the study to make certain predictions about what the state of fish populations would be post-impoundment.

Doan (1979), in Commercial Catch of the Fishery at Cedar Lake, Manitoba, Before and After the Grand Rapids Hydroelectric Development examines catch records from a period of 12 years before and after impoundment of Cedar Lake. He finds that a doubling of total yield and short term increases in catches of walleye, pike, and goldeye and the subsequent decline of goldeye were correctly forecast by the 1961 report. However, longer term predicted reductions of whitefish, walleye, and pike yields did not occur.

The predictions made in 1961 for the Cedar Lake fishery were only partially correct. In the case that a compensation plan had been agreed

upon between Manitoba Hydro and Cedar Lake fishermen partly based on the 1961 predicted decreases in whitefish, walleye, and pike yields, Manitoba Hydro would have overcompensated fishermen in these respects.

Post-impoundment studies also have the scientific benefits of refining future pre-impoundment predictions and of compiling basic information on areas where flooding is occurring, information which to a large extent is presently lacking. Improvements in either of these areas could potentially improve accuracy and administration of future compensation agreements.

## 2.6 Social Changes

Aside from Collinson et al. (1973) little work has been done specifically regarding social dynamics at South Indian Lake. One must realize that there are profound differences in lifestyles between people following a traditional Indian economy and people participating in the southern industrial economy. A man who pursues fishing and trapping performs fundamentally different patterns of activities that a man working a 40 hour week as an industrial worker. The Federation of Saskatchewan Indians (1976) describes in detail daily activities of individuals pursuing a tradtional lifestyle and the social relationships coexistant with such an economy.

Of the subjects discussed in this chapter, social aspects is certainly the subject most susceptible to value judgements. Totally opposite viewpoints have been espoused with equal justification being expressed by advocates of both sides.

Van Ginkel Associates (1967) in Transition in the North: The Churchill River Diversion and the People of South Indian Lake take a

very definite stand. They come to the "unqualified conclusion that the communities of native people that exist throughout Manitoba...have no future". They state that rebuilding the South Indian Lake community near its original site would be a waste in terms of long range benefits. Rather a "transition community" sould be constructed in a location conducive to development of primary industry and close to existing transporation systems. In this new community innovative education and training programs would be initiated which would enable its residents to become productive members of an industrial society.

Collinson et al. (1973) take an antithetical stand. They recommend that the residents of South Indian Lake be able to choose their economic lifestyle, that future viability of the fishery be ensured, and that residents who may wish to change their means of earning a living, and hence their lifestyle should be assisted in choosing between alternative opportunities. Certainly the approach advocated by this report would cause less social disruption.

It must be remembered that resource bases for any commmunity are finite. The size of local natural resources will place limits on the number of individuals who can pursue a tradtional lifestyle in an economically viable fashion.

Milford and Perry (1974) consider methods of minimizing social stress among people affected by large-scale public projects. Social Change and Stress: A Focus on Northern Development accentuates the need for effective communication between government and communities, local public participation, and the need to protect already existing lifestyles. They note that the Manitoba government did not seem to use a

public participation approach.

Social-Psychological Response to Forced Relocation due to Watershed Development discusses some effects of impoundment construction in the eastern United States. Napier (1974) finds that negative attitudes in relocated communities were directed toward the external change agent (government) and toward the inconvenience in moving. Relationships within the community did not suffer. Whether these findings are directly applicable to the relocation of residents of South Indian Lake is questionable, because of the different social structures of a northern Manitoba native community and a small town in eastern United States. As a result of relocation a new social structure formed in South Indian Lake (Collison et al. 1974). Such a change was not noted by Napier (1974).

Though in the long-term the traditional Indian lifestyle may disappear, presently it is still a realistic option for people in remote areas. In areas where it does exist, large scale introduction of the southern industrial economy must occur in consultation with local people in order to prevent social disruption.

# Chapter 3

# METHODS

## 3.1 Field Activities

Field activities for this study occurred from June 7th to August 23th, 1980, when the author was living at Loon Narrows and was able to obtain significant insights into daily activities of fishermen.

The primary method of information gathering was a questionnaire which was administered to fishermen on a voluntary basis. An attempt was made to interview as many fishermen as possible. Only three individuals refused to be interviewed during the entire period.

The questionnaire used was one which had been used previously by the Economics and Marketing Directorate of the Department of Fisheries and Oceans (see Appendix A). The only significant change made to the questionnaire was that a section that dealt with "Large Boats or Inboard/Outboard Yawls" was deleted. Questionnaire accuracy is discussed in Appendix B.

## 3.2 Other Information Sources

Aside from the questionnaire, a number of other sources of information were used. They included:

1) Invoices of purchases made by fishermen, of groceries and fuel from the FFMC store at Loon Narrows.

2) "Daysheets" which recorded daily the quantity of each species

of fish delivered by each fisherman to Loon Narrows landing station.

3)Fishermen's accounts with the FFMC up until August 21st, obtained at the FFMC plant in Leaf Rapids.

4) FFMC fishermen's equipment price lists, obtained from FFMC offices in Winnipeg.

5) A record of the total incentive and differential payments made to each fisherman for the 1980 summer season was obtained from Manitoba Hydro.

6) Final individual fisherman and aggregate lake catches of fish and payments to fishermen, obtained from FFMC records.

7) Costs of skiffs were obtained from Lake Winnipeg Boat Works Ltd., Gimli, Manitoba, and from interviews.

8) Cost of outboard motors were obtained from marinas in Winnipeg, as well as from interviews.

Values of expenditures and income extracted from the sources of information were totalled and corrected using a hand calculator.

## 3.3 Extrapolation of Data

Records of fishermen's expenditures on food and fuel were obtained for the period from late May until August 21st, shortly before the author left the field. Fishing continued however, until September 13th.

To determine fishermen's expenditures for the period after August 21st, averages of weekly grocery and fuel expenditures for the period until August 21st were calculated. The length of time an individual continued to fish after August 21st was determined from the FFMC record of weekly deliveries. The average weekly expenditure for each individual was then extrapolated the appropriate length of time.

## 3.4 Economic Performance Criteria

At the level of the firm, economic analysis is largely concerned with ascertaining returns to owners of labor, capital, and other factors of production. In the case of a fishing enterprise, fishermen own labor and capital. In the case of an inland fishery the Crown, in the right of the Provinces, owns the other major factor of production, the resource (Thompson 1974).

Resource royalties are generally levied by the Crown to collect the economic rent generated by the resource. However, in Manitoba, the Crown has not instituted fish royalties, as it has in other provinces. Consequently, the fish enter the private accounts of fishing enterprises at a zero cost. Consideration of the return to the fishery resource is beyond the scope of this study.

This study shall judge a fishing enterprise to be economically viable if the revenue generated by an enterprise exceeds the sum of variable (operating) costs required to run the enterprise, plus "reasonable" return to labor, plus "reasonable" return to capital invested in the enterprise. Enterprises meeting these criteria may be considered to be economically viable in the long run.

If an enterprise fails to generate revenue equal to these espenses it will be considered to be economically non-viable. In such a case individuals may be better off in other activities where their labor and capital can be invested more productively. It should be noted that such enterprises may be economically viable in the short run, able to meet operating costs and return to labor, but will be incapable of re-investing in capital equipment.

### 3.4.1 Definition of a Fishing Enterprise

The fishing enterprise is the basic unit by which economic returns were analyzed. Fishing enterprises were not homogenous units. Three types could be defined:

1) One individual, one vessel.

2) Two or more individuals, one vessel.

3) Two or more individuals, two or more vessels.

In each case the total revenues and costs accruing to each enterprise were analyzed.

## 3.5 Returns to Labor

Economic analysis, given normally functioning markets, generally equates the return to labor to the supply price (observed wages) of labor (Treasury Board 1976). In this study it was not possible to observe wage rates, because fishermen, being self-employed individuals, do not generally pay themselves explicit wages. Rather they are inclined to take residual profits (returns to capital and labor) as their income. As a consequence, it is necessary to impute a wage for this analysis. Commonly, "reasonable" return to labor is estimated using the economic concept of opportunity cost. Opportunity cost of labor is generally defined as the income an individual could earn in his next best alternative employment (Ferguson and Maurice 1978). Three possible opportunity costs of labor were considered.

### 3.5.1 Employment at Ruttan Mine

The Ruttan Mine is approximately 1¼ hour trip, by boat and road, from the town of South Indian Lake. Wages there are those typical of a remote mine, well above minimum wage.

Few residents of South Indian Lake work at the mine. This may simply be that daily commuting to the mine would be time consuming and could be difficult, depending on weather. Residents of South Indian Lake who wish to become miners may be forced to move to Leaf Rapids, from where company buses shuttle miners to and from the mine.

Relatively few Indian people work at the mine. This may be because someone who was raised within a traditional economy is used to having flexible working hours and so drives greater utility from working fewer hours or from working more flexible hours than he would working a rigid shift schedule but earning more money.

Ruttan Mine wages may be the opportunity cost of labor for some individuals. But not everyone can become a miner. What was needed as a measure of the opportunity cost of labor was a benchmark which could be applied to all individuals.

### 3.5.2 Welfare Allowance

Though a plausible alternative source of income to commercial fishing, value of welfare allowances were not used as the opportunity cost of labor, for the following reasons.

First, the size of a welfare allowance a potential fisherman would receive would depend on the size of his family. Different rates are paid per person to a single adult, two adults, parents with one child, and parents with more than one child. The size of welfare payments is also affected by age of children, medical expenses, and cost of utilities. The information required to calculate potential welfare allowances was not gathered while the author was in the field as such information gathering was beyond the scope of this study. Calculation

of a standard welfare payment would be extremely difficult and its accuracy questionable.

Second, a basic monthly welfare allowance (groceries, clothing, personal and household supplies) to an adult north of the 53rd parallel was approximately $160 at the time of the study (Manitoba Income Security Branch, personal communication). Employment at the minimum wage level ($3.15/hr x 8 hr/day x 22 work days/month) earns $554. Measuring personal utility strictly on the basis of monetary income, the next best alternative to fishing is the minimum wage. Recall that the opportunity cost of an endeavor should measure the next best alternative.

Finally, a fisherman on welfare is classed an "unemployed employable" by government agencies. As such he is encouraged to find work. His tenure on welfare is not assured, which casts further doubt on the accuracy of using welfare payments as the opportunity cost of labor.

### 3.5.3 Minimum Wage

The provincial minimum wage was the value used to obtain the opportunity cost of labor.

Some employment opportunities exist in the town of South Indian Lake. Additional opportunities exist in Leaf Rapids and seasonally with the FFMC. Though employment opportunities are limited, they are probably available for an individual who chooses to pursue them.

The minimum wage provides a "benchmark" for the returns to labor from fishing. As such it may be construed as the minimum valuation of labor. Fishing enterprises that are unable to attain this level of return are very likely to be economically non-viable. The minimum wage also has the advantage of being a common denominator in the provincial

economy and as such allows comparison of employment within the economy. The Manitoba provincial minimum wage was $3.15 per hour throughout 1980.

The number of hours of labor per day spent by fishing was variable. This was not only the case from fisherman to fisherman. but also on a day to day basis. Factors which affected time spent fishing appeared to include the number of nets being fished, size of catch, skill of the operator, number of crew members, and weather conditions. In arriving at a labor cost, an eight hour day was chosen in spite of the above noted variability. This was done, because in general an individual had to be prepared to commit himself to a full day fishing, regardless of whether in fact it took three hours or 10 hours.

The total number of days fished per enterprise was determined by summing the number of deliveries of fish made to FFMC landing stations, plus the number of days spent preparing for the fishing season, plus one day for returning to town at the end of the season. Generally, fishermen delivered fish each day that they lifted their gillnets.

## 3.6 Returns to Capital

What may be considered as reasonable returns to capital can be measured by using an opportunity cost of capital. Inclusion of an opportunity cost of capital in an accounting statement indicates that money is tied up in capital items, money which could have been put to other uses.

Capital items (skiffs, outboard motors, and nets) normally last more than one fishing season. A depreciation calculation spreads the opportunity cost of capital over the lifetime of the item. It also

serves the accounting function of representing physical deterioration of a capital item. In this report straight-line depreciation is the method used to account for the opportunity cost of capital. Depreciation calculations are based on the 1980 replacement costs of capital items.

The Economics Section of the Department of Fisheries and Oceans commonly assumes a 10 year lifetime for skiffs. It also assumes a book value of zero for skiffs and outboard motors at the end of their lifetime (P. Thompson, Fisheries and Oceans, personal communication). The mean age of skiffs owned by fishermen who were interviewed was 3.9 years. This value was considered to be artificially low, for two reasons. First, during the mid 1970's special ARDA grants were available for fishermen to purchase capital items. These loans allowed fishermen to purchase boats when without these loans they may not have done so. Second, in the mid to late 1970's fiberglass skiffs became available to replace the wooden ones used up until then. Fiberglass hulls require less maintenance than wooden hulls. They are also lighter and so reduce expenditures on gas. These reasons would encourage fishermen to buy fiberglass hulls though their wooden ones were still serviceable. A number of wooden skiffs in seemingly reasonable condition, pulled up on shore and unused, were seen by the author. Consequently, this report assumes that with reasonable maintenance the expected lifetime of a skiff is 10 years.

The mean age of outboard motors owned by fishermen who were interviewed was 2.5 years. Fishermen commonly expected nets to last two summer seasons. Depreciation for these items was calculated over these respective time periods.

A book value of zero was assumed for all capital items at the end of their lifetimes.

## 3.7 Interest Expenses

Interest expenses are the interest payments on loans made to fishermen to pay for capital items. Interest payments do not contribute toward paying off principle of a loan. Rather they are a charge made by the loan agency for the use of its money. Hence interest payments are not considered a capital expense (Meigs et al. 1973).

The Manitoba Agricultural Credit Corporation (MACC) is the agency most fishermen approach for loans for capital equipment. Payments on loans consist of a maximum of 25% of the gross revenue of a fisherman's catch, calculated weekly. Most fishermen pay the 25% maximum, but fishermen who are high producers pay a lower proportion, frequently 20%.

MACC loans to fishermen use a subsidized interest rate. In the summer of 1980 the rate was 14.5% (O. Josephson, MACC, personal communication). MACC attempts to amortize its loans over a period of time shorter than the lifetime of the item for which the loan was made. For this study, an amortization period of three years was thought to most accurately portray the real situation (P. Thompson, Fisheries and Oceans, personal communication). Capital recovery factors were obtained from tables in Grant et al. (1976).

In calculating the size of interest payments, any item three or more years old was considered to be paid off. No interest was charged on these items. Interest payments were calculated for all capital equipment less than three years old.

Interest payments are not made on nets. Nets are bought directly from the FFMC. Their purchase is not financed by MACC loans.

## 3.8 Net Present Value of Fishing Enterprises

### 3.8.1 Present Value of Cash Flow

The present value of a fishing enterpirse is the value a fisherman now places on all present and future cash flow from the enterprise, given the fisherman's marginal time preference rate. A marginal time preference rate places a higher value on present income than on future income by discounting successive annual future incomes at a given rate. In practice, a standardized discount rate is used in lieu of measuring individuals' marginal time preference rates.

The lifetime of a fishing enterprise is synonomous with the expected lifetime of a skiff, 10 years. The present value of a fishing enterprise was obtained by discounting the 1980 cash flow, made annually over a 10 year period. The discount rate used was the MACC interest rate in the summer of 1980, 14.5%.

### 3.8.2 Present Value of Cost of Investment

The cost of investment for a fishing enterprise is the amount spent on capital items, boats, motors, and nets. The present value of the cost of investment is the discounted ( at the MACC rate) amount of money required to be spent on capital items over the 10 year life of an enterprise. This was calculated in the following manner:

1) Skiffs - $1775 spent on a 20 foot (6 m) skiff in year zero.

2) Motors - $513 spent for a 25 HP outboard motor in years zero, 2.5, 5, and 7.5.

3) Nets - $1292, the value of the average number of nets owned by an enterprise, spent in years zero, 2, 4, 6, and 8.

### 3.8.3 Net Present Value

This measure of the profitability of an enterprise was obtained by substracting the present value of the cost of investment from the present value of an enterprise. A positive net present value was considered indicative of economic viability. A negative net present value was indicative of unviable economic performance.

## 3.9 Case Study Selection

In order to qualitatively describe fishing operations, four enterprises (17% of total) are discussed in detail. The enterprises were randomly chosen, on the basis of net income without compensation payments, one from each quartile, with the restriction that there would be at least $500 difference in net income between enterprises selected from adjacent quartiles.

# Chapter 4

# RESULTS

## 4.1 Sample Size

The author interviewed a total of 55 fishermen. This number represented approximately 70% of all fishermen who made deliveries to Loon Narrows during the time of field research. It also accounted for approximately 80% of fishermen who were at Loon Narrows at the end of the period of field research, and for 50% of the total number of licensed fishermen fishing Southern Indian Lake in the summer 1980.

As analysis for this study was conducted on an enterprise, not individual basis, a number of individuals who were interviewed but whose partners were not, had to be excluded from the analysis.

As well, some partners who were not interviewed but whose FFMC account statements the author felt were very complete, were included in the analysis. These men contributed little to the enterprise in which they were included. Any errors introduced to the data because of the lack of an interview were minimal.

The final analysis consisted of 24 enterprises worked by 55 men. Fifty-one of these were interviewed and four were not.

## 4.2 Historic Revenue

Table 1 represents summer fishery gross aggregate revenues for the

entire lake, for 1970 to 1980 (FFMC data). The values are exclusive of any subsidy payments. It can be seen that the 1980 summer season fits into a general increase in the number of fishermen over time. It also fits into a plateau in the gross aggregate value of the catch, which appears to have occurred since impoundment in 1976. In these respects the 1980 summer season appears to be representative of future likely trends in the fishery.

## 4.3 Tabulation of Data

Firms are analyzed on the basis of fixed and variable costs. In the following tabulation of data, items 1) to 7) fall into the category of variable costs. These costs are closely related to the amount of fishing done by an enterprise and generally increase with the length of time spent fishing. Items 8), 9), and 10) may be termed semi-variable costs. Though they are seasonal costs they are fixed or indirectly related to the level of production of an enterprise. Depreciation costs are fixed costs stemming from the size of capital investment in an enterprise. They are spread out over more than one season, for the life-time of the particular capital item.

Table 2 and Appendix D present the aggregate and individual enterprises' revenues and expenditures. Headings in their left most columns have the following meanings:

1) Fuel - amount spent on gas, oil, gear oil. and grease for outboard motors.

2) Repairs - unforseen work needed on boats and motors.

3) Miscellaneous - expenditures needed to maintain capital

Table 1

Lake Aggregate Gross Revenues 1970-1980
Summer Fishery (1980 $)*

| Year | Number of Operators | Total Catch (lb) | Total Catch (kg) | Aggregate Gross Revenue | Mean Revenue | Maximum Revenue | Minimum Revenue |
|---|---|---|---|---|---|---|---|
| 1980 | 111 | 801,582 | 363,592 | 259,850 | 2,341 | 10,131 | 11 |
| 1979 | 101 | 881,329 | 339,765 | 279,523 | 2,767 | 15,035 | 31 |
| 1978 | 89 | 956,030 | 433,648 | 223,266 | 2,508 | 10,049 | 18 |
| 1977 | 92 | 1,098,874 | 498,441 | 412,224 | 4,481 | 33,417 | 158 |
| 1976 | 74 | 924,524 | 419,358 | 379,556 | 5,129 | 23,099 | 45 |
| 1975 | 53 | 657,699 | 298,328 | 210,290 | 4,137 | 29,802 | 401 |
| 1974 | No fishing. Employment was available on Manitoba Hydro construction. | | | | | | |
| 1973 | 70 | 747,481 | 339,052 | 200,295 | 2,347 | 10,499 | 15 |
| 1972 | 63 | 451,603 | 204,844 | 139,973 | 2,222 | 58,831 | 31 |
| 1971 | 75 | 746,588 | 338,647 | 215,981 | 2,879 | 12,593 | 114 |
| 1970 | 83 | 722,551 | 327,744 | 165,719 | 1,996 | 11,683 | 32 |

*The consumer price index (CPI) for the Winnipeg area was used to convert to 1980 $. Though not all the goods and services included in calculation of the CPI are applicable to fishing operations at Southern Indian Lake, other measures of inflation, such as the producer's price index are not truely representative either.

equipment (boats and motors), such as spark plugs and batteries. Includes improvements, such as the purchase of steering gear.

4) Fishing Gear - amount spent on gloves, knives, fish tubs, oilers (waterproof clothing), rubber boots, sideline, floats, and weights. Does not include expenditures for nets, which are treated as capital items.

5) Camp Gear - expenditures on equipment such as tents, lanterns and axes. Includes values for tarps and paint, which were also used as fishing equipment. Includes values for naptha gas for stoves and lanterns.

6) Food - amount spent on food for the fisherman or his partners, but not for dependents. Includes items such as tobacco, soap, matches, and insect spray.

7) Labor - opportunity cost of the time spent fishing or on fishing related activities such as performing repairs on equipment. Values used were the Manitoba minimum wage of $3.15 per hour and an eight hour day.

8) License - paid to the Manitoba Department of Natural Resources. Ten dollars per fisherman.

9) Insurance - boat insurance.

10) UIC - Unemployment Insurance Commission contributions deducted from the gross payments made to fishermen by the FFMC. See Appendix C for the calculations involved.

11) Depreciation - accounts for physical deterioration of capital equipment. Explained in section 3.6.

12) Interest expenses - accounts for interest paid on loans made for the purchase of capital equipment. Explained in section 3.7.

13) Net income - income from fishing remaining after operations,

indirect, depreciation, and interest expenses are deducted from gross revenue.

14) Cash flow - net income plus interest payments, plus depreciation costs. This is what the fishery or an enterprise has earned and has available to meet its capital costs.

4.3.1 Net Income

Net income is a commonly used annual accounting measure of the financial viability of an enterprise. In the present case it provides a seasonal "snapshot" of the performance of the fishery.

Concisely put, net income equals total revenue minus total expenses. At first reading, this statement seems straightforward enough. There is, however, more than one commonly accepted method of arriving at the value of total expenses. Different accountants may well arrive at different net income values with equal justificaion. For instance, there is more than one conventional method of calculating depreciation. If a method other than straight-line depreciation had been used to calculate capital item deterioration of the sampled fishing enterprises, different net income values would have been obtained.

Consequently, though net income calculations provide an immediate judgement of financial viability of an enterprise, they do not offer an unambiguous measure of the amount of money an enterprise can expect to generate over a given period of time. Effective financial planning for an enterprise requires such knowledge.

When considering the long run, that is the time frame in which it is necessary for an enterprise to buy another skiff, use of net income to evaluate economic performance is again precluded. It is

precluded for a second reason, in addition to the fact that various values for net income result from the use of different accounting precedures. The method of straight-line depreciation used here to obtain net income values disregards the concept of marginal time preference for money. Use of net income values to evaluate long run economic performance would discount future depreciation at 0%. In otherwords, equal value is placed on a given amount of money at the beginning of the first year of operation as is placed upon the same amount ten years hence. This is inconsistent with the reaminder of the accounting procedures used in this report. Net income cannot be used for evaluation of long run economic performance.

### 4.3.2 Cash Flow

Cash flow provides a measure of the amount of money generated, after variable costs have been deducted, to repay the cost of total investments. It provides an important method of assuming the profitability of an enterprise over an investment period.

In the short run, one summer season in the present case, enterprises are economically successful if they generate a positive cash flow. Because, by definition, capital investment is not a consideration in short run economic operations, fixed costs are not included in calculations of one summer's fishing operations. Capital costs are taken into account when discussing long run economic potential of the fishery, in section 4.6.

In this study long run economic performance is assessed by discounting cash flows over the average lifetime of an enterprise, 10 years. Thus one obtains the present value of the aggregate sample or of an individual enterprise. In order for fishing operations to be economically viable, the present value of capital expenses must be less

than the present value of cash flow.

It is apparent that by discounting the cash flow values of the 1980 summer fishery absolute values (profit or loss) of cash flow will not change and so neither will final verdicts of economic viability or non-viability. Such a long run evaluation will put in proper perspective the magnitude of profit or loss which the aggregate sample or individual enterprises can expect to incur over the average life expectancy of an enterprise. That is, until a major capital expense, that of buying another skiff, is experienced.

One weakness of the discounting method used here is that data were obtained for only one season. No measure could be made of yearly variability of revenues and expenditures. Annual vaiability in revenues and expenditures may be caused by a number of factors, some of which are:

1) As the major market for whitefish is in the United States, fluctuations in the Canadian-American exchange rate could affect the price received for whitefish.

2) Increased or decreased costs, relative to the price received for fish, could affect cash flows. A real increase in the cost of gasoline would reduce cash flows, for example.

3) Weather conditions may affect the year to year level of fishing effort or the catchability of fish.

4) Changing limnological conditions may lead to further changes in physical catch per unit effort or other factors affecting the catchability of fish.

These sort of changes may make evaluation of the fishery, based only on 1980 data, either overly optimistic or overly pessimistic. Nevertheless this type of analysis provides a basis for evaluation of the

economic performance of the industry. If the parameters of variabiltiy were known the anlaysis could be adapted to provide a sensitivity test for the affects of variability on economic performance.

## 4.4 Unit Cost of Fishing

The unit cost of fishing answers the question "How much does it cost to catch a pound of fish?". It is expressed here as the average cost of catching one pound of fish ($/lb). This was determined both for variable costs and for total costs.

Economic theory holds that fishermen will continue to fish as long as revenue from the daily catch (marginal revenue) exceeds the daily cost of fishing (marginal cost). As long as this relation holds, average revenue will exceed average variable (operating) cost. Profits will be made, at least in the short run.

Whether or not sufficient revenue is generated for an enterprise to realize "reasonable" returns to capital is determined by the size of the difference between seasonal total revenue and total cost compared to the size of capital investment.

### 4.4.1 Variable Unit Cost

Variable unit cost of fishing was obtained by dividing aggregate variable costs, which are incurred on a daily basis, by the total catch of the aggregate sample.

$$\frac{\$111,709 \text{ (Table 2)}}{454,867 \text{ lb } (206,328 \text{ kg}) \text{ (FFMC data)}}$$

$$= \$0.246/\text{lb } (\$0.542/\text{kg})$$

Average unit revenue was $0.324 (FFMC data). As average unit revenue exceeded unit cost one would expect the aggregate sample to be viable in the short run.

Even though aggregate average revenue exceeded aggregate average cost, one third of sampled enterprises were not viable, even in the short run. This is discussed further in section 4.5.2.

4.4.2 Total Unit Cost

Total unit cost of fishing considered semi-variable and fixed costs in addition to variable costs.

$$\frac{\$111,709 + \$1,822 + \$43,131 \text{ (Table 2)}}{454,867 \text{ lb } (206,328 \text{ kg}) \text{ (FFMC data)}}$$

$$= \$0.344/\text{lb } (\$0.759/\text{kg})$$

This cost exceeded the average unit revenue of $0.324/lb ($0.714/kg). The aggregate sample could not generate revenue adequate enough to cover its capital costs, according to this equation.

The fixed costs in this equation were based on straight-line depreciation, the shortcomings of which were discussed in section 4.3.1. Nonetheless, as discussed in secion 4.5.1, this equation provides an immediate estimate of the capital budgeting problems faced by the fishery, based on 1980 revenues and expenditures.

Capital costs of fishing probably have not been substantially increased by impoundment of the lake. Damage to boats, motors, and nets due to floating debris has been compensated for by Manitoba Hydro (see section 5.2). The high unit cost of fishing likely is caused by high variable costs. Variable costs have probably been increased by decreased

Table 2

Aggregate Sample Revenues and Expenditures (1980 $)

| | |
|---|---|
| FISH SALES | 143,328 |
| OPERATIONS | |
| Fuel | 25,212 |
| Repairs | 5,610 |
| Misc. | 1,387 |
| Fishing gear | 11,763 |
| Camp gear | 4,575 |
| Food | 11,329 |
| Labor | 51,833 |
| Total | 111,709 |
| INDIRECT COSTS | |
| License | 508 |
| Insurance | 301 |
| UIC | 1,013 |
| Total | 1,822 |
| GROSS OPERATING PROFIT | 29,797 |
| DEPRECIATION | |
| Skiff | 4,721 |
| Motors | 22,911 |
| Nets | 15,499 |
| Total | 43,131 |
| NET OPERATING PROFIT | -13,334 |
| INTEREST EXPENSES | 7,816 |
| NET INCOME | -21,150 |
| CASH FLOWS | |
| Net income | -21,150 |
| Depreciation | 43,131 |
| Interest | 7,816 |
| Cash flow | 29,797 |

catch per unit effort and increased fuel expenses, caused by the more frequent relocation of nets.

### 4.4.3 Size of Catch

Generally the larger an enterprise's total catch, the lower was the unit cost of fishing. Enterprise 24, the enterprise with the highest catch (69,494 lb or 31,516 kg) had the lowest variable and total unit costs of fishing, $0.12/lb ($0.26/kg) and $0.173/lb ($0.381/kg), respectively. Enterprise 17 had the smallest catch, 3,3188 lb (1,446 kg) and had the largest unit costs of fishing. Variable unit cost was $0.6/lb ($1.31/kg). Total unit cost was $0.823/lb ($1.81/kg).

## 4.5 Evaluation - Short Run

### 4.5.1 Aggregate Sample

Cash flow for the aggregate sample was $29,797 (see Table 2). This indicates that the fishery generated a cash flow for the length of one summer which was large enough to cover variable and semi-variable costs, including "reasonable" returns to labor, but excluding considerations of returns to capital. The aggregate sample operated with economic viability in the short run.

If one considers capital expenses, the aggregate sample operated with a negative net income of -$21,150. Though all these capital expenses were not actually incurred in the 1980 summer season, this figure provides additional information regarding economic viability of the fishery by describing what might be termed as an "average" seasonal cost of capital. The aggregate sample operated in a fashion such that average revenues from daily catches exceeded average variable costs of fuel, food, etc.

As long as a daily profit is made, enterprises will continue to fish. Having made an initial investment in a skiff this cost is in the past and no longer affects an enterprise's seasonal and daily decisions to continue fishing. A decision to continue fishing in the short run could likely be reinforced by the traditional lifestyle followed by native fishermen. The large negative aggregate net income indicates that when it becomes necessary to replace a skiff at least some enterprises will likely not have sufficient cash flow to do so. The economic viability of such enterprises would be restricted to the short run.

### 4.5.2 Individual Enterprises

Appendix D shows that out of the 24 enterprises, 16 generated positive cash flows and eight operated with negative cash flows in the 1980 summer season. Enterprises which operated with negative cash flows were unable to generate "reasonable" returns to labor as defined in section 3.5.3. Despite the positive aggregate cash flow, one third of the sampled enterprises operated in an unviable economic fashion in the short run.

This apparant discrepancy of a viable aggregate fishery being only marginally viable when its individual enterprises are considered can be explained by considering the distribution of cash flows. See Figure 6.

The distribution of cash flows is skewed heavily to the left. A large proportion of enterprises have low or negative cash flows. In the aggregate these poorer enterprises are masked by the few enterprises with very large cash flows, making the aggregate seem more positve than an evaluation on the basis of individual enterprises would allow. The

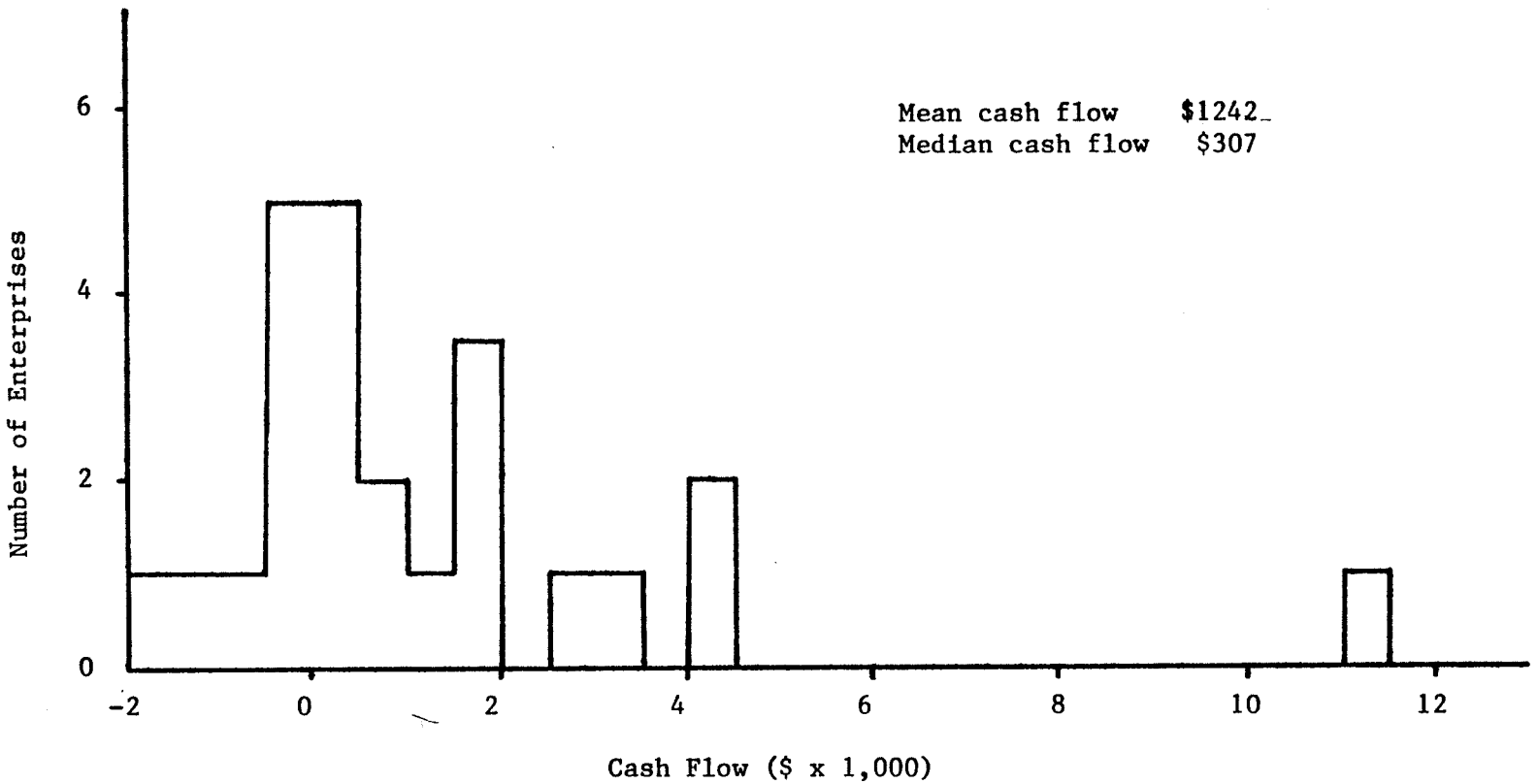



Figure 6

DISTRIBUTION OF CASH FLOWS

same phenomenon is present also in the long run evaluation in section 4.6.

Of the eight enterprises with negative cash flows (enterprises 3, 6, 10, 13, 17, 18, 19, and 22) at least some of them were in the classic position of having daily marginal cost exceeding daily marginal revenue, yet they still continued to fish. Enterprises 3, 17, and 18 likely experienced this situation and should have been aware of it. Enterprise 22, on the other hand, had a reasonably high daily average revenue ($129/day). Its negative cash flow was due largely to unpredictable large repair costs.

On the basis of cash flows of individual enterprises the fishery is marginally viable in the short run. Enterprises which fished with lower amounts of fishing effort were most likely to operate with negative cash flows, though fishing in an intensive manner was not a guarantee of receiving a positive cash flow.

## 4.6 Evaluation - Long Run

A fishery normally operates in the long run. Continued fishing requires the eventual replacement of capital items. There are exceptions to this expectation. For instance, an individual wishing to retire from a fishery would not be concerned about buying another boat.

Assuming individuals wish to continue fishing, realistic economic evaluation of a fishery must consider the long run exclusively, with the exception of special cases such as the retiree mentioned above.

### 4.6.1 Breakeven Analysis

In the case of commercial fishing operations the breakeven point is the minimum average size of annual catch an enterprise would have to

land over its lifetime in order to generate a discounted cash flow equal to the enterprise's total capital expenditures. In simpler terms, assuming average revenue exceeds average variable cost, the breakeven point is the size of annual catch required to pay for an enterprise's skiff, motor, and nets. If an enterprise had no fixed costs, the problem of reaching a breakeven point would not occur.

A breakeven point analysis is a long run evaluation of economic performance since it makes an effort to include capital (fixed) costs in its determination. The present breakeven analysis is only an approximate measure since it is based on the "average" capital cost incurred by enterprises, in the form of straight-line depreciation. As was mentioned in section 4.5.1 "average" capital costs were not actually incurred by enterprises. It also assumes that over the average lifetime of an enterprise, costs and prices remain proportional to one another. This is not likely to be true in reality.

The breakeven point can be determined by the following formula:

$$Q = \frac{FC}{AR-AVC}$$

Where Q is size of catch, FC is fixed costs, AR is average revenue (exclusive of subsidy payments), and AVC is average variable cost. For the aggregate sample, this equation was:

$$Q = \frac{\$43,131 + \$508 + \$301 \text{ (Table 2)}}{0.324 \text{ \$/lb (FFMC data)} - 0.246 \text{ \$/lb (FFMC data and Table 2)}}$$

$$Q = 559,745 \text{ lb } (253,896 \text{ kg})$$

In this equation FC equals depreciation costs plus two annually

fixed (semi-variable) costs, license and insurance.

The actual quantity caught by all enterprises was 454,867 lb (206,289 kg). This was only 81% of the size of catch required for the aggregate sample to breakeven.

There may be a number of reasons which contributed to the enterprises in question failing to attain their aggregate breakeven catch. Some possibilities are:

1) Decreased catch per unit effort and dispersion of fish stocks from traditional fishing grounds have increased the average variable cost of fishing and hence the size of the breakeven catch.

2) Overcapitalization in the fishery has increased fixed and, to a lesser extent, variable costs to a level which is not required in order to catch the lake's quota.

3) Three man crews manned some skiffs. A third man increase labor, food, and clothing costs while not being essential to the operation of a skiff.

4)If enterprises had fished more intensively, that is if they had fished more frequently and/or with a larger number of nets in the water at once, greater revenues would have accrued to the same level of fixed costs.

If the 1980 season was typical of future summer season fisheries, this breakeven analysis forces one to conclude that in the aggregate, the enterprises under consideration are not economically viable in the long run. Their aggregate catch was too small to cover their capital cost.

### 4.6.2 Aggregate Sample

As mentioned in section 4.3.2 the present value of future cash

flows is an important indicator of the future profitability of an enterprise over an investment period. In order for a fishing operation to be considered profitable in the long run, its present value of cash flow must be greater than its present value of cost of investment. That is, it must have a positive net present value in order to achieve "reasonable" returns to labor and capital. In the Southern Indian Lake fishery, the cost of investment was measured as the amount spent over the 10 year average lifetime of an enterprise on skiffs, motors, and nets.

The present value of cost of investment for an individual enterprise was determined to be $7140. For the aggregate sample this value was 24 x $7140, or $171,360.

These figures are optimistic. They were based on the price of a 25 hp outboard motor, whereas many enterprises used larger, more expensive motors. It is also based on the price of a 20 ft. (6 m) skiff, whereas a few fishermen used 22 ft. (7 m) skiffs. Nonetheless a 25 hp motor and a 20 ft. (6 m) skiff are adequate equipment for a fishing enterprise, even though they may not be preferred by some fishermen. Five of the 24 sampled enterprises used such equipment. If enterprises use larger motors and boats than those which were used in these calculations, their present value of cost of investment will be increased. They will have to market larger catches in order to achieve a positive net present value of cash flow.

Using the MACC discount rate of 14.5% the present value of future cash flows was $174,542. Subtracting the net present value of cost of investments, $171,360, yields a positive aggregate net present value of $3,182. Though this is a positive figure it is small considering that it

is the result of 10 years' work by 24 enterprises. Though the aggregate sample is viable in the long run, it is so by an extremely narrow margin.

In the previous section, the breakeven analysis found that the aggregate sample was not viable. The breakeven analysis was approximate as it was based on "average" capital costs which all did not actually accrue to the 1980 fishery. It also was based on the historic costs of some enterprises purchasing outboard motors, perhaps more than one per enterprise, larger than 25 hp. It also was based on some skiffs larger than 20 ft. (6 m). All three of these factors would increase capital costs and so make it more difficult for the fishery to operate in the long run. It would be more likely that the breakeven analysis would find the aggregate sample not to be viable in the long run.

Use of 25 hp motors and 20 ft. (6 m) skiffs in the net present value calculation was not unrealistic since these were future projections. It did not contradict anything which have happened in the past. There is no guarantee that 1980 levels of capital expenditure will continue into the future. Use of smaller, less expensive capital items merely presented an optimistic view of future expenditures.

### 4.6.3 Individual Enterprises

Though the aggregate sample was slightly viable in the long run the question of individuals' well being is addressed by the viabiltiy of individual enterprises.

Present values of the cash flows of individual enterprises is shown in Table 3. As can be seen, only 8 of the 24 enterprises had an unsubsidized cash flow in excess of $7140, the calculated average present value of capital investment. The remaining 16 enterprises were not

Table 3

Present Values of Enterprises' Cash Flows (1980 $)

| Enterprise | PV of Cash Flow | PV of CF plus Freight Sub. | PV of CF plus Hydro Comp. | PV of CF plus F.S. plus H.C. |
|---|---|---|---|---|
| 1 | 25,288 | 40,986 | 35,732 | 51,431 |
| 2 | 3,977 | 9,156 | 14,299 | 19,489 |
| 3 | -978 | 3,229 | 12,202 | 16,419 |
| 4 | 24,368 | 36,277 | 50,083 | 61,992 |
| 5 | 1,763 | 7,422 | 20,701 | 26,360 |
| 6 | -2,255 | 1,213 | 3,520 | 6,988 |
| 7 | 14,802 | 22,253 | 38,971 | 46,422 |
| 8 | 10,830 | 18,141 | 15,306 | 22,617 |
| 9 | 18,059 | 27,015 | 49,498 | 58,454 |
| 10 | -2,724 | 2,179 | 13,613 | 18,516 |
| 11 | 1,833 | 5,436 | 12,875 | 16,478 |
| 12 | 6,080 | 11,194 | 21,035 | 26,149 |
| 13 | 1,025 | 4,311 | 15,371 | 20,707 |
| 14 | 1,300 | 4,827 | 10,105 | 13,631 |
| 15 | 11,305 | 17,936 | 32,885 | 39,516 |
| 16 | 3,626 | 7,474 | 14,896 | 18,744 |
| 17 | -6,033 | -4,873 | -3,591 | -2,431 |
| 18 | -4,792 | -1,300 | -503 | 2,987 |
| 19 | -1,166 | 3,931 | 15,107 | 20,203 |
| 20 | 10,913 | 19,553 | 37,015 | 45,655 |
| 21 | 1,470 | 7,316 | 21,410 | 27,256 |
| 22 | -8,939 | -750 | 12,688 | 20,877 |
| 23 | 129 | 5,032 | 16,407 | 21,310 |
| 24 | 66,766 | 91,122 | 85,780 | 110,136 |
| Mean | 7,360 | 14,128 | 23,024 | 29,579 |
| Median | 1,798 | 7,369 | 15,338 | 21,094 |

economically viable since they generated insufficient revenue to cover capital costs.

On the basis of individual enterprises economic performance of the sample was sub-marginal.

## 4.7 Freight Subsidy and Compensation

The fishery receives two substantial income supplements, a provincial freight subsidy and Manitoba Hydro compensation. For the enterprises under consideration, provincial freight subsidy payments amounted to $28,083 and Manitoba Hydro compensation amounted to $68,302, for a total of $91,385. This represented 39% of the total $234,713 of revenue from all sources accruing to these enterprises. The remaining 61% or $143,328 was revenue from fish sales to the FFMC.

The provincial freight subsidy program began during the 1976 summer season. Continuation of this program is not assured as it has been subject to review. Because it currently makes a critical contribution to incomes derived from fishing it seems reasonable to include it in assessments of long run economic performance.

Manitoba Hydro compensation programs are currently negotiated with Southern Indian Lake fishermen on an annual basis. The amount of compensation which will be received in future years is unknown. Compensation payments are nonetheless included in long run evaluations of economic performance, based on the 1980 summer compensation agreement. Consideration of this compensation will at least give an idea of how Manitoba Hydro compensation may affect the future economic performance of the fishery.

Inclusion of both these subsidies in revenue calculations is also justified by the accounting stance taken by this report. This report is evaluating the private accounts of fishing enterprises. From this standpoint these income supplements are regarded as a source of revenue. As such they may help explain the decisions of fishermen to continue fishing despite the marginal state of the fishery.

It is Manitoba Hydro's intention to arrive at a permanent compensation agreement with the fishermen of Southern Indian Lake (K. Koenig, Manitoba Hydro, personal communication). Once this occurs it will be possible to include accurate compensation payments in long run economic analyses of the fishery.

More detailed discussions of the provincial freight subsidy and Manitoba Hydro compensation are found in Chapter 5.

### 4.7.1 Short Run Effects

Effects of the income supplements on cash flow of the aggregate sample and on individual enterprises are shown in Tables 4 and 5 respectively.

Table 4 shows the increases in aggregate cash flow which resulted from subsidization and compensation of the fishery. These income supplements increased the success of what appeared to be an already successful fishery in the aggregate.

In section 4.5.2 it was pointed out that despite the positive unsupplemented aggregate cash flow, eight or one third of sampled enterprises were not viable, even in the short run. It is at the level of individual enterprises where supplements had their most pronounced effect.

In Table 5 it can be seen that by itself the provincial freight subsidy increased from 16 to 21 the number of enterprises which were

Table 4

Present Value of Aggregate
Cash Flows (1980 $)

| Cash Flow | 1980 Value | PV | NPV |
|---|---|---|---|
| 1) Aggregate Cash Flow | 29,797 | 174,542 | 3,182 |
| 2) Aggregate Cash Flow plus Freight Subsidy | 57,880 | 339,044 | 167,684 |
| 3) Aggregate Cash Flow plus Hydro Compensation | 98,099 | 574,635 | 403,275 |
| 4) Aggregate Cash Flow plus Freight Subsidy plus Hydro Compensation | 126,182 | 739,136 | 567,776 |

successful in the short run. Manitoba Hydro compensation by itself increased the number from 16 to 22. Both supplements in combination caused 23 out of 24 enterprises to generate "reasonable" returns to labor and so to be termed as viable in the short run.

Inclusion of income supplements in the private accounts of fishing enterprises caused the fishery to move from a state of marginal economic viability to a state of definite viability in the short run.

### 4.7.2 Long Run Effects

Table 4 shows the substantial increases in the present values of aggregate cash flows caused by inclusion of income supplements. In the aggregate, subsidization improved the long run performance of the fishery from marginal to viable.

Without the supplements only 8 of the 24 enterprises had present values of cash flows greater than the $7140 average present value of capital expenses. In Table 3 can be seen the effects which income supplements had on the economic viability of individual enterprises. Alone the freight subsidy increased to 13 the number of viable enterprises and Manitoba Hydro compensation alone increased the number to 21. In combination, they caused 22 out of the 24 enterprises to generate a present value of cash flow which exceeded the present value of cost of investment.

It must be remembered that these evaluations are based on smaller, less expensive items of capital equipment. If larger, more expensive items are purchased, enterprises' chances of attaining long run viability are lessened.

Table 5

Enterprises' Cash Flows with Subsidies (1980 $)

| Enterprise | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Cash Flow | 4,317 | 679 | -167 | 4,160 | 301 | -385 |
| Freight Subsidy | 2,680 | 886 | 720 | 2,033 | 966 | 592 |
| Subtotal | 6,997 | 1,562 | 553 | 6,193 | 1,267 | 207 |
| Hydro Comp. | 1,783 | 1,762 | 2,250 | 4,390 | 3,233 | 986 |
| Subtotal | 6,100 | 2,441 | 2,083 | 8,550 | 3,534 | 601 |
| Total CF plus Subsidies | 8,780 | 3,327 | 2,803 | 10,583 | 4,500 | 1,193 |

| Enterprise | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|
| Cash Flow | 2,527 | 1,849 | 3,083 | -465 | 313 | 1,038 |
| Freight Subsidy | 1,272 | 1,248 | 1,529 | 837 | 615 | 873 |
| Subtotal | 3,799 | 3,097 | 4,612 | 372 | 928 | 1,911 |
| Hydro Comp. | 4,126 | 764 | 5,367 | 2,789 | 1,885 | 2,553 |
| Subtotal | 6,653 | 2,613 | 8,450 | 2,324 | 2,198 | 3,591 |
| Total CF plus Subsidies | 7,925 | 3,861 | 9,979 | 3,161 | 2,813 | 4,464 |

Table 5 (continued)

| Enterprise | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|
| Cash Flow | -175 | 222 | 1,930 | 619 | -1,030 | -818 |
| Feight Subsidy | 911 | 602 | 1,132 | 657 | 198 | 596 |
| Subtotal | 736 | 824 | 3,062 | 1,276 | -832 | -222 |
| Hydro Comp. | 2,799 | 1,503 | 3,684 | 1,924 | 417 | 732 |
| Subtotal | 2,624 | 1,725 | 5,614 | 2,543 | -613 | -86 |
| Total CF plus Subsidies | 3,535 | 2,327 | 6,746 | 3,200 | -415 | 510 |

| Enterprise | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|
| Cash Flow | -199 | 1,863 | 251 | -1,526 | 22 | 11,398 |
| Freight Subsidy | 870 | 1,475 | 998 | 1,398 | 837 | 4,158 |
| Subtotal | 671 | 3,338 | 1,249 | -128 | 859 | 15,556 |
| Hydro Comp. | 2,778 | 4,456 | 3,404 | 3,692 | 2,779 | 3,246 |
| Subtotal | 2,579 | 6,319 | 3,655 | 2,166 | 2,801 | 14,644 |
| Total CF plus Subsidies | 3,449 | 7,794 | 4,653 | 3,564 | 3,638 | 18,802 |

## 4.8 Gross Fishing Revenues

Gross revenues ranged from a low of $893 to a high of $20,224. Mean income was $5972. Median income was $4734.

Topolniski, in Weagle and Baxter (1973) found a direct relationship among Southern Indian Lake fishermen between enterprises' gross incomes and the number of days spent fishing. The enterprises in the present study were not strictly comparable. The number of skiffs and men involved in an enterprise at any one time varied two and threefold, respectively. A quantitative comparison of size of gross incomes versus number of days fished would necessarily have to consider only enterprises which were similar. In this case, equal numbers of men and skiffs involved in an enterprise was taken to indicate homogeneity sufficient to allow comparison. The largest group of what was considered sufficiently homogeneous enterprises was a group of 13 which operated with two men and one skiff for the entire time spent fishing. A plot of log of gross revenue versus log of the number of days fished (both data were drawn from log normal distributions and which required plotting of log values) for the 13 enterprises is shown in Figure 7.

There is no striking relation between gross revenue and the number of days fished. The $r^2$ value indicates that the number of days fished accounts for only 31% of the variability in values of gross revenue. This value was significant with $p>0.90$. Perhaps if other parameters, such as the average number of nets set or experience of the fishermen, had been considered, a higher degree of correlation would have been found. Perhaps the low correlation resulted merely from chance fluctuations in this rather small sample.

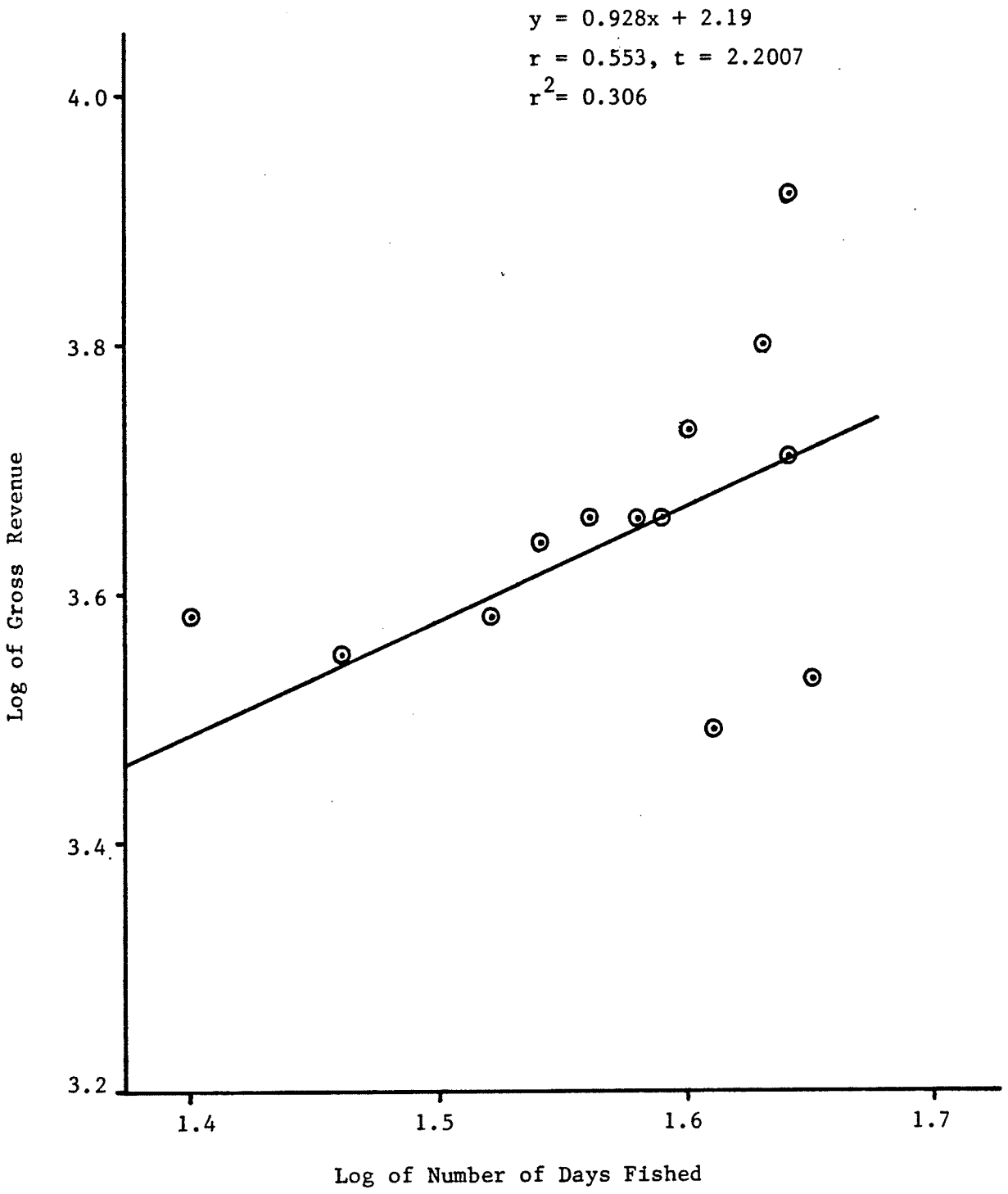



Figure 7

GROSS REVENUE VERSUS NUMBER OF DAYS FISHED

The difference between the findings of Topolniski and this study might be explained by the changes which have occurred in the lake since impoundment. Prior to impoundment fishermen fished in traditional areas where good sized catches of light whitefish were almost assured. In 1980 good sized catches were not consistently produced in given areas of the lake. Also, the proportion of dark fish in a catch was generally higher, and more variable than it was for pre-impoundment. This could perhaps explain the lower correlation between gross revenue and number of days fished that this study found, compared to that found by Topolniski for the summer of 1973.

Nevertheless among all enterprises there were some indications that the number of days fished and gross revenue were related. For instance, enterprises 1 and 24, the enterprises with the highest gross revenues, fished the greatest number of days, 74 and 90 respectively. The enterprise with lowest gross revenue, 17, fished the least number of days, 21.

There were then some qualitative indications that gross revenues were related to the number of days fished. Quantitative comparison of 13 similar enterprises showed a low correlation between number of days fished and gross revenue.

## 4.9 Case Studies

In order to give a qualitative description of fishing activities four enterprises are discussed in detail. To best reflect the commercial fishing ability of each enterprise, random selection of the enterprises described was based on unsubsidized net income. In this case net income is used as an indicator of long run viability, despite its limitations,

since it is historic returns to labor and capital which are discussed. Potential net present value of an enterprise would not describe activities during the summer of 1980 as accurately since to obtain this value generalized assumptions were made regarding capital equipment which were not true in the case of each individual enterprise. A description of the case studies is given in Table 6.

### 4.9.1 Enterprise 17

This enterprise was taken from the lowest quartile of the net income distribution. It was one of the two single man enterprises encountered during the season.

This man fished from a 22 ft. wooden skiff bought in 1973, powered by a 1979 20 hp outboard motor. He also owned a 1978 25 hp outboard which was not operable. He owned 20 nets and usually had 12 nets in the water at once.

This individual fished both in South Bay and in the North Basin. He fished (made deliveries) the least number of days of any enterprise and had the highest average variable cost of fishing. His average variable cost of fishing was greater than the average revenue of 0.3241 $/lb (0.7145 $/kg). Calculation of this enterprise's breakeven point is not possible. This enterprise did not stand a chance of generating a positive net income since its average cost exceeded its average revenue.

### 4.9.2 Enterprise 5

This enterprise was taken from the second lowest quartile of the net income distribution.

This enterprise was a two man partnership which shared expenses

Table 6

Case Studies Description

| Enterprise | 17 | 5 | 14 | 16 |
|---|---|---|---|---|
| Days Fished | 21 | 44 | 41 | 29 |
| Total Catch (lb) | 3,188 | 15,483 | 9,855 | 10,587 |
| Total Catch (kg) | 1,446 | 7,023 | 4,470 | 4,802 |
| Gross Revenue (1980 $) | 893 | 5,167 | 3,115 | 3,514 |
| Variable Cost | 1,908 | 4,755 | 2,841 | 2,841 |
| Semi-Variable Costs | 15 | 111 | 52 | 54 |
| Fixed Costs | 1,557 | 1,708 | 923 | 1,687 |
| Net Income | -2,587 | -1,407 | -701 | -81 |
| Cash Flow | -1,030 | 301 | 222 | 619 |
| Breakeven (lb) | ---- | 125,532 | 27,654 | 13,530 |
| Breakeven (kg) | ---- | 56,893 | 12,533 | 6,132 |
| Average Variable Cost per lb | .60 | .31 | .29 | .27 |
| Average Variable Cost per kg | 1.32 | .68 | .64 | .59 |

for gas, oil, and food on a 50:50 basis. They also shared the catch equally.

This enterprise owned two boats, both 20 ft. fiberglass skiffs, but only operated one boat at a time. One boat was bought in 1974, the other in 1976. The enterprise owned three outboard motors, two 40 hp bought in 1976, and a 50 hp, bought in 1980. In total the enterprise owned 44 nets and typically had 21 nets in the water at any one time.

This enterprise fished exclusively in the North Basin.

### 4.9.3 Enterprise 14

This enterprise was selected from the second highest quartile of the net income distribution.

This enterprise was a partnership from mid-June until the third week in July, when one of the partners stopped fishing for the season. The remaining partner fished alone until the end of the season. During the partnership expenses for fuel and food, and the catch, were shared on an equal basis.

The enterprise fished from a 20 ft. 1976 fiberglass skiff powered by 1979 20 hp outboard. Both were owned by the individual who fished all summer. This man owned 14 nets.

This enterprise was based in a cabin about 15 miles north of Loon Narrows.

### 4.9.4 Enterprise 16

This enterprise was selected from the highest quartile of the net income distribution.

This enterprise consisted of a total of three men. From early June

until the end of June, two men fished as partners. The first partner then quit fishing for the summer. The second partner fished alone during July, then in early August began fishing with the third man, until mid-August when the enterprise stopped fishing.

The boat and motor used by the enterprise were owned by the second partner. These were 1976 20 ft. fiberglass yawl and a 40 hp 1975 outboard. This man also owned 20 nets. The first partner owned seven.

Both partnerships within the enterprise shared expenses for gas and oil and revenue from the catch, on a 50:50 basis. The owner of the boat and motor paid for any necessary repairs.

This enterprise was based in a shack tent a few hundred yards from the Loon Narrows landing station.

# Chapter 5

# DISCUSSION

## 5.1 Economic Performance of the Summer Fishery

The results of Chapter 4 indicate that the economic performance of the Southern Indian Lake commercial fishery was generally poor. In the absence of provincial transfer payments and Manitoba Hydro compensation only 33% of sampled enterprises appeared to harvest enough fish and generate sufficient cash flow to earn "reasonable" returns to labor and capital. An additional 33% of enterprises were viable only in the short run. That is, returns to labor appeared to be adequate but returns to capital were not. At the time that equipment requires replacement, these enterprises will go out of business, in the absence of public assistance.

The fishery appeared to be straddling the margin of economic viability. Substantial percentages of the sampled enterprises were both viable and non-viable, in both short and long run evaluations. Only if enterprises worked hard and consistently could they generate sufficient cash flow to cover capital and operating costs. Such enterprises evidently have gained enough skill at fishing and/or knowledge of the lake that they fished in a more economically efficient fashion than less successful enterprises.

Enterprises which did not work in such a fashion had greater difficulty achieving "reasonable" returns. Even so, if a potentially

viable enterprise were to suffer damaged equipment or if by chance it did not make substantial catches, its chances of achieving a positive cash flow were seriously reduced. Enterprise 22 was an example of such a situation.

If short run performance is marginal and long run performance worse, why do enterprises continue to fish? Part of the answer lies in the number of enterprises which operate in the short run. They are able to recover their variable costs of operation which includes returns to labor and continue to operate until reinvestment is required.

A second cause is the traditional lifestyle followed by these fishermen. This is discussed in section 5.9.

The main reason, however, appears to relate to the presence of subsidy programs which improve the private accounts of the industry. The subsidy programs are pervasive. They include capital subsidies, subsidized loans (ie - low MACC interest rates), special Unemployment Insurance benefits, and the freight subsidy, which this study investigated.

### 5.1.1 Freight Subsidy

The provincial freight subsidy is administered by the Department of Natural Resources. The Department paid a 6¼ cent per pound ($0.138/kg) freight subsidy to Southern Indian Lake fishermen for all species and commercial grades caught, except walleye. The size of this payment is decided upon annually for each lake in the province that is commercially fished. This payment is intended to subsidize fishermen for transport costs of fish from lakeside points to Winnipeg. An evaluation of the procedure used to determine the size of these payments is beyond the

scope of this study.

Payment is made to fishermen after the end of the season when the size and species composition of each fisherman's catch is finalized. The information on which payment is based is provided by the FFMC.

The effect of this subsidy was to make 88% of sampled enterprises economically viable in the short run and 54% viable in the long run. It is clear that the freight subsidy improved labor and capital returns of the private sector and aided its ability to fish. Still it should be noted that 46% of the sample was still incapable of earning sufficient returns to labor and capital.

The critical source of funds which, from the point of view of individual fishermen, made the fishery undeniably viable, was compensation payments from Manitoba Hydro.

### 5.1.2 Effect of Manitoba Hydro Compensation

Analogous to the effect of the public transfer payments, Manitoba Hydro compensation payments improved the economic performance of the fishery. With the contribution of these payments 92% of sampled enterprises became economically viable while 96% of enterprises became viable only in the short run. The addition of this final subsidy made the aggregate sample definitely economically viable, from the private viewpoint.

### 5.1.3 Commentary

Though from the private entrepreneurial viewpoint the fishery is economically viable, it may not be so from the public's standpoint. Society pays into the fishery in the form of capital financing assistance, freight subsidies, and crown corporation (Manitoba Hydro) funds. It would be

difficult to suppose that substantial payments such as these have had no effect on individuals' decisions to continue or to begin to fish. These payments can thereby encourage overcapitalization and inefficient operations in the fishery.

Total societal cash flow regarding the primary sector of this fishery may be negative. Even if it is to the benefit of society to subsidize the fishermen of Southern Indian Lake, it may be economically more efficient to use the funds to have fishermen begin a different, more profitable economic activity. Issues like these concern public accounts mainly at the provincial level and are thus beyond the scope of this study. But it is important to remember that the private accounts of fishing enterprises are only part of the entire economic description of the fishery.

## 5.2 Manitoba Hydro Compensation

Manitoba Hydro began a "Commercial Fishermen's Assistance Program" in 1978 for fisheries affected by the Churchill River Diversion (Manitoba Hydro 1978).

For the Southern Indian Lake fishery, assistance to date has taken two main forms, replacement of damaged equipment, and compensation payments for whitefish.

During the 1980 summer season, numerous fouled nets were turned in to the plant manager at Loon Narrows, which were replaced with nets provided by Manitoba Hydro. The author encountered one situation where a fisherman was provided with an outboard motor by Manitoba Hydro while his was being repaired after it had struck floating debris. Manitoba Hydro also would entirely replace outboard motors or boats which were

damaged severely by debris (Manitoba Hydro 1978).

### 5.2.1 Compensation Payments

It is the compensation payments aspects of fishermen's assistance which is directly relevant to this report. Compensation payments take two forms, incentive payments, for light whitefish and differential payments, for dark whitefish.

As mentioned in Chapter 1, the North Basin of the Lake, between Long and Sand Points, is an established traditional fishing area. Prior to 1976, the proportion of dark whitefish in the commercial catch was extremely small. The area north of Sand Point was not normally fished because catches there were usually composed entirely of dark whitefish.

Subsequent to impoundment in 1976, the physical catch per unit effort in the North Basin decreased. By the 1979 summer season it had decreased 40%, from the 1972 summer figure of 51 lb/net/night (23 kg/net/night) to 31 lb/net/night (14 kg/net/night), as was discussed in Chapter 2.

In search of a steady catch, some fishermen moved their fishing operations to the area north of Sand Point. During the 1979 summer season 62% of fishing effort (net nights) occurred north of Sand Point (Bodaly et al. 1980).

To encourage fishermen to fish in the traditional light whitefish areas, Manitoba Hydro, in 1978, introduced an incentive payment of five cents per pound ($0.11/kg), to be paid on all light whitefish caught in traditional fishing areas. As well, this payment was intended to encourage fishermen to fish in traditional areas for a longer time if and when seasonal production decreased (Manitoba Hydro 1978).

This compensation figure of five cents per pound ($0.11/kg) was an arbitrary figure. It was not based on a measured loss, as suggested by Quinn and Trebilcock (1981). It in no way attempted to compensate fishermen on a realistic basis for decreased catch per unit effort but was, as its name implies, merely an incentive to encourage fishermen to remain fishing in the North Basin.

That same year, Manitoba Hydro also introduced a differential payment on dark whitefish caught in traditional light whitefish areas. The differential payment was equal to the difference in price between continental and export grades of fish. Fishermen would receive export prices for continental fish. This payment would be paid on that amount of dark whitefish which exceeded the traditional proportion of 1-2% of the catch in light whitefish areas (Manitoba Hydro 1978).

Assuming that the combined catch per unit effort of darks and lights equalled the pre-impoundment catch per unit effort of only light whitefish, differential payments undercompensated fishing enterprises on a Pareto optimal basis. Pareto optimality would have been achieved only if both incentive and differential payments had applied to catches of dark whitefish.

There is not appropriate catch per unit effort data to prove or disprove the assumption in the above paragraph. Information in Bodaly et al. (1980) shows that in the summer of 1979, incentive payments did undercompensate fishermen on a Pareto optimal basis because of a continued drop in catch per unit effort. It must be remembered that such compensation was not a stated objective of the 1978 assistance program. Nonetheless Pareto optimality serves as a reference point by which the 1978 assistance program can be evaluated.

The 1978 assistance program stipulated that fishermen would receive differential payments for dark fish caught in historically dark continental areas only when they were unable to attain their historic average catch in traditional export areas.

This compensation program was in effect from the 1978 summer season until the 1979-80 winter season.

## 5.3 Assessment of 1980 Compensation Program

### 5.3.1 Description

In the 1980 summer season a new compensation program was introduced. In the new program incentive payments were increased to $0.22/lb ($0.49/kg) from $0.05/lb ($0.11/kg). This 22 cent amount corresponded to the 40% decrease in catch per unit effort measured between 1972 and 1979. It comprised 56, 45, 39, and 35% of the final dockside price to fishermen for small, medium, large, and jumbo light whitefish, respectively. See Table 7.

In the 1980 compensation program, differential payments continued to make up the difference between the price of continental and export grades. These payments would only commence after continued efforts in traditional light whitefish areas were proven to be unproductive and unjustified. This was a change from the previous policy, in which differential payments were made all summer.

When differential payments commenced, payments would be made on dark whitefish taken from any area of the lake, including the area north of Sand Point. This also was a change from the previous policy, in which payment initially was made only on dark whitefish taken from traditional light areas.

Table 7

Price Structure and Compensation
Payments Summer 1980

| | | Leaf Rapids Fish Prices | Less Boat | Less Weighman | Dockside Lake Fishermen | Add Incentive & Differential | Final Dockside to Fishermen |
|---|---|---|---|---|---|---|---|
| Export (Lights) | Sm. | 24 3/4 | -6 | -2 | 16 3/4 | 22 | 38 3/4 |
| | Med. | 34 3/4 | -6 | -2 | 26 3/4 | 22 | 48 3/4 |
| | Lge. | 42 3/4 | -6 | -2 | 34 3/4 | 22 | 56 3/4 |
| | Jbo. | 49 3/4 | -6 | -2 | 41 3/4 | 22 | 63 3/4 |
| Cont. (Darks) | Sm. | 20 3/4 | -6 | -2 | 12 3/4 | 04 | 16 3/4 |
| | Med. | 25 3/4 | -6 | -2 | 17 3/4 | 09 | 26 3/4 |
| | Lge. | 25 3/4 | -6 | -2 | 17 3/4 | 17 | 34 3/4 |
| | Jbo. | 30 3/4 | -6 | -2 | 22 3/4 | 19 | 41 3/4 |
| Pickerel (Hdls.) | Sm. | 74 3/4 | -6 | -2 | 66 3/4 | | 66 3/4 |
| | Med. | 92 3/4 | -6 | -2 | 84 3/4 | | 84 3/4 |
| | Lge. | 92 3/4 | -6 | -2 | 84 3/4 | | 84 3/4 |
| Jacks (Dsd.) | 4-9 | 18 3/4 | -6 | -2 | 10 3/4 | | 10 3/4 |
| Jacks (Hdls.) | | 22 3/4 | -6 | -2 | 14 3/4 | | 14 3/4 |
| Trout (Dsd.) | 2-4 | 32 3/4 | | | 32 3/4 | | 32 3/4 |
| | 4-8 | 47 3/4 | | | 47 3/4 | | 47 3/4 |
| Trout (Hdls.) | | 52 3/4 | | | 52 3/4 | | 52 3/4 |
| Tullibee (Cont.) | | 12 3/4 | -6 | -2 | 4 3/4 | | 4 3/4 |

This was a marked change of approach from the 1978 assistance program. In the 1980 program incentive payments actually were intended to compensate for a specifically sized decrease in catch per unit effort. This intent was absent in the 1978 program where incentive payments were intended purely as incentive.

### 5.3.2 Analysis Approach

One of the specific objectives of this study was to review the adequacy of compensation paid to fishermen as a consequence of the impoundment of the lake as part of hydroelectric development of the Churchill-Nelson river systems. Earlier discussion stressed that two major consequences to the fishery flowed from the development. The first was the reduction in average revenues from loss of quality and value of the commercial harvest. The second was the increase in average (and marginal) costs to the fishery from a loss in productivity in the fishery, increased travel times and increase damage to equipment from debris. Because of lack of data an empirical assessment of all these changes and estimation of total loss of producers' surplus or profitability flow from impoundment and diversion was not possible. Therefore a direct assessment of the adequacy of Manitoba Hydro payments as compensation for losses incurred was also not possible.

It was nonetheless possible to address those areas of loss for which pre-impoundment data does exist. Those areas for which pre-impoundment data does not exist were evaluated on a more qualitative basis.

### 5.3.3 Catch per Unit Effort

Decreased catch per unit effort is one characteristic symptom of

overexploited fish stocks. Pre-impoundment (Ayles and Koshinsky 1974) and more recent (Bodaly et al. 1980) evidence discussed in sections 2.2.1 and 2.2.2 indicated that whitefish stocks in the lake were not overfished. The alternate hypothesis used to explain the decrease in catch per unit effort from 1972 to 1979 was that it was related to impoundment and diversion (Bodaly et al. 1980).

Manitoba Hydro accepted this verdict to the extent that it operated the fishermen's assistance programs herein.

### 5.3.4 Pareto Optimality

The main effect of the 1980 incentive payments, as regards catch per unit effort, was to fulfill the Pareto improvement criterion by making fishermen as well off as they were prior to impoundment. That is, having incentive payments on light whitefish comprising approximately 40% of the final dockside price corresponded with the measured 40% post-impoundment decrease in catch per unit effort in the North Basin.

Presumably, payment of this compensation was made possible because the Kaldor-Hicks principle applies in the case of the Churchill River Diversion. That is, the magnitude of benefits accruing from the Diversion enables payment of compensation to losers because of the Diversion while still permitting a net increase in welfare on the part of the gainers. This statement concerns the public accounts of Manitoba Hydro and so an evaluation of the Kaldor-Hicks principle in the case of the Churchill River Diversion is beyond the scope of this study.

The $0.22/lb ($0.49/kg) incentive payment was determined in the manner recommended by Quinn and Trebilcock (1981), by actual measurement of losses. Fishermen could be accurately compensated in this respect.

This was an improvement over the compensation program in effect from 1978 to 1979-80.

### 5.3.5 Information Lag

The 40% decrease in catch per unit effort was measured during the 1979 summer season. It was used as the basis for compensation in the 1980 summer season. Bodaly et al. (unpublished work) indicate that by the summer of 1980 catch per unit effort in the North Basin had decreased further, to 23 lb/nt/night (10 kg/net/night). This represents a 51% decrease in catch per unit effort since 1972. Incentive payments to fishermen for the 1980 summer fishery then were 11% less than what was required to maintain the pre-impoundment welfare level of fishermen.

The difficulty involved in this criticism is that prior to the 1980 summer season it was not possible to predict what the physical catch per unit effort would be during that season. This is a perennial problem in fisheries management, where managers are forced to use last year's data to plan for the following year. Until a sound predictive model of the fish populations and their environment is formulated, predictions of catch per unit effort are likely to be inaccurate. The best approximation of catch per unit effort for a given season may be the figure from the previous year.

Presently the information necessary to formulate a predictive model of whitefish populations is incomplete. It seems likely that in the near future incentive payments may inaccurately compensate fishermen for changes in the physical catch per unit effort as long as the present procedure for determining incentive payments is continued. A method which would ensure Pareto optimality of incentive payments would be for

Manitoba Hydro to make final payments to fishermen at the end of the season. These payments would reflect any difference between the incentive payment scheme adopted prior to the start of the season and a Pareto optimal incentive payment rate as defined by measurement of catch per unit effort during the season. If it was found that fishermen had in fact been overcompensated because of an increase in catch per unit effort, future payments by Manitoba Hydro could be reduced by the amount of overpayment.

### 5.3.6 Financial Compensation

In addition to decreased catch per unit effort, producers' surplus has been reduced by increased frequency of net relocation, which necessitates larger expenditures on fuel. Producers' surplus has also been affected by fouling of nets by debris. Though damaged nets are replaced by Manitoba Hydro, catches are reduced when nets become fouled.

Both of these impacts are of a financial nature and in theory Pareto optimality compensation payments could be calculated. Regarding net relocation, and related fuel expenditures Bodaly et al. (1980) state that in 1972 the mean number of days nets were left at the same site were 18.3 days. In 1979, after flooding, nets were left set at the same site an average time of only 6.9 days. In 1980, south of Sand Point, nets were left in the same location an average of only five days (Bodaly et al. unpublished work). Locations of fishing enterprises in 1972, 1979, and 1980 are also reported in these two works. Variable cost data are available for 1972 from Weagle and Baxter (1973) and for 1980 from Chapter 4 of this report.

If these above data sources contain sufficiently specific proper

information it may be possible to calculate a mean increase in the cost of fishing caused by more frequent net relocation. This would likely be an aggregate value for the entire fishery, although values may be able to be calculated for individual enterprises which were interviewed in 1972 and since impoundment.

Regarding fouled nets, calculation of the mean lost catch per fouled net is probably possible using both aggregate fishery and individual enterprise catch per unit effort data.

Calculation of this type of compensation payment could be fairly tenuous. It might require assumptions regarding past and present work patterns of fishermen which could be only partially accurate. Though it could be difficult to administer, compensation for this areas of financial loss is required to maintain Pareto optimality of the fishery.

### 5.3.7 Differential Payments

Differential payments do not attempt to address the problem of decrease in catch per unit effort, that is, maintaining Pareto optimality, as do incentive payments. Rather, they arose from the need to address in some fashion the post-impoundment increase in the proportion of dark whitefish in the commercial catch.

The increased proportions of dark whitefish in the commercial catch is difficult to treat on the basis of Pareto optimality. While the problem did not exist prior to impoundment, the post-impoundment situation has been at least partly aggravated by the purposeful actions of fishermen. The choice, by some fishermen, to intentionally fish for dark whitefish blurred the measurable extent to which the problem was caused by impoundment alone. So while some compensation would seem in

order, compensation of dark whitefish to the same extent as lights would seem to overcompensate fishermen.

Incentive payments increased the price received for darks to the uncompensated FFMC price for lights. This was an intermediate level of compensation which did not obviously over or undercompensate. But it was an entirely arbitrary level of compensation, albeit one with a certain intuitive appeal. Perhaps that is why Manitoba Hydro chose this level of compensation. Because of a lack of concrete data, a quantitative evaluation of the size of incentive payments would be difficult, if not purely speculative.

Since differential payments did not commence until August 15th, fishermen were not compensated at all for any dark whitefish caught in traditional fishing grounds prior to that date. In this respect the differential payment program undercompensated fishermen.

Quinn and Trebilcock (1981) point out that compensation measures should improve the appropriateness of adjustments to new conditions. Differential payments in 1980 were smaller than incentive payments (see Table 7), only increasing the price of any dark whitefish caught up to the corresponding FFMC price for light whitefish. As well differential payments were not made until August 15th, the approximate time each summer when the light whitefish catch traditionally dropped. These two features of differential payment compensation improved the appropriateness of adjustment to new conditions in that they encouraged fishermen to fish for light whitefish, thereby acting to preserve the quality of the commercial catch.

Though a catch of light whitefish is considered best for the fishery as a whole, it may not be best for individual fishing enter-

prises. The two fishing enterprises with highest cash flows in the summer of 1980 fished primarily north of Sand Point, in traditionally dark areas. Both these enterprises fished a greater number of days than other enterprises and fished more frequently and often with more nets than other enterprises. To these extents they were atypical.

Though they fished in a very intensive manner, their high cash flows were also caused by the higher average catch per unit effort characteristic of the area north of Sand Point. It appears that the policy of encouraging fishermen to pursue higher priced light whitefish may in some individual cases, actually decrease individual cash flows by encouraging fishermen to fish in areas of lower catch per unit effort. If this is true, according to Quinn and Trebilcock (1981) to improve the appropriateness of adjustments to new conditions, that is to increase economic effeciency, compensation arrangements should encourage the catching of dark whitefish. To this end, compensation from differential payments would have to be increased relative to that from incentive payments.

This approach to compensation alters the purpose of compensation from Pareto optimal maintenance of pre-impoundment conditions to active pursuit of increased economic effeciency. Unfortunately, not enough necessary information was available to this study to definitely decide whether all fishing enterprises could expect to have high net incomes, were they to fish north of Sand Point. It would be merely speculative with the information available to suggest that the basic thrust of Manitoba Hydro compensation now be changed.

5.3.8 Miscellaneous Comments

Dasgupta and Pearce (1971) state that compensation payments should be made in the form of lump sum payments so as to leave incentives to work unaffected.

Part of the reasoning behind this statement may lie in the economic perception of wealth. A lump sum payment would be interpreted by economics as an increase in wealth, not as revenue. Work must then continue much as before, to insure incoming revenue. Whether this distinction would be realized by an operation as individualistic and as marginal as a Southern Indian Lake fishing enterprise is debatable.

There may well be individuals who, if they were given a lump sum compensation payment, would invest the money wisely, collect interest from the investment, and continue to fish. On the other hand, if a lump sum payment was made to an individual who was a sub-marginal fisherman he might be in financial straits which would require him to spend the payment on necessities regardless of whether or not he continued to fish. Alternatively, an individual might choose to live off the payment for a season, instead of fishing. In the case of Southern Indian Lake fishermen, treatment of a lump sum payment would depend largely on individuals' natures and financial circumstances.

This study did not attempt to measure fishermen's willingness to work in relation to the method of compensation distribution. The problem involved with a one time lump sum payment is the question of determining the size of the payment. Because of the uncertain limnologic future of the lake the proper size of such a payment, be it judged on the basis of Pareto optimality or any other basis, would be very difficult to determine.

As it would no doubt be a negotiated settlement, Southern Indian Lake fishermen would bargain for as large an amount as possible, for fear of being undercompensated. Manitoba Hydro would of course want to pay a minimal amount, out of concerns that they would be overcompensating fishermen.

Given the poor economic state of the fishery, large lump sum payments could present fishermen with a chance to opt out of the fishery and begin an alternate, more viable, economic activity. This possibly could be done on a communal basis to form a large enterprise.

Quinn and Trebilcock (1981) warn that compensation payments should not become so large as to provide disincentive for people to work enthusiastically. This statement could perhaps be kept in mind when considering an appropriate size for lump sum payments.

As regards the 1980 compensation plan, incentive payments accounted for an average of 43.8% of final dockside prices paid to fishermen for light whitefish. Differential payments accounted for 38% of payments made for dark whitefish, after August 15th only. Though an evaluation of the size of compensation payments as they affected willingness to work was not an objective of this study compensation payments did not seem large enough, when compared to the price received for the total catch, to have provided fishermen with a reason to cease fishing earlier than they normally would have.

Peterson (n.d.) suggests compensation payments should be made to the Crown, to enable it to make compensating investments in the affected areas. In contrast, direct payment of compensation to fishermen, currently the procedure used, avoids the expenses of salaries and other expenditures on the part of the third party Crown agency, and enables fishermen to

decide by themselves how to best use money received as compensation. The present plan also ensures that the best fishermen receive the most compensation, which is correct on an equity basis, as they suffer the greatest loss in producers' surplus. Whether or not this would happen if a Crown agency invested compensation payments is debatable.

### 5.3.9 Summation

The 1980 compensation plan was restricted to financial aspects of economic loss, principally addressing decreases in catch per unit effort. Losses due to decreased catch per unit effort were undercompensated for on a Pareto improvement criterion basis because 1979 data were used as the basis of 1980 compensation payments, when during the intervening year catch per unit effort had again decreased.

Other financial losses, such as increased fuel consumption due to the need to relocate nets more frequently, were not accounted for. It may be possible to calculate Pareto optimal compensation for such losses. Such calculation may be difficult because of limited pre-impoundment data.

The size and commencement data of differential payments, compared to the same parameters of incentive payments, encouraged fishermen to pursue light whitefish, thereby maintaining the quality of the commercial catch. Evidence indicates though, that large cash flows might be expected by enterprises which intentionally fish for dark whitefish.

## 5.4 Fishermen's Criticism of Compensation

### 5.4.1 Communication

As perceived by fishermen, the main problem encountered with administration of 1980 Manitoba Hydro compensation payments was caused

by poor communication between Manitoba Hydro and individual fishermen. Prior to 1980, differential payments were made during the entire summer season. In 1980 this policy was changed. Differential payments began on August 15th, the approximate time in previous summers when the light whitefish catch began to decline.

Fishermen were under the wrong impression that differential payments were in effect for the entire season, as in previous years. Fishermen who fished in traditionally dark areas made their decisions to do so while under this wrong impression.

About August 1st, some fishermen realized they were not being paid differential payments. This realization created consternation within the fishing community which resulted in the manager of the Leaf Rapids FFMC plant flying into Loon Narrows for a meeting with fishermen on August 13th, 1980. At the meeting he explained to fishermen Manitoba Hydro's plan regarding differential payments.

Why fishermen had this wrong impression is uncertain. According to the minutes of a meeting between Manitoba Hydro representatives and representatives of the South Indian Lake Fishermen's Association, held on April 29th, 1980, fishermen were informed of this aspect of the compensation plan. If this is true, there was obviously a serious problem of communication within the Association.

As well, on the May 8th, 1980 there was a meeting between all fishermen and representatives from Manitoba Hydro, the FFMC, and provincial and federal fisheries departments, when this point should have been emphasized.

A possible source of the wrong impression is represented by Table 7 and Figure 8, which are facsimilies of documents handed out to

# SOUTH INDIAN LAKE
# MANITOBA HYDRO COMPENSATION PROGRAM

RE 3214 FPT

SOUTH INDIAN LAKE
MANITOBA
ROB INO

610365587 DATE (WEEK ENDING) DAY | MONTH | YEAR

| | 397 POUNDS | | RATE | | AMOUNT |
|---|---|---|---|---|---|
| Incentive Payments | 300 | X | .22 | = | 66.00 |
| Differential Payments | | | | | |
| Small Whites | 50 | X | .04 | = | 2.00 |
| Medium Whites | 100 | X | .09 | = | 9.00 |
| Large Whites | 100 | X | .17 | = | 17.00 |
| Jumbo Whites | 100 | X | .19 | = | 19.00 |
| Total Compensation | | | | | $113.00 |

White - Fisherman's Copy Pink - Office Copy Yellow - Hydro copy

Figure 8

HYPOTHETICAL DAILY CATCH RECORD
GIVEN TO FISHERMEN

fishermen at the May 8th meeting. Neither document indicates that differential payments would not be made for the entire season. Figure 8 is a reproduction of a hypothetical daily catch record (DCR) which fishermen receive for every delivery of fish. It is misleading in as much as it shows a fisherman receiving both incentive and differential payments for a day's catch. This could easily lead a fisherman to believe that differential payments were to be paid for every day of the season.

As a result of the wrong impression which fishermen operated under numerous fishermen suffered decreases in their expected income, some substantially so. It is in the best interest of all parties involved in this situation to ensure that this sort of confusion does not occur in the future. Doing so will eliminate much frustration and mistrust among the people involved.

5.4.2 "Adequacy"

Generally, fishermen seemed satisfied with the size of compensation payments. No complaints regarding the amount of compensation payments were encountered. This may have been because of the substantial increase in the size of incentive payments over the previous year. The only complaint encountered was the misunderstanding regarding the commencement date for differential payments.

One possibly valid criticism which was encountered regarding compensation arrangements was that they fail to account for individuals who make an "honest effort" yet catch very little. Such situations were encountered on traditional fishing grounds. Some individuals became obviously discouraged by their lack of success. How precisely compensation would be administered in such cases is a difficult question. Certainly

monitoring such "honest effort" would be a delicate task.

Alternatively, Quinn and Trebilcock (1981) state that compensation payments should increase the rapidity of adjustment to a post-project situation. There may be cases where, because of impoundment, a fisherman's limited fishing skill prevents him from operating successfully. Quinn and Trebilcock's (1981) principle would not allow payment to be made to such an individual on a daily "honest effort" basis. Such payments would not increase the rapidity of response to the new situation, but would prolong an economically inefficient fishing operation. In such a case a one time lump sum payment, compensating a fisherman for lost future earnings, might be in order. The fisherman would not be encouraged to fish in the future since he would lose money. Rather he could use the money received as compensation to get a start in a better economic alternative.

## 5.5 Experimental Fishing Program

In the 1980 summer season Manitoba Hydro operated a fishing boat in an attempt to establish whether or not it was feasible to fish for export grade whitefish in the North Basin. It was also intended that information gathered by this boat might be used to develop maps which could assist fishermen in finding productive fishing areas. Based at Missi Falls, this boat systematically covered the North Basin.

On at least two occasions this boat caught a reasonable amount of fish in areas which were not being exploited by fishermen at that time. In both situations skiffs moved into the area. The catches were encouraging enough to have some enterprises remain in those locations for a number of days afterward. To this extent, the activities of the experimental boat may have had a direct positive effect on the gross revenues of

fishing enterprises.

## 5.6 The 1981 Compensation Program

### 5.6.1 Description

The 1981 Commercial Fishermen's Assistance Program (Manitoba Hydro 1981 unpublished work) is the most extensive compensation program Manitoba Hydro has agreed to administer to Southern Indian Lake fishermen. In addition to separate clauses regarding traditional areas, the area north of Sand Point, and the winter fishery, all of which have been included in past agreements, there is a section dealing with transportation to outlying lakes. This report will concern itself only with arrangements regarding the summer fishery of Southern Indian Lake itself. See Appendix E.

Fish prices for the 1981 summer fishery were very similar to those for the 1980 summer fishery (M. Sloboda, Fisheries and Oceans, personal communication). See Appendix F.

During the winter of 1980-81 Manitoba Hydro's original proposal for compensation for the 1981 summer fishery was rejected by Southern Indian Lake fishermen. The proposal finally agreed to by both parties was reached by negotiation between the two parties. This was the first time a negotiated agreement has been put into effect. Quinn and Trebilcock (1981) state that a negotiated compensation agreement is the type most likely to reflect real welfare losses of impacted parties. So in theory the 1981 program should have been the program which thus far most accurately compensated actual losses in the economic welfare of Southern Indian Lake fishermen.

There were a number of major changes in compensation arrangements for the summer fishery. They were:

1) The inclusion of all quota species, not just whitefish, in the incentive payments.

2) Maximum allowed compensated catch for the area north of Sand Point, 200,000 lb (90,720 kg), and for the remainder of the lake, 500,000 lb (226,800 kg). This total of 700,000 lb (317,520 kg) is less than the total poundage, 801,582 lb (363,529 kg), taken in the summer of 1980, but is essentially completely made up by a maximum of 100,00 lb (45,360 kg) allotted to inland lakes.

3) Guaranteed total compensation payments, $60,000 for the area north of Sand Point, and $170,000 for the remainder of the lake. Any remaining funds which were not paid to fishermen during the season were distributed among fishermen on a pro-rated basis after the end of the season.

4) The requirement that an absolute quota of 200,000 lb (90,720 kg) be established, in cooperation with the Province of Manitoba, for the area north of Sand Point.

5) The termination of the standby motor program.

6) The stipulation that a maximum of 100 fishermen be allowed to participate in the program.

7) The stipulation that a fisherman harvest a minimum of 1000 lb (454 kg) to be eligible for compensation.

### 5.6.2 Species

The inclusion of all species in incentive payments may have influenced fishermen's actions, and hence production of the fishery, in

two ways. Firstly, a higher price on all fish could have led to less waste in the fishery. Low priced species such as cisco may have been retained, whereas previously they frequently were discarded. Secondly, with compensation applicable to all quota species, walleye became by far the highest price species, at $1.077/lb ($0.863/lb + $0.214/lb incentive). This may possibly have caused increased selective fishing for walleye, that is use of 4¼ inch (10.8 cm) nets may have increased.

### 5.6.3 Maximum Allowable Catch

Having a ceiling on the amount of catch which is compensated, especially at a level well below past quotas, could have led to under-exploitation of a readily accessible resource. It may have proved cheaper for all concerned to place a higher compensated catch level on Southern Indian Lake, than to finance plan transportation to outlying lakes.

### 5.6.4 Guaranteed Payments

As long as the maximum allowed poundage was caught, the guaranteed payments would be completely utilized.

An important change in compensation arrangements was the inclusion of a guaranteed final payment amount. The FFMC, during the season, pays fishermen 80% of the price for which it anticipates it will be able to sell fish. The additional 20% protects the FFMC in case of price fluctuations. Revenue which the FFMC obtains in addition to the 80% paid to fishermen, is paid to fishermen as a final payment after the end of the season. Manitoba Hydro's contributions to final payments entails differential payment for price differences between light and dark white-fish (K. Koenig, Manitoba Hydro, personal communication).

Manitoba Hydro guaranteed $55,000 for final payment. For the 1980

summer fishery this amount was approximately $56,000 (K. Koenig, Manitoba Hydro, personal communication). It was theoretically possible that during the season the price for light whitefish could have dropped substantially relative to the price for darks. In that case the size of the final payment Manitoba Hydro would have had to make to fishermen could have been substantially less than the guaranteed $55,000.

### 5.6.5 Sand Point Quota

As discussed in previous section 5.3.7, there is evidence indicating that it might be highly profitable for fishing enterprises to operate exclusively north of Sand Point. The 200,000 lb (90,720 kg) absolute limit established north of Sand Point might limit aggregate gross revenue to the fishery.

### 5.6.6 Limited Entry

Two stipulations of the 1981 compensation plan acted to limit entry into the fishery by limiting access to compensation payments. the first of these, the stipulation that the number of fishermen eligible for compensation be limited to 100, favored older, skilled individuals, established in the community and with reputations as hard working fishermen. In the 1980 summer fishery nine individuals out of 110 would have been eliminated by this stipulation.

There is a possibility, realized in the summer of 1981, that stocks in the lake may now be overfished (see section 5.11). It might be argued that Manitoba Hydro is responsible to compensate only those fishermen who were fishing at the time of impoundment. It might be said that it owes nothing to the new fishermen who appear each year (see Table 1) and who are encouraged to do so by compensation payments. The new fishermen, by

increasing fishing effort, now possibly contribute to overfishing. Overfishing decreases catch per unit effort, for which Manitoba Hydro pays correspondingly increasingly large incentive payments. If this is the scenario which is occurring, Manitoba Hydro is itself partly the cause of ever larger incentive payments.

It might also be argued that Manitoba Hydro is not required to compensate fishermen who were not fishing at the time of impoundment, even if overfishing is not occurring. The additional fishing effort brought by these individuals would then have no effect on the catch per unit effort. Since they have not suffered a loss in welfare because of impoundment it might be said that Pareto optimality does not require compensation to be paid.

In either of these above cases Manitoba Hydro would be considered as presently overcompensating fishermen.

Antithetically, it could be said that without impoundment the fishery would now be economically viable and compensation should reimburse all fishermen, regardless of when they began to fish. New fishermen could be thought of as suffering a decrease in potential welfare.

By limiting compensation to 100 individuals, Manitoba Hydro indicated that it did not feel responsible for the reduced producers' surpluses of new fishermen. It should be noted that even this number is much larger than the number of fishermen at the time of impoundment.

This limited access to the fishery will possibly reduce overcapitalization which currently limits economic viability of the aggregate fishery. It may also reduce fishing effort, which may now be affecting fish stocks, thereby conserving the resource.

The second stipulation was that fishermen must catch at least 1000 lb (454 kg) to be eligible for compensation. This may discourage halfhearted dabbling in the fishery. In the summer of 1980, eight fishermen fitted this description. It would be better from a point of view of aggregate economic efficiency if these individuals, and the unnecessary additional costs they bring to the fishery were eliminated.

Costs removed by the absence of these individuals would mainly be variable costs. It is likely that their catches were low because they merely fished a few days with established enterprises. This was the case in three out of the four individuals in this category which the author observed.

### 5.6.7 Pareto Optimality

The Pareto improvement criterion was addressed again by incentive payments compensating for decreased catch per unit effort in traditional fishing areas. The $0.214/lb ($0.472/kg) payment on all species comprised 34, 38, 45, and 57% of final dockside payment for jumbo, large, medium and small commercial sized light whitefish, respectively. This approximately corresponded to a 55% decrease in catch per unit effort measured in the North Basin in 1972 and 1980, from 51 to 23 lb/net/night (23.1 to 10.4 kg/net/night).

Once again this was an instance of data obtained in one year (1980) used to calculate compensation payments the following year (1981). Catch per unit effort in fact decreased once again between the 1980 and 1981 summer fisheries (R. Bodaly, Fisheries and Oceans, personal communication), once again rendering incentive payments inadequate as regards Pareto optimality.

### 5.6.8 Other Compensation

The differential payment necessary to raise the price of continental grade to export grade price was projected to be $0.095/lb ($0.209/kg). This was determined by subtracting the mean expected price for dark whitefish from the mean expected price for lights.

An "increased effort" value of $0.09/lb ($0.198/kg) for fish caught north of Sand Point was intended to compensate fishermen for increased fuel costs involved in travelling the long distance from north of Sand Point to the Loon Narrows Landing Station (K. Koenig, Manitoba Hydro, personal communication).

Inclusion of compensation for extra fuel now used in fishing partly compensates for areas of financial loss which were completely exclused from previous compensation programs. The $0.09/lb ($0.198/kg) amount decided on was estimated by fishermen, not based on actual measurement and so may inaccurately provide Pareto optimal compensation. An evaluation of the accuracy of this payment would require the sort of calculations tentatively outlined in section 5.3.6.

## 5.7 Review of Compensation Programs

Since Manitoba Hydro's fishermen's assistance programs first began in 1978, they have greatly improved in quality. Incentive payments made to fishermen under the 1978 program were based on a rather crudely chosen arbitrary amount. Incentive payments in the 1980 program reflected the decreased catch per unit effort in a Pareto optimal fashion. The 1981 program took into account additional costs incurred by the fishery for increased travel. The development of these successive programs indicated

that Manitoba Hydro has become more cognizant of the external damage caused by its development projects and now more willingly responds to criticism in a responsible manner.

By the widening scope of compensation and mitigation that it has considered, Manitoba Hydro has admitted that considerations of hydroelectric development go far beyond financial estimates of construction costs and revenues from the generated power. This is the type of broadened planning horizon recommended by Tritschler (1979). It is hoped that future planning by the utility will bear this in mind.

Manitoba Hydro did not formulate its fishermen's assistance programs in isolation. Data on which compensation was base came from pre- and post-impoundment biological and economic research. Negotiation with Southern Indian Lake fishermen was responsible for the comprehensive nature of the most recent program. Pre- and post-project research, and negotiation with impacted groups are necessary to achieve accurate compensation programs.

In a large public project such as the Churchill River Diversion, development of an accurate and practical compensation program involves active exchange of ideas and information between developers, impacted groups, and independent assessors of impacts. Compensation arrangements must not be unchangable once first formulated. They must be receptive to new information, more so the more novel the situation. Each successive fishermen's assistance program came a step closer to this description, though some aspects of the program were not changed in spite of past errors. For example, the catch per unit effort figure for 1980 was used as the basis for 1981 compensation when the catch per unit effort had decreased in the intervening year. This same error in methods had

occurred the previous year. The 1981 program was the most advanced in terms of the scope of compensation and mitigation. Hopefully compensation programs for the Southern Indian Lake fishery will continue to improve.

## 5.8 Income Limitations

There are a number of factors which acted to limit the cash flow of fishing enterprises.

### 5.8.1 Number of Nets

Manitoba Fishery Regulations allow a Southern Indian Lake commercial fisherman to have up to 1500 yards (1372 m) of gill nets, that is fifteen 100 yards (914 m) nets, in the water at any one time. Only on 21 of the 278 occasions when enterprises were asked the number of nets they had in the water at the time, was as enterprise using the maximum allowable (Bodaly et al. unpublished work).

Such performance certainly limts the income of individual enterprises. Lifing nets by hand is hard work, especially in deep water. This is perhaps a major factor limiting the number of nets set at any one time.

One possible method of increasing the number of nets an individual could set might be the adoption of the use of gill net lifters. Such a mechansism is essentially a pulley, powered by its own motor, over which nets can be drawn taut and so are pulled aboard by the pulley. The Manitoba Hydro boat had a net lifter. With moderate catch, the crew was able to pull in 100 yards (914 m) of net in about 45 minutes with little strain on the man doing the pulling.

In 1976 the Manitoba Department of Renewable Resources and Transportation Services and the Department of Fisheries and Oceans operated an experimental boat on Southern Indian Lake which was equipped with a hydraulic net reel to pull nets aboard. During an 18 day trial period the boat caught an average of 356 lb (166 kg) daily, compared to an average of 319 lb (145 kg) for fishermen using traditional methods (Manitoba Dept. of Renewable Resources 1977). This boat was also larger than the boats used by fishermen and had a more powerful inboard motor. During the 18 day trial period the boat employed a fisherman from one of the less successful enterprises of this report as a local guide. The larger catch obtained by this boat was probably not due to exceptional local knowledge of the lake on the part of the local fisherman.

A hydraulic reel such as the experimental boat had would likely not prove satisfactory because of maintenance problems. An internal combustion engine powered net lifter could easily be maintained by fishermen. Unfortunately, net lifters are not readily available (P. Slezak, John Leckie's Ltd., personal communication). Those that might be available are designed for boats larger than 20 foot (6 m) skiffs commonly used on Southern Indian Lake and are expensive, costing in the neighborhood of $4000 (H. Shale, FFMC, personal communication). As such, it is unlikely they would be used by skiff fishermen. In the immediate future net lifters introduced into the fishery would likely have to be homemade.

### 5.8.2 Number of Fishermen and Quota

A second factor limiting fishing enterprises' incomes was the number

of fishermen in the fishery and the size of the summer quota.

In previous sections of this report it was suggested that for an enterprise to generate positive cash flow, it was necessary to fish intensively for many days in order to create a gross revenue larger than expenditures. If all enterprises began to fish in this fashion the quota would have to be enlarged to allow sufficient amounts of fish to be caught. At present the quota is probably too small to allow the present number of fishermen all to generate positive cash flows. With the summer lake quota set at 800,000 lb (362,880 kg), and 110 fishermen participating it is impossible for enterprises' average gross revenue to exceed the revenue from 7207 lb (3269 kg).

In the summer of 1980 the quota was filled by late August and so was extended by allowing fishermen to fish until September 13th. This was accomplished by the Manitoba Department of Natural Resources transferring poundage from the winter fishery quota to the summer quota. If the quota is not filled, the fishery may legally remain open until mid-October. The large number of fishermen cause the quota to be filled long before this date.

Commercial fisherman licenses are assigned by the South Indian Lake Fishermen's Association. As a rule, any town resident who wishes to fish can get a license. This practice probably has its roots in the perception of fishing as part of a lifestyle, not only as a commercial operation. As long as this practice is followed a large number of fishermen will exist and individual incomes will be limited. With the inclusion in the 1981 fishermen's assistance program of restrictions limiting access to compensation payments, the rate of increase in the number

of individuals annually applying for licenses may possibly slow down.

It is desirable from the view of economic efficiency to limit the number of licensed fishermen. By decreasing overcapitalization in the fishery, additional profits would become available for meeting community and individual needs. The South Indian Lake Fishermen's Association may find such a policy difficult from an equity viewpoint since their traditional culture allows unrestricted access to resources.

A large number of fishermen has no affect on the size of gross aggregate revenue. But a fishery can become overcapitalized by having too many fishermen. Aggregate expenditures for additional boats, motors, and other equipment unnecessary to fulfill the quota reduce aggregate and individual cash flows.

With fixed quota and especially with a large number of fishermen, individuals who acquire a gill net lifter could potentially increase their income at the expense of those fishermen who did not possess net lifters. It is also possible that if use of net lifters could become widespread, as fishermen tried to maintain their share of the total catch. In this case the quota would be filled even faster than at present.

## 5.9 Social Influence on Economics

Through this report an underlying assumption of the analysis has been that enterprises act in a manner whereby they attempt to maximize profits. This is a central assumption of microeconomics which was developed in an industrial society. In reality, no one in any society is a revenue maximizer, since this would require one always to work incessantly during one's waking hours. It is, however, a necessary assumption if

observed economic performance is to be evaluated against its potential.

In 1980, the summer fishery operated for 105 days, from June 1st to September 13th. If fishermen were revenue maximizers, one would expect them to make deliveries on all 105 days. The difference between 105 and the number of days an enterprise made deliveries, can be considered as a measure of the number of days on which the utility an enterprise derived from a pastime other than fishing exceeded the utility derived from fishing.

Since utility is the degree of satisfaction an individual derives from a situation, there are no concrete measures of utility. Sources of utility other than fishing could be economic in nature, say if an individual had a chance to work at wage employment for a few days. Sources of utility could also be social in nature, such as an obligation to attend a wedding, which did happen during the 1980 season. Or sources of utility might be psychological, such as the perceived need for a day off.

The number of days fished by each enterprise is shown in Table 8. It can be seen that enterprises fished far less than the maximum possible number of days.

The difference between possible and actual number of days fished is viewed as a maximum possible measure of the demands of social circumstances upon revenue maximization. It is a maximum value since there definitely were reasons for not fishing on some days which were not social in nature, days with bad weather, for instance. Other reasons were purely economic. Early in June many individuals did not fish because catches are generally expected to be small at that time of year. Marginal costs were expected to exceed marginal revenue. With that expectation it was

Table 8

Number of Days Fished by Enterprises

| Enterprise | Number of Days Fished |
|---|---|
| 1 | 74 |
| 2 | 36 |
| 3 | 33 |
| 4 | 42 |
| 5 | 44 |
| 6 | 25 |
| 7 | 37 |
| 8 | 26 |
| 9 | 44 |
| 10 | 35 |
| 11 | 38 |
| 12 | 35 |
| 13 | 36 |
| 14 | 41 |
| 15 | 43 |
| 16 | 29 |
| 17 | 21 |
| 18 | 45 |
| 19 | 38 |
| 20 | 57 |
| 21 | 40 |
| 22 | 55 |
| 23 | 39 |
| 24 | 90 |
| Mean | 42 |
| Median | 38 |
| Possible Maximum | 105 |

economically correct not to fish.

Suppose it were possible to compare the degree of revenue maximization displayed by the sample enterprises with the degree of revenue maximization measured in an industrial economy. One could then determine whatever effect a traditional Indian culture has on revenue maximization as it is realized in the type of society where economic theory was developed. Such an evaluation is beyond the scope of this study.

## 5.10 Social Significance

In remote native communities commercial fishing is not perceived of as only an entrepreneurial endeavor. During the field activities for this report it became apparent that fishing is very much a part of the rhythm of annual activities in a highly seasonal climate. Since its beginnings in the 1940's fishing has become ingrained into the pattern of community life. One individual spoke of getting "fishing fever" in springtime.

Individuals fish, not only for monetary gain, but for the sake of fishing, because that is what they do in the summer. Particularly for older individuals, it would be difficult to change from an independent activity such as fishing, to wage employment, for instance. The lack of wage employment opportunities also encourages the pursuit of traditional activities, such as fishing.

Another reason which encourages continuation of commercial fishing is that fish used for domestic consumption are caught at the same time as commercial catches. The welfare of fishermen's households is thereby increased through fishing, in a manner which is not reflected

and cannot be reflected in calculations of returns to capital and labor. This type of non-market consumption is described and quantified by the Federation of Saskatchewan Indians (1976).

## 5.11 Future Potential

As shown in Table 1, the number of individuals participating in the fishery is increasing annually. This is probably mainly due to the steadily increasing town population, characteristic of northern Manitoba native communities (Manitoba North n.d.). This increase may also partly be due to past subsidization of the fishery which may have caused some individuals to begin or to remain fishing. Barring the Fishermen's Association changing its practice of assigning licenses, this trend will continue.

One consequence of this trend, given a quota which remains fixed, is that individual gross revenues will decrease as each individual gets a progressively smaller fraction of the quota. Post-impoundment studies indicated that the initial drop in catch per unit effort was caused by impoundment, not by overfishing (Bodaly et al. 1980). It may be assumed that the continued decrease in catch per unit effort through the summers of 1980 and 1981 has made it progressively more difficult for fishing enterprises to generate revenue sufficient to cover their costs. The observed decrease in catch per unit effort from 1979 through 1981 may be attributable to two hypothetical causes:

1) Continued change in the limnological conditions of the lake, due to impoundment, has decreased catchability of fish and/or

2) Because of impoundment, the increasing level of fishing effort

is now too high for existing stocks, resulting in fish populations now being overfished (R. Bodaly, Fisheries and Oceans, personal communication).

If the latter cause is in fact the true situation, the quota should be decreased or fishing halted completely until stocks recover.

Currently the summer fishery is overcapitalized. If enterprises had fished in an efficient manner the summer quota in 1980 could have been caught with significantly fewer enterprises and less cost. If the catchability of fish stocks continues to decline, only enterprises which are prepared to work intensively for many days will be able to generate positive cash flows. Both of these statements argue for a decrease in the number of fishing enterprises from the standpoint of economic efficiency.

Suppose, on the other hand, the catch per unit effort increases back to at least about its 1980 value, with no evidence of overfishing being detected. It may then be possible to increase the quota. This would allow more enterprises to generate positive cash flows, based on 1980 cost data, especially if enterprises began to work more intensively. An increased quota could argueably also provide a reason for allowing more enterprises to enter the fishery, depending on the circumstances at the time.

One possible option to ease this dilemma would be the re-opening of inland lakes to commercial fishing. This was part of the 1981 Manitoba Hydro compensation arrangements. The economic viability of this scheme remains to be proven.

It is apparent that at some point in the future, if present trends of catch per unit effort and numbers of fishermen continue, gross revenues will have shrunk substantially. This may already have happened

in the 1981 fishery. Perhaps at that point fishermen who do not fish primarily as entrepreneurs will realize that the small returns from fishing do not make it econmically worthwhile. Hopefully, before that point is reached the Fishermen's Association will change its approach to distributing licenses and the provincial government will take a more active interest in setting a realistic quota.

It will at some point be necessary for these bodies to regulate access to the fishery if it is expected that individual enterprises will generate positive cash flows. Currently, Manitoba Hydro, by limiting fishermen's access to compensation payments, is the only agency regulating access to the fishery.

The future of the fishery is very uncertain. Because of its unique circumstances policy makers concerned with the Southern Indian Lake reservoir have little knowledge to draw on from elsewhere. Increases in the future numbers of potential fishermen are assured. Models of the present fish populations are incomplete. The future reaction of fish populations to impoundment is largely unpredictable. Continued deterioration in the qualtiy and size of the summer catch demand that the responsible agencies take action if economic viability is to be realized.

# Chapter 6

# CONCLUSIONS

## 6.1 Economic Analysis

The theory of the firm is at the heart of much microeconomic analysis. Two principal assumptions regarding this theory are that firms operate in an industrial economy and that firms act to maximize profits. Analysis in this report was conducted at the level of the firm, the fishing enterprise.

Though strictly speaking, commercial fishing is an activity with costs for all inputs and a price received for its product, at Southern Indian Lake commercial fishing occurs within the context of a traditional native economy. A principal effect of this setting was a lack of rigidity of the firm.

Partnerships changed frequently during the summer of 1980. The author recorded partnership changes from FFMC "daysheets", approximately every three days during the summer. It was rare that new partnerships did not appear during any three day interval. Some partnerships did remain stable all summer. These were generally the more successful enterprises.

To a large extent the high mobility of labor concealed the existance of established firms. The small vessels involved combined with the high mobility of labor makes analysis of commercial fishing within a traditional economy possibly as justified on an individual basis as on a firm basis.

This concept gains support when one considers that the core of an enterprise as defined in this study, a skiff, is used by its owner only partly for fishing. It is also used as basic transportation around the lake and for supplying traplines, for example. In the absence of a fishery some type of boat would still be required for an individual to travel away from town. A fishing skiff fills more than one role for an individual.

The assumption that firms act to maximize profits also suffers in a traditional economic setting (see Table 8). A few individuals worked many days in a systematic, organized fashion. A large number of enterprises worked over extended periods of time, but did not fish every day. Less than maximum fishing effort such as this does not maximize profits, but is nonetheless common practice. As was discussed in section 5.9, this is explained by sources of utility other than fishing income. As well, the pursuit of fishing as a traditional activity instead of as an entrepreneurial activity de-emphasizes considerations of economic efficiency.

It seems that commercial fishing operations may be anlayzed on one of two different bases, depending on circumstances of the situation. Within the context of fisheries economics analysis of firms facilitates comparison of fisheries in different geographic locations. Within the context of a traditional economy it is just as realistic to view fishing as individual's efforts, composing only part of his annual economic activities. The type of analysis used should reflect the context within which the analysis occurs and the purpose to which the analysis will be put.

## 6.2 Concluding Remarks

Economic performance of the Southern Indian Lake summer commercial fishery in the summer of 1980 was generally poor. Without subsidization only 33% of sampled enterprises earned sufficient returns to labor and capital to demonstrate economic vaibility. With subsidization, 92% of enterprises were viable. Economic viability was judged only on the basis of the private accounts of fishing enterprises. Public accounts regarding the cash flow of subsidization into the fishery were not evaluated.

Topolniski, in Weagle and Baxter (1973) stated that there was a need to introduce basic business principles to the fishermen of Southern Indian Lake. Given that the objective of commercial fishing is to generate net profits, this statement remains true. A large number of enterprises did not operate in the intensive fashion which the author found necessary for the economic viability of an enterprise.

If an objective of a fishery is to reinforce a social system, considerations of economic efficiency must be modified. The licensing procedure of the South Indian Lake Fishermen's Association reduces economic efficiency by allowing easy access to the fishery and subsequent overcapitalization. But by doing so it prevents the social stress which would occur if traditional access to the fishery were restricted. Open access also reduces government transfer payments in the form of welfare payments which would likely be made to individuals excluded from the fishery.

Continuance of the free access policy by the Fishermen's Association may now be contributing to overfishing and the decline of fish populations. The fact of overfishing remains to be proven.

Subsidizing a largely economically unviable fishery has an advantage of having people employed at a productive activity. The alternate might be to have them do nothing while they wait for their monthly welfare cheques.

Manitoba Hydro compensation payments were largely responsible for making the fishery economically viable from the standpoint of private accounts of fishing enterprises. Judged on the basis of Pareto optimality the 1980 compensation program was inadequate. Incentive payments were too small and no compensation was paid for the additional travel now required in the post-impoundment situation.

If comprehensive yearly pre- and post-impoundment data regarding fishing costs and catch per unit effort were available, this study could have made recommendations with more accuracy and more detail. Such research could have provided a basis for mitigation and compensation of the Southern Indian Lake fishery. It also could have provided a good source of baseline data for similar future projects which may be undertaken by Manitoba Hydro or other hydroelectric utilities. Such information would allow compensation programs to be budgeted for in the fiscal plans of an utility.

In the summer season subsidization payments amounted to 38% of the total revenue accruing from fish sales. If catch per unit effort continues to decrease and Manitoba Hydro compensation continues to increase as it has in the summers of 1979, 1980, and 1981, it is possible that the size of subsidization payments could in the future equal or exceed the value of the catch.

If and when this situation arises, decisions will have to be made

whether or not to continue to subsidize the fishery as in the past or to promote other economic activity in the community. A detailed analysis of this problem is beyond the scope of this study.

In summation, the 1980 summer fishery performed in marginal economic fashion. The aggregate fishery was viable only with substantial subsidization with public funds. Future trends in fish populations are as yet largely unpredictable. These trends will largely dictate catches per unit effort, the size of quotas, and the number of unsubsidized enterprises which will be economically viable. The number of subsidized enterprises which will be able to operate in the long run depends largely on future compensation arrangements which Manitoba Hydro negotiates with fishermen.

## LITERATURE CITED


Alder, J. S. 1979. An application of analysis of variance - split plot in time - to environmental observations on Southern Indian Lake (1974-1978) before and after impoundment. Canada Fisheries and Marine Service Technical Report 895:24p.

Anderson, L. G. 1977. The Economics of Fisheries Management. The John Hopkins University Press. Baltimore, Md. 214p.

Ayles, H. A. 1976. Lake whitefish (Coregonus clupeaformis (Mitchill)) in Southern Indian Lake, Manitoba. Canada Fisheries and Marine Service Technical Report 640:28p.

Ayles, H. A. and G. D. Koshinsky. 1974. The fisheries of Southern Indian Lake. LWCNRSB, Technical Report, Appendix 5, Vol.1, 118p.

Bodaly, R. A. 1977. Evolutionary divergence between currently sympatric lake whitefish, Coregonus clupeaformis, in the Yukon Territory. Ph.D. thesis, University of Manitoba, Winnipeg, Man. 119p.

Bodaly, R. A., R. N. Erickson, and R. J. P. Fudge. 1980a. Pre- and post-impoundment experimental fish catches, Southern Indian Lake, Manitoba, 1972-1979. Canadian Data Report of Fisheries & Aquatic Sciences 201:73p.

Bodaly, R. A. and R. E. Hecky. 1979. Post-impoundment increases in fish mercury levels in the Southern Indian Lake reservoir, Manitoba. Canada Fisheries and Marin Service Manuscript Report 1531:15p.

Bodaly, R. A., T. W. Johnson, and R. J. Fudge. 1980. Post-impoundment changes in commercial fishing patterns and catch of lake whitefish (Coregonus clupeaformis) in Southern Indian Lake, Manitoba. Canadian Manuscript Report of Fisheries and Aquatic Sciences 1555:14p.

Cass-Beggs, D. 1969. The Proposed Churchill River Diversion and Associated Problems. 32p.

Cleugh, T. R., H. Ayles, and W. Baxter. 1974. The morphometry of Southern Indian Lake: present conditions and implications of hydroelectric development. LWCNRSB, Technical Report, Appendix 5, Vol.1, 15p.

Collinson, J. D. et al. (other names not given). 1973. Social and economic impact of the Nelson River hydro development (with emphasis on South Indian Lake). LWCNRSB, Technical Report, Appendix 8, Vol.2, 300p.

Dasgupta, A. K. and D. W. Pearce, 1972. Cost-Benefit Analysis: Theory and Practice. The Macmillan Press Ltd. London, 270p.

Doan, K. H. 1979. Commercial catch of the fishery at Cedar Lake, Manitoba, before and after the Grand Rapids hydroelectric project. Manitoba Department of Mines, Natural Resources and Environment MS Report 79-48:28p.

Federation of Saskatchewan Indians. 1976. Aski-Puko (The Land Alone). Saskatoon, Sask. 475p.

Ferguson, C. E. and S. C. Maurice. 1978. Economic Analysis: Theory and Application. Irwin-Dorsey Ltd. Georgetown, Ont. 520p.

Framingham, D. F., J. A. MacMillan, and J. Craven. 1974. Simulation of Alternatives for the South Indian Lake Commercial Fishery. Manitoba Department of Mines, Resources and Environmental Management. 36p.

Gillespie, E. D., F. F. Slaney, and P. D. McTaggart-Cowan. 1972. The Clearing Program for Southern Indian Lake and The Diversion Channel from South Bay to Notigi. 24p.

Gislason, G. S. (n.d.). Socio-Economic Characteristics of Selected Manitoba Commercial Fishermen, 1974-75. Natural Resources Institute, University of Manitoba, Winnipeg, Man. 212p.

Grant, E. L., W. G. Ireson, and R. S. Leavenworth. 1976. Principles of Engineering Economy, sixth edition. John Wiley and Sons. Toronto, Ont. 624p.

James F. MacLaren Limited. 1978. Report to Manitoba Hydro on Changes in Quality of Whitefish Fishery on Southern Indian Lake. Willowdale, Ont. 16p.

Lake Winnipeg, Churchill, and Nelson Rivers Study Board. 1975. Technical Report. Winnipeg, Man.

Lindsey, C. C. and C. S. Woods (eds.). 1970. Biology of Corregonid Fishes. University of Manitoba Press. Winnipeg, Man. 560p.

MacTavish, W. B. 1952. A Biological Investigation of Southern Lake, Summer 1952. Manitoba Department of Mines and Natural Resources. 97p.

Manitoba Department of Renewable Resources and Transportation Services. 1977. The Graham Yawl: Design and Construction. 13p.

Manitoba Hydro. 1978. Commercial Fisherman's Assistance Program. 26p.

Manitoba North, maps. (n.d.). 269p.

Meigs, W. B., A. N. Mosich, C. E. Johnson, and J. D. Blazouski. 1973. Accounting: The Basis for Business Decisions. McGraw-Hill Ryerson Limited. Toronto, Ont. 950p.

Milford, J. T., and R. P. Perry. 1974. Social Change and Stress: A Focus on Northern Development. LWCNRSB, Technical Report, Appendix 8, Vol.3, 97p.

Napier, T. L. 1974. Social-psychological response to forced relocation due to watershed development. Water Resources. 81:784-794.

Peters, R., and C. Wall. (n.d.). Manitoba Fisheries Fact Book. Government of Manitoba.

Peterson, K. G. (n.d.). Benefit/cost analysis as a basis for compensation and mitigation decisions for hydroelectric projects. In The Mitigation Symposium: A National Workshop on Mitigating Losses of Fish and Wildlife Habitats. U.S. Department of Agriculture General Technical Report RM-65. 681p.

Quinn, J., and M. J. Trebilcock. 1981. Compensation, transition costs, and regulatory change. Economic Council of Canada Working Paper No.18:93p.

Schramm, G. 1976. Analyzing Opportunity Costs: The Nelson River Development. Natural Resources Institute, University of Manitoba, Winnipeg, Man. 82p.

Sunde, L. A. 1964. South Indian Lake Whitefish Infestation Test, March 5th to 7th, 1963. Manitoba Department of Mines and Natural Resources. 3p.

Stabler, J. C., R. G. Beck, J. A. Warner, D. Russel, M. R. Olfert, S. M. Howard, and A. Tuck. 1975. Socio-economic (Saskatchewan). Churchill River Study, Final Report 25, 465p.

Thompson, P. C. 1974. Institutional constraints in fisheries management. Journal of the Fisheries Research Board of Canada. 31:1965-1981.

Treasury Board. 1976. Benefit-Cost Analysis Guide. Department of Supply and Services. Ottawa, Ont. 80p.

Tritschler, G. E. 1979. Final Report. Commission of Inquiry into Manitoba Hydro. 483p.

Underwood McLellan & Associates Limited. 1970. Churchill River Diversion: Study of Alternative Diversions. Winnipeg, Man. 124p.

United States Department of the Interior, Fish and Wildlife Service and Manitoba Department of Mines and Natural Resources. 1961. Grand Rapids Hydro-Electric Project, Saskatchewan River, Manitoba: A Report on Fish and Wildlife Resources. Washington, D.C. 108p.

Van Ginkel Associates. 1967. Transition in the North: The Churchill River Diversion and the People of South Indian Lake. Vol.1. Winnipeg, Man. 44p.

Watson, R. A. 1977. Metazoan parasites from whitefish, cisco and pike from Southern Indian Lake, Manitoba: a preimpoundment and diversion analysis. M.Sc. thesis, University of Manitoba, Winnipeg, Man. 197p.

Weagle, K. V., and W. Baxter. 1973. The fisheries of Southern Indian Lake. Exploitation and reproduction. LWCNRSB, Technical Report, Appendix 5, Vol.1, 163p.

Appendix A

QUESTIONNAIRE USED IN INTERVIEWS

FISHING EXPENSES

PLEASE INDICATE THE STATIONS YOU DELIVERED FISH TO AND THE TIME YOU SPENT FISHING.

| STATION | DATE STARTED | DATE FINISHED | APPROXIMATE NO. OF LIFTS | APPROXIMATE DAYS SPENT BEFORE & AFTER PREPARING EQUIPMENT |
|---|---|---|---|---|

LABOR EXPENSES

PLEASE LIST THE NAMES OF THE PEOPLE YOU HAD WORK FOR YOU. PLEASE INCLUDE MEMBERS OF YOUR FAMILY EVEN IF YOU DID NOT PAY THEM.

| NAME | DATE STARTED | DATE FINISHED | PAYMENT (SHARE % OR WAGES PER WEEK) | TOTAL WAGES RECEIVED |
|---|---|---|---|---|

DO YOU HAVE A PARTNER?

NAME:

ADDRESS:

PLEASE DESCRIBE YOUR SHARING ARRANGEMENT:

| YOUR % | PARTNER'S % |
|---|---|

1) CATCH

2) EXPENSES

OR DESCRIBE

PLEASE INDICATE WHETHER YOU SELL ALL THE FISH YOU CATCH UNDER YOUR NAME OR WHETHER YOU SELL YOUR PARTNER'S PERCENTAGE UNDER HIS NAME:

GENERAL EXPENSES: (purchased during the 1980 fishing season)

| | AMOUNT | APPROXIMATE COST |
|---|---|---|
| OIL | (litres) | $ |
| GASOLINE | (gallons) | $ |
| DIESEL FUEL | (gallons) | $ |
| KEROSENE | (gallons) | $ |
| PROPANE | (pounds) | $ |
| NAPTHA GAS | (gallons) | $ |
| GREASE | (tubes) | $ |
| TRANSMISSION OIL | (litres) | $ |
| ANTIFREEZE | (gallons) | $ |
| | | |
| GILLNET MESH | (yards) | $ |
| FLOATS | | $ |
| LEADS | or lbs. | $ |
| LEAD CORE LINE | (yards or lbs.) | $ |
| SEAMING TWINE | (lbs.) | $ |
| ROPE | | $ |
| SIDELINE | (lbs.) | $ |
| | | |
| TARP | | $ |
| PAINT | (gallons) | $ |
| SHOVELS | | $ |
| CHISELS | | $ |
| JIGGERS | | $ |
| AXES | | $ |
| SAWS | | $ |
| PLASTIC TUBS | | $ |
| FISH BOXES | | $ |
| NET TRAYS | | $ |
| BUOYS | | $ |
| FLAGS | | $ |

GENERAL EXPENSES (continued)

| | AMOUNT | APPROXIMATE COST |
|---|---|---|
| MITTS | (pairs) | $ |
| GLOVES | (pairs) | $ |
| BOOTS | (pairs) | $ |
| OILERS | | $ |
| PARKAS | | $ |
| SOCKS | (pairs) | $ |
| KNIVES | | $ |
| FIRE EXTINGUISHERS | | $ |
| LIFE JACKETS | | $ |
| FOOD | | $ |
| BOAT INSURANCE | | $ |
| FISHING INSURANCE | | $ |
| RADIO LICENSES | | $ |
| SPARK PLUGS | | $ |
| POINTS AND CONDENSERS | | $ |
| OIL FILTERS | | $ |
| BATTERIES | | $ |
| ICE | | $ |
| OTHERS (please list) | | $ |
| _____ | | $ |

MAINTENANCE AND REPAIR EXPENSES

PLEASE LIST REPAIRS AND PARTS PURCHASED.

| REPAIR | PARTS COST | LABOR COST | TOTAL COST |
|---|---|---|---|

FREIGHT EXPENSES

HOW MUCH WAS CHARGED FOR FREIGHTING YOUR FISH TO YOUR FFMC AGENT DELIVERY POINT? $_____

IF YOU DELIVERED YOUR CATCH YOURSELF PLEASE INDICATE:

a) ROUND TRIP MILEAGE TO AND FROM FFMC AGENT _____

b) NUMBER OF DELIVERIES MADE BY YOU YOURSELF _____

FINANCING EXPENSES

IF YOU HAVE BORROWED MONEY TO FINANCE YOUR FISHING BUSINESS COULD YOU PLEASE INDICATE:

ORIGINAL AMOUNT BORROWED _____

INTEREST RATE _____

DATE LOAN STARTED: MONTH _____ YEAR _____

NUMBER OF YEARS TO REPAY _____

NUMBER OF PAYMENTS REQUIRED PER YEAR _____

FISHING INCOME

PLEASE ESTIMATE YOUR INCOME FROM FISH SALES FOR FISH WHICH YOU DID NOT SELL TO FFMC BUT SOLD PRIVATELY: $_____

PLEASE ESTIMATE THE AMOUNT OF FISH SOLD PRIVATELY:

| | NUMBER OF POUNDS |
|---|---|
| WHITEFISH | |
| PICKEREL | |
| LAKE TROUT | |
| NORTHERN PIKE (JACKFISH) | |
| SAUGER | |
| TULLIBEE | |
| INCONNU | |
| PERCH | |
| MULLET | |
| CARP | |
| OTHERS: | |

WHO DID YOU SELL YOUR FISH TO?

| | | |
|---|---|---|
| MINK RANCHERS | RESTAURANTS | PRIVATE INDIVIDUALS |
| PET FOOD COMPANY | HOTELS | OTHERS |

EQUIPMENT INVENTORY

TYPE OF BOAT

"WHITEFISH BOAT" YAWL (INBOARD/OUTBOARD) SKIFF

"BOW PICKER" YAWL (OUTBOARD) CANOE

OTHER _____

BOAT DETAILS

NAME OF BOAT MOT REG. NO. _____

NAME OF MANUFACTURER DATE OF MANUFACTURE

MONTH YEAR

ADDRESS DATE PURCHASED

MONTH YEAR

LENGTH WIDTH

HULL CONSTRUCTION

STEEL WOOD PLANKS FIBERGLASS ALUMINUM PLYWOOD OTHER _____

OUTBOARD ENGINES

MAKE _____ HP _____ MODEL YEAR _____

MAKE _____ HP _____ MODEL YEAR _____

MAKE _____ HP _____ MODEL YEAR _____

PLEASE INDICATE THE NUMBER OF YEARS THAT YOU EXPECT YOUR OUTBOARD ENGINE TO LAST YOU FOR FISHING: _____

DO YOU OWN THIS BOAT? IF YOU RENT, DO YOU RENT:

BOAT ONLY MOTOR(S) BOAT AND MOTOR BOAT, MOTOR AND EQUIPMENT

PLEASE INDICATE:

NAME OF OWNER: _____

ADDRESS: _____

AMOUNT OF RENT, OR IF YOU SHARE YOUR CATCH AND/OR EXPENSES WITH THE OWNER, PLEASE INDICATE:

| $ _____ | YOUR PERCENTAGE | OWNER'S PERCENTAGE |
|---|---|---|
| 1) CATCH | | |
| 2) EXPENSES | | |

IF YOU DO SHARE YOUR CATCH WITH THE BOAT OWNER DO YOU SELL ALL THE FISH YOURSELF OR DO YOU SELL THE OWNER'S PERCENTAGE OF THE CATCH UNDER HIS NAME?

FISHING EQUIPMENT

| GILLNETS | MESH SIZE | TWINE SIZE | DEPTH IN MESHES | LENGTH IN YARDS | NUMBER |
|---|---|---|---|---|---|

IS LEAD CORE LINE USED ON THE NETS? ON HOW MANY NETS IS IT IN USE?

| | NUMBER | APPROXIMATE COST |
|---|---|---|
| DEPTH SOUNDER | | $ |
| FISH FINDER | | $ |
| NET TRAYS | | $ |
| PLASTIC FISH TUBS | | $ |
| STEEL NET ANCHORS | | $ |
| BUOYS | | $ |
| CHAINS | (FEET) | $ |
| BOAT ANCHORS | | $ |
| LIFE JACKETS | | $ |
| FIRE EXTINGUISHERS | | $ |
| TENTS | | $ |
| SLEEPING BAGS | | $ |
| STOVES | | $ |
| COOLERS | | $ |
| LANTERNS | | $ |
| OTHERS (please list) | | |
| _____ | | $ |
| _____ | | $ |
| _____ | | $ |
| _____ | | $ |

HOW MANY NETS DO YOU GENERALLY LIFT AND SET ON A NORMAL DAY? _____

HOW MANY OPEN WATER FISHING SEASONS DO YOU EXPECT YOUR NETS TO LAST? _____

## Evaluation of Questionnaire

On the whole, the questionnaire proved quite adequate. The questionnaire required an average time of approximately 10-15 minutes to administer, longer if two partners were questioned simultaneously.

There are some minor improvements which could have been made:

1) Under either General Expenses or Maintenance and Repair Expenses, an additional item, "fiberglass", should be added. Fiberglass kits are frequently bought to repair cracks in yawls.

2) In the General Expenses section, the items "fish boxes" and "net trays" could be omitted. Fishermen exclusively use "plastic tubs" for packing fish and nets.

3) In the General Expenses section, the item "flags" can be omitted. Flags are considered to be part of buoys they are attached to.

4) In the General Expenses section, along with the item "food" there should be a question "For how many people?".

5) For the Southern Indian Lake fishery, the section Freight Expenses can be omitted. The prices paid to fishermen for their catch are net of freight expenses to Leaf Rapids.

6) The secion Fishing Income could be omitted or at least abbreviated. No fishermen were encountered who sold their catch to any buyer other than the FFMC.

7) The section dealing with boats could be duplicated. Fishermen frequently own more than one boat.

## Appendix B

## QUESTIONNAIRE ACCURACY

By comparing fishermen's accounts with the FFMC to values of expenditures obtained from the questionnaire, the accuracy of information gathered by the questionnaire was measured. There were a total of 15 instances in the records of the 55 fishermen interviewed where these two sources of information could be directly compared. The mean error was 6.53% (median error 6.7%). The average deviation of error from the median was 7.97%. In nine cases questionnaire information underestimated expenditures and in six cases expenditures were overestimated.

This error was probably caused by partially inaccurate information from interviews and by price changes during the summer for the equipment sold to fishermen by the FFMC.

This measure of error of questionnaire information may be an underestimation. If a discrepancy between questionnaire and FFMC account information was large it may have made it impossible to recognize the two values as representing the same purchase. The error in such a case would be undetected.

ERRORS FOUND IN QUESTIONNAIRE DATA

| Error Number | FFMC Records ($) | Questionnaire ($) | % Error |
|---|---|---|---|
| 1 | 504.68 | 500.48 | -0.8 |
| 2 | 227.35 | 209.00 | -8.1 |
| 3 | 227.35 | 209.00 | -8.1 |
| 4 | 317.89 | 307.07 | -3.4 |
| 5 | 458.64 | 457.57 | -0.2 |
| 6 | 403.82 | 430.30 | +6.6 |
| 7 | 418.87 | 456.05 | +11.0 |
| 8 | 407.86 | 455.30 | +11.6 |
| 9 | 281.12 | 262.11 | -6.8 |
| 10 | 96.32 | 110.99 | +15.2 |
| 11 | 519.29 | 550.81 | +5.7 |
| 12 | 121.54 | 110.99 | -8.7 |
| 13 | 637.21 | 620.87 | -2.5 |
| 14 | 124.91 | 133.28 | +6.7 |
| 15 | 222.86 | 217.04 | -2.6 |
| | | Total of absolute values | 98.0 |

$$\text{Mean error} = \bar{x} = \frac{98}{15} = 6.53\%$$

$$\text{Average deviation from mean} = \frac{\sum(x_i - \bar{x})}{15} = 7.97\%$$

## Appendix C

### UNEMPLOYMENT INSURANCE COMMISSION CONTRIBUTION

The procedure for determining the UIC contribution for fishermen for the 1980 summer season was as follows:

The gross value of the fisherman's weekly catch (Fish Purchase Ticket) was multiplied by 0.75 to determine his insurable earning. This value was then multiplied by 0.0135, to determine the UIC contribution, which was deducted by the FFMC.

Weekly insurable earnings had a maximum allowed value of $290 and a minimum allowed value of $87. Hence the maximum and minimum allowed weekly UIC contributions were $3.92 and $1.17 respectively.

If an individual's insurable earnings were above or below the allowed limits, he was assessed the maximum or minimum allowed contribution. In the case that his insurable earnings were below the minimum limit but he was assessed at the minimum, it was very likely that a reasonably hard working fisherman would make up this deficit by having insurable weekly earnings of more than $290 in the future.

Appendix D

FISHING ENTERPRISES' REVENUES AND EXPENDITURES

| ENTERPRISE | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| FISH SALES | 13,542 | 4,527 | 3,774 | 8,065 | 5,167 | 3,038 |
| OPERATIONS | | | | | | |
| Fuel | 2,706 | 645 | 703 | 875 | 1,051 | 948 |
| Repairs | 8 | 30 | 400 | 0 | 0 | 0 |
| Misc. | 7 | 153 | 34 | 43 | 43 | 43 |
| Fishing gear | 752 | 308 | 698 | 519 | 561 | 681 |
| Camp gear | 247 | 176 | 83 | 255 | 195 | 35 |
| Food | 1,110 | 463 | 329 | 311 | 436 | 156 |
| Labor | 4,284 | 2,015 | 1,625 | 1,790 | 2,469 | 1,512 |
| Total | 9,114 | 3,790 | 3,872 | 3,790 | 4,755 | 3,375 |
| INDIRECT COSTS | | | | | | |
| License | 30 | 27 | 25 | 16 | 20 | 20 |
| Insurance | 0 | 0 | 0 | 43 | 42 | 0 |
| UIC | 81 | 31 | 44 | 47 | 49 | 28 |
| Total | 111 | 58 | 69 | 106 | 111 | 48 |
| GROSS OPERATING PROFIT | 4,317 | 679 | -167 | 4,160 | 301 | -385 |
| DEPRECIATION | | | | | | |
| Skiff | 178 | 178 | 178 | 178 | 178 | 178 |
| Motors | 1,050 | 1,184 | 0 | 1,184 | 659 | 525 |
| Nets | 806 | 849 | 461 | 874 | 871 | 244 |
| Total | 2,034 | 2,211 | 639 | 2,236 | 1,708 | 947 |
| NET OPERATING PROFIT | 2,283 | -1,532 | -806 | 1,924 | -1,407 | -1,332 |
| INTEREST EXPENSES | 305 | 348 | 0 | 551 | 239 | 447 |
| NET INCOME | 1,975 | -1,880 | -806 | 1,373 | -1,649 | -1,779 |
| CASH FLOWS | | | | | | |
| Net income | 1,975 | -1,880 | -806 | 1,373 | -1,649 | -1,779 |
| Depreciation | 2,034 | 2,211 | 639 | 2,236 | 1,708 | 947 |
| Interest | 305 | 348 | 0 | 551 | 239 | 447 |
| Cash flow | 4,317 | 679 | -167 | 4,160 | 301 | -385 |

| ENTERPRISE | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|
| FISH SALES | 7,023 | 5,639 | 8,326 | 4,348 | 2,785 | 4,887 |
| OPERATIONS | | | | | | |
| Fuel | 926 | 1,141 | 611 | 1,311 | 368 | 978 |
| Repairs | 329 | 25 | 322 | 219 | 200 | 244 |
| Misc. | 35 | 61 | 51 | 61 | 34 | 76 |
| Fishing gear | 459 | 478 | 671 | 708 | 313 | 472 |
| Camp gear | 126 | 83 | 234 | 155 | 33 | 335 |
| Food | 367 | 382 | 936 | 430 | 339 | 399 |
| Labor | 2,192 | 1,562 | 2,344 | 1,870 | 1,159 | 1,210 |
| Total | 4,434 | 3,733 | 5,115 | 4,754 | 2,446 | 3,714 |
| INDIRECT COSTS | | | | | | |
| License | 24 | 23 | 20 | 20 | 10 | 24 |
| Insurance | 0 | 0 | 48 | 0 | 0 | 63 |
| UIC | 38 | 34 | 60 | 39 | 16 | 48 |
| Total | 62 | 57 | 128 | 59 | 26 | 135 |
| GROSS OPERATING PROFIT | 2,527 | 1,849 | 3,083 | -465 | 313 | 1,038 |
| DEPRECIATION | | | | | | |
| Skiffs | 178 | 178 | 178 | 178 | 178 | 178 |
| Motors | 1,328 | 880 | 1,099 | 659 | 912 | 659 |
| Nets | 965 | 839 | 839 | 662 | 219 | 911 |
| Total | 2,461 | 1,897 | 2,116 | 1,499 | 1,309 | 1,748 |
| NET OPERATING PROFIT | 66 | -48 | 967 | -1,964 | -996 | -710 |
| INTEREST EXPENSES | 478 | 273 | 352 | 239 | 178 | 422 |
| NET INCOME | -412 | -321 | 615 | -2,203 | -1,174 | -1,132 |
| CASH FLOWS | | | | | | |
| Net income | -412 | -321 | 615 | -2,203 | -1,174 | -1,132 |
| Depreciation | 2,461 | 1,897 | 2,116 | 1,499 | 1,309 | 1,748 |
| Interest | 478 | 273 | 352 | 239 | 178 | 422 |
| Cash flow | 2,527 | 1,849 | 3,083 | -465 | 313 | 1,038 |

| ENTERPRISE | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|
| FISH SALES | 5,273 | 3,115 | 6,255 | 3,514 | 893 | 3,380 |
| OPERATIONS | | | | | | |
| Fuel | 669 | 406 | 1,000 | 519 | 576 | 997 |
| Repairs | 176 | 8 | 0 | 0 | 25 | 563 |
| Misc. | 38 | 13 | 34 | 26 | 34 | 154 |
| Fishing gear | 729 | 31 | 222 | 449 | 217 | 648 |
| Camp gear | 624 | 124 | 227 | 220 | 58 | 121 |
| Food | 528 | 318 | 675 | 392 | 318 | 324 |
| Labor | 2,597 | 1,941 | 2,066 | 1,235 | 680 | 1,566 |
| Total | 5,361 | 2,841 | 4,224 | 2,841 | 1,908 | 4,148 |
| INDIRECT COSTS | | | | | | |
| License | 20 | 20 | 20 | 22 | 10 | 17 |
| Insurance | 35 | 0 | 35 | 0 | 0 | 0 |
| UIC | 32 | 32 | 46 | 32 | 5 | 33 |
| Total | 87 | 52 | 101 | 54 | 15 | 50 |
| GROSS OPERATING PROFIT | -175 | 222 | 1,930 | 619 | -1,030 | -818 |
| DEPRECIATION | | | | | | |
| Skiff | 178 | 178 | 178 | 178 | 215 | 178 |
| Motors | 472 | 440 | 965 | 0 | 912 | 1,131 |
| Nets | 365 | 305 | 544 | 522 | 430 | 382 |
| Total | 1,015 | 923 | 1,687 | 700 | 1,557 | 1,691 |
| NET OPERATING PROFIT | -1,190 | -701 | 243 | -81 | -2,587 | -2,509 |
| INTEREST EXPENSES | 122 | 113 | 348 | 0 | 188 | 475 |
| NET INCOME | -1,312 | -814 | -105 | -81 | -2,775 | -2,984 |
| CASH FLOWS | | | | | | |
| Net income | -1,312 | -814 | -105 | -81 | -2,775 | -2,984 |
| Depreciation | 1,015 | 923 | 1,687 | 700 | 1,557 | 1,691 |
| Interest | 122 | 113 | 348 | 0 | 188 | 475 |
| Cash flow | -175 | 222 | 1,930 | 619 | -1,030 | -818 |

| ENTERPRISE | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|
| FISH SALES | 4,580 | 8,021 | 5,352 | 7,076 | 4,533 | 20,224 |
| OPERATIONS | | | | | | |
| Fuel | 900 | 1,155 | 1,155 | 1,878 | 805 | 2,894 |
| Repairs | 200 | 13 | 500 | 2,167 | 120 | 61 |
| Misc. | 77 | 43 | 26 | 155 | 95 | 51 |
| Fishing gear | 648 | 554 | 539 | 250 | 855 | 270 |
| Camp gear | 164 | 265 | 243 | 202 | 174 | 196 |
| Food | 428 | 532 | 276 | 722 | 538 | 620 |
| Labor | 2,318 | 3,502 | 2,293 | 3,100 | 1,865 | 4,637 |
| Total | 4,735 | 6,064 | 5,032 | 8,474 | 4,452 | 8,727 |
| INDIRECT COSTS | | | | | | |
| License | 20 | 30 | 20 | 30 | 20 | 20 |
| Insurance | 0 | 0 | 0 | 35 | 0 | 0 |
| UIC | 24 | 64 | 49 | 63 | 39 | 79 |
| Total | 44 | 94 | 69 | 128 | 59 | 99 |
| GROSS OPERATING PROFIT | -199 | 1,863 | 251 | -1,526 | 22 | 11,398 |
| DEPRECIATION | | | | | | |
| Skiff | 178 | 178 | 178 | 413 | 178 | 355 |
| Motors | 1,050 | 1,184 | 1,318 | 1,977 | 1,099 | 2,234 |
| Nets | 715 | 483 | 471 | 1,323 | 948 | 590 |
| Total | 1,943 | 1,845 | 1,967 | 3,713 | 2,225 | 3,179 |
| NET OPERATING PROFIT | -2,142 | 1,863 | 251 | -1,526 | 22 | 8,219 |
| INTEREST EXPENSES | 207 | 305 | 409 | 1,103 | 381 | 333 |
| NET INCOME | -2,349 | -287 | -2,125 | -6,342 | -2,584 | 7,886 |
| CASH FLOWS | | | | | | |
| Net income | -2,349 | -287 | -2,125 | -6,342 | -2,584 | 7,886 |
| Depreciation | 1,943 | 1,845 | 1,967 | 3,713 | 2,224 | 3,179 |
| Interest | 207 | 305 | 409 | 1,103 | 381 | 333 |
| Cash flow | -199 | 1,863 | 251 | -1,526 | 22 | 11,398 |

Appendix E

# SOUTHERN INDIAN LAKE

# COMMERCIAL FISHERMAN'S ASSISTANCE PROGRAM

# SUMMER 1981 & WINTER 1981/82

Manitoba Hydro
Production Division
Mitigation Section
May 1981

# INTRODUCTION

On April 13, 1981 Manitoba Hydro presented the Southern Indian Lake Fisherman's Association Board of Directors with a proposal for an Assistance Program for the 1980/81 fishery. This proposal was not endorsed by the Board of Directors of the Fisherman's Association, and an alternate proposal was presented to Manitoba Hydro on April 23, 1981.

Following a review meeting in Thompson on May 5, 1981 the parties collectively agreed to implement on a without prejudice basis, and subject to ratification by Manitoba Hydro, the following six part Fisherman's Assistance Program for the 1980/81 fishery.

# SOUTHERN INDIAN LAKE
# COMMERCIAL FISHERMAN'S ASSISTANCE PROGRAM
# SUMMER 1981 & WINTER 1981/82

1. ASSISTANCE SUBSIDY PAYMENTS

During the term of this Program, Manitoba Hydro will provide assistence subsidy payments to each eligible licenced commercial fisherman who is actively fishing Southern Indian Lake (S.I.L.) as noted herein.

The unit price subsidies noted herein shall apply to all quota species of fish caught in the eligible area up to the maximum poundage noted in Part 2 herein. In the event that the maximum poundage for each eligible area is not secured during the applicable season, Manitoba Hydro shall guarantee the full subsidy amounts as detailed below, with the unearned subsidy amount distributed back to each eligible fisherman on a pro-rated harvet basis at season end.

Subsidy Amounts

| Guaranteed Amount | Unit Price | Eligible Area | Season |
|---|---|---|---|
| $ 60 000 | 30¢/lb | S.I.L. North of Sand Point | Summer 1981 (Harvest after August 1) |
| 170 000 | 34¢/lb | S.I.L. North of Opachuanau to South of Sand Point | Summer 1981 |
| 30 000 | 30¢/lb | Inland Lakes | Summer 1981 & Winter 1981/82 |
| 38 000 | 38¢/lb | S.I.L. North of Opachuanau to South of Sand Point | Winter 1981/82 |

$298 000 - Total guaranteed amount for 1981 summer and 1981/82 winter season.

NOTE: Although fishing will be permitted in the area North of Sand Point the entire season subsidies shall be paid only for that harvest after August 1, 1981. Any harvest prior to August 1, 1981 shall reduce the applicable poundage and shall reduce the Guaranteed Amount accordingly. The 60 000 dollars Guaranteed Amount shall apply only if the maximum poundage is secured in total after August 1.

2. MAXIMUM POUNDAGE ELIGIBLE FOR SUBSIDY PAYMENTS

The subsidies noted Part 1 herein will apply to all quota species during the 1981 Summer and 1981/82 Winter fishing season up to the maximum poundage noted below.

| Maximum Poundage | Eligible Area | Season |
|---|---|---|
| 200 000 lb | S.I.L. North of Sand Point | Summer 1981 |
| 500 000 lb | S.I.L. North of Opachuanau to South of Sand Point | Summer 1981 |
| 100 000 lb | Inland Lakes | Summer 1981<br>Winter 1981/82 |
| 100 000 lb | S.I.L. North of Opachuanau to South of Sand Point | Winter 1981/82 |

The Fishermen and the Province of Manitoba shall establish an absolute quota limit of 200 000 lb for the area North of Sand Point.

3. ADMINISTRATION

All unit price subsidy payments noted in Part 1 herein will be paid directly to each eligible fisherman on a weekly basis by Freshwater Fish Marketing Corporation, based On Field Purchase Ticket invoices, provided only that the fisherman has secured the minimum harvest noted in Part 6 herein. At the end of each eligible season, any funds remaining in the guaranteed amounts will be distributed to each eligible fisherman by the Freshwater Fish Marketing Corporation on a pro-rated basis. Manitoba Hydro will reimburse F.F.M.C. all amounts paid to fishermen as subsidy payments within thirty days of receipt of invoice and appropriate supportive documents.

4. ADDITIONAL PROGRAMS

a) Programs Funded by Manitoba Hydro

In addition to the subsidy payments noted herein in Part 1, Manitoba Hydro will administer and fund the following programs:

a) Experimental Fishing Boat

b) Replacement Nets

c) Motor Repair

d) Fish Sorter

b) Program Costs included in Subsidy Payments

With implementation of the subsidies noted in Part 1 herein Manitoba Hydro will not be required to implement the standby motor program and will not make final payment adjustments at end of the 1981 summer and 1981/82 winter fishing season.

5. DURATION OF PROGRAM

This Program will commence during the 1981 summer fishing season and remain in effect until the close of the 1981/82 winter fishing season.

6. ELIGIBLE FISHERMEN

In order for a fisherman to be eligible for assistance subsidies under this Program, he must:

a) Be a licenced commercial fisherman.

b) Harvest a minimum of 1 000 lb during the summer season and/or 500 lb during the winter season.

NOTE: The maximum number of fishermen eligible for subsidies under this Program shall be limited to 100.

We the undersigned do hereby agree to the implementation of the Commercial Fisherman's Assistance Program at Southern Indian Lake for the 1981 summer and 1981/82 winter season as described herein:

Witnesses: _____ per _____

per _____

per _____

per _____

Executed this _____ day of _____, 1981.

# SOUTHERN INDIAN LAKE
# COMMERCIAL FISHERMAN'S ASSISTANCE PROGRAM
# UNIT/COST BREAKDOWN
# 1981 SEASON

1. TRANSPORTATION TO OUTLYING LAKES

Single Otter costs - $2.60/mile.

Average haul 207 miles return. (Leaf Rapids to North Indian Lake)

Average capacity - 1 800 lb.

$$\text{Unit costs} = \frac{207 \text{ miles} \times \$2.60}{1\,800} = 30¢/\text{lb}$$

2. COSTS IN TRADITIONAL AREAS (SUMMER)

Assume catch 500 000 lb composed of 300 000 lb darks and 200 000 lb of lights.

| | | | |
|---|---|---|---|
| a) Extra effort | = 500 000 x 21.4¢/lb | = | $107 000 |
| b) Differential | = 300 000 x 9.5¢/lb | = | 28 500 |
| c) Final Payment | = 300 000 x 11¢/lb | = | 33 000 |
| | | Total = | $170 000 |

$$\text{Unit Cost} = \frac{\$170\,000}{500\,000} = 34¢/\text{lb}$$

3. COSTS IN NORTH END (SUMMER)

| | | |
|---|---|---|
| a) Differential | @ | 9.5¢/lb |
| b) Increased effort | @ | 9.0¢/lb |
| c) Final payment | @ | 11.0¢/lb |
| | SAY | 30.0¢/lb |

4. COSTS IN TRADITONAL AREA (WINTER)

Assume catch 100 000 lb composed of 50 000 darks and 50 000 lights.

a) Extra effort = 100 000 x 26.5¢ = $26 500
b) Differential = 50 000 x 10.5¢ = 5 250
c) Final payment = 50 000 x 12.0¢ = 5 000
TOTAL COST = $37 750

$$\text{Unit Cost} = \frac{37\ 750}{100\ 000} = 38¢/\text{lb}$$

Total Guaranteed Amounts

| | | | |
|---|---|---|---|
| a) Traditional area | 500 000 x 34¢/lb | = | $170 000 |
| b) North end | 200 000 x 30¢/lb | = | 60 000 |
| c) Outlying lakes | 100 000 x 30¢/lb | = | 30 000 |
| d) Winter season | 100 000 x 38¢/lb | = | 38 000 |
| | 900 000 lb | | $298 000 |

## Appendix F

## 1981 SUMMER SEASON FISH PRICES

**Delivery Point: Leaf Rapids**

| | | $/kg | $/lb | Less Freight and Weighman |
|---|---|---|---|---|
| Whitefish | | | | |
| Export: | S | .539 | .244 | .164 |
| | M | .759 | .344 | .264 |
| | L | .939 | .426 | .346 |
| | J | 1.089 | .494 | .414 |
| Continental: | S | .449 | .207 | .127 |
| | M | .559 | .254 | .174 |
| | L | .559 | .254 | .174 |
| | J | .669 | .303 | .223 |
| Walleye: (Round) | S | 1.639 | .743 | .663 |
| | M | 2.079 | .943 | .863 |
| | L | 2.079 | .943 | .863 |
| Northern Pike | | | | |
| Dressed: | M | .434 | .197 | .117 |
| | L | .739 | .335 | .255 |
| Headless: | M | .429 | .195 | .115 |
| | L | .429 | .195 | .115 |
| Cisco | | | | |
| Export | | .429 | .195 | .115 |
| Continental | | .279 | .127 | .047 |