The Policy Implications of Alternative Fisheries Management Objectives in the Manitoba Commercial Fishing Industry

by

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

Natural Resources Institute
University of Manitoba
September 1985

ISBN 0-315-33571-8

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A practicum submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of Master of Natural Resources Management.

TO MY FATHER

Mr. Vacys Stankevicius

August 18,1918 - December 11, 1982

For his courage, vision and perserverance.

ABSTRACT

In general, fisheries management programs in Manitoba have been established to ensure that the natural wealth of commercially exploited fishery resources make the greatest possible contribution to Manitobans. However, management agencies responsible for these resources have traditionally established programs that attempt to simultaneously protect fish stocks, maximize employment, increase incomes to fishermen and promote regional economic development. To the extent that these objectives are in conflict with each other, any efforts to make improvements are extremely difficult and in general frustrate further attempts at rationalizing the fishery. As a consequence, the fishing industry in Manitoba is characterized by excess labour and capital, low incomes to fishermen, high fish processing and marketing costs and the continual concern that premium fish stocks will be depleted by overfishing. This situation explains the serious problems that currently contribute to the poor economic performance of the Manitoba commercial fishing industry. In the absence of defined management strategies the potential wealth of the resource has been dissipated, while perpetuating significant economic loss to the citizens of Manitoba.

In this study, attention is focussed on the policy implications of conflicting management objectives in the Manitoba commercial fishing industry. A review of the fishing literature is provided which examines the rent dissipation and excessive resource exploitation that has developed from the common-property characteristic of fishery resources under open-access conditions. An empirical analysis measures the costs of serving the objective of maximizing employment against the objective of increasing incomes to fishermen and generating the greatest possible net value of production. Three commercial fisheries are examined in the financial analysis. In accordance with generally accepted accounting principles, a model is developed to provide the framework for the analysis. An assessment of the financial costs of serving alternative management objectives would permit rationale priorization of fisheries management objectives in Manitoba and promote efficient management and utilization of the resource.

ACKNOWLEDGEMENTS

The completion of this study was not accomplished without the thoughtful guidance and assistance received from the advisory committee members. In recognition of this, I would like to extend my sincere appreciation to Dr. D. Cauvin, Associate Director, Freshwater Institute, Department of Fisheries and Oceans; Dr. B. Owen, Professor, Faculty of Administrative Studies, University of Manitoba and Dr. W. Henson, Director, Natural Resources Institute, University of Manitoba. The committee's expertise and dedication provided a particularly enriched learning environment, which will always be remembered.

I would also like to thank Mr. P. Thompson, Fisheries Economics, Department of Fisheries and Oceans, for the cost and revenue information analyzed in this study. In addition, I wish to express my appreciation for the considerable amount of computer time provided by the Natural Resources Institute.

Finally, I would like to convey my gratitude for the encouragement and support received from my parents, Mr. and Mrs. V. Stankevicius throughout the duration of this study.

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INTRODUCTION

1.1 HISTORY OF THE MANITOBA COMMERCIAL FISHING INDUSTRY

1.1.1 Background

The fishery resources of Manitoba have historically made a valuable contribution to the human diet. Indigenous hunter-gatherers relied substantially on these resources as a basic food source for themselves and their dogs. Nevertheless, Judson (1961) points out that "...given the inefficient methods which were employed...(to harvest fish)...there was some element of truth in the contention of missionaries and traders that the Indians would starve unless they fished in the spawning season". However, as European explorers, fur traders and settlers established themselves in the region the introduction of efficient fish harvesting technologies contributed to substantial increases in fish production. Given increased demands for food, fish provided an important and readily available staple that aided the growth and expansion of these early settlements.

The expansion of the fur trade and the increased settlement of the region during the 1800's contributed significantly to the establishment of commercial fisheries in Manitoba. The importance of fish as an accessible food

source during the establishment of settlements in Manitoba is noted by Judson (1961) who explains that "good fishing became even more essential to fort location as the buffalo supply diminished". Judson (1961) further states that while fishing played an important role in the Selkirk settlement in 1812, fishing was basically a domestic activity. Apparently, the first truly commercial fishing venture to make use of drag seines and gill nets did not begin until 1872 in the Dauphin River. Although a fishing station was established for the purpose of supplying the Winnipeg market with fresh and salted whitefish, the venture was unsuccessful. This initial lack of success appears to be attributed to the inexperience of the fishermen and the small size of the Winnipeg market at the time.

The immigration of Icelandic colonists to Winnipeg in 1875 and their settlement in Gimli shortly thereafter, enabled the first successful commercial fishing venture to become established. By 1879 a fleet of 129 boats was commercially fishing Lake Winnipeg and during the 1882-83 fishing season the Lake Winnipeg commercial fishery landed 127,000 pounds of mostly whitefish.

In retrospect, these early beginnings are of particular interest in that a sizeable work force was already operating on the lake. The fact that average production appears to be low, suggests that fishing was probably a part-time activity, with most of the production being used

primarily for local consumption. However, with the entrance of American fishing firms into the industry, US export markets were developed which sharply increased the demand for fish.

As commercial fishing activity increased to meet the demand for fish, lake-side fishing communities became quickly established and in retrospect reflect the early patterns of settlement in Manitoba. According to Judson (1961),the first fishing villages to be established on Lake Winnipeg arose on the east shore of Lake Winnipeg in the vicinity of Selkirk in 1880. In 1885 fishing villages had also been established on the east side of Lake Manitoba. By 1890 settlements were founded at the narrows on Lake Manitoba and by Lake Winnipegosis at Red Deer Point. Since then, many lake-side communities along many lakes have been established, but the Lake Winnipeg fishery, the Lake Manitoba fishery and the Lake Winnipegosis fishery represent the three largest and most productive lakes in the province.

Although the importance of skilled fishermen in developing the commercial fishing industry in Manitoba can not be underestimated, the economic success of the commercial fishing industry hinged on the United States market for freshwater fish. For example, in 1884 fish production was being exported to the United States in greater quantities than was sold locally and by 1887 over 60% of the annual production of 2 million pounds was being exported to the

United States. To the extent that the US markets for freshwater fish were expanding, this gradually lead to American fishing company representatives and their firms gaining control of the industry. But, as Judson (1961) notes, it was primarily due to the increased flow of American funds into Manitoba that enabled rapid development of the Lake Winnipeg fishery and expansion of the fishing industry in general.

During this period of development in the Manitoba commercial fishing industry, most fish production exported to the United States was shipped frozen. However, as markets for frozen fish declined, Manitoba initiated sales of fresh fish to the United States. In this regard, Table 1, provides a perspective of the type and quantities of whitefish (Coregonus clupeaformis), pickerel (Stizostedion vitreum vitreum), pike (Esox lucius), and tullibee (Coregonus artedii) exported to major US markets in 1888.

While the US markets played an important role in the establishment of a commercial fishing industry in Manitoba, they were however subject to extreme fluctuations in price. In attempts to counteract these market forces and maintain profit margins, collusion between large fish buyers was common and as a result kept competition to a minimum. As market conditions for fish improved in the early 1900's, rising prices for fish stimulated additional commercial fishing activity which in turn lead to increased export sales of fish from Manitoba. With the introduction of gas powered boats

TABLE 1

United States destination of Manitoba and Northwest Territories fish exports in 1888 by type

Destination	Fresh (lbs)	Preserved (lbs)	Total (lbs)
Detroit	264,667	363,037	627,704
Buffalo	408,023		408,023
Chicago	328,425	118,078	446,503
St. Paul	168,643	76,950	245,593
Minneapolis	59,194	94,800	153,994
Omaha	59,108		59,108
Kansas City	24,000		24,000
Total	1,312,060	652,865	1,964,925

Source: Letter from the United States Consul as quoted in Canada, Sessional Papers, VII, 1889, p. 222 (From Juson, T.A. 1961)

and new railway construction linking the northern regions of the province, commercial fishing activity expanded further.

During the 1930's, the effects of the stock market crash saw the fishing industry in Manitoba contract. In addition, the transfer of natural resources from the federal government to the provincial government in 1930 (The Natural Resources Transfer Act) placed additional emphasis on industry to operate more efficiently and decrease costs under provincial jurisdiction. These developments and the requirement that fish exported to the US meet the newly established US fish inspection regulations, created additional

pressures and precipitated a decline in American fish purchases from the Lake Winnipeg fishery (Judson 1961).

In 1939, deteriorating market conditions and surplus production resulted in the Government of Manitoba introducing regulations to limit fishing licences and the number of gas powered boats on Lake Winnipeg. While these regulations were intended to control the flow of production and stabilize prices, the results were minimal. That is, fish buyers banded together and by reorganizing and restructuring their operations were able to retain their bargaining positions in the trade.

The onset of World War II induced cyclical fluctuations in the stability of the Manitoba commercial fishing industry. In this regard, the war time impacts on the industry are described by Judson (1961) who comments that:

> although the prosperity of the wartime cycle was longer and more than usually profitable, in other respects its characteristics were those of a typical cycle. Prices and buying costs rose, effort expanded into more remote areas, product quality deteriorated and fish companys made large profits. Also the number of fishermen became too large to yield good returns to the average licensee, their expectations became less favourable and numbers declined somewhat, but dealers continued to make good profits. Then prices and buying costs fell, more contraction in effort resulted and low prices further reduced returns per fisherman. Despite good expectations and profits throughout most of the period, expansion in investment on the upswing of the cycle was limited largely to short-term capital and minimal plant improvement. Such features as those found in this protection cycle were normally evident in the many fluctuations that harassed the industry.

The years following World War II were characterized by a period of increasing controls governing the harvest and processing of fishery resources in Manitoba. Since the new regulations often required fish dealers to upgrade their fish processing establishments, a higher investment by fish dealers resulted than would normally have occurred. Faced with these additional expenses, collusive oligopsony characterized the market structure in the 1950's and early 1960's. These practices allowed dealers to buy fish at low prices from fishermen without fear of new competition. In addition, the prestige of holding a summer licence and the low mobility of most fishermen provided for an adequate supply of operators at low cost to dealers (Judson 1961). Although fishermen attempted to improve their position by organizing and establishing fishing co-operatives, in most cases these attempts were only of limited success. Judson (1961) points out that due to the welfare aspects present in this scheme (co-operatives) United States buyers often shied away from dealing with marketing agencies of this sort.

1.1.2 Regulation

Given the rapid expansion of the commercial fishing industry in Manitoba, concern for fish resources was expressed early. In this regard, the establishment of commercial fishing enterprises in Manitoba had pronounced effects on native fisheries. With greater demands placed on the native subsistence fisheries to supply themselves and the fur traders

with fish, cries of depletion arose as commercial fishing enterprises expanded to supply the growing demand of export markets. The ensuing conflict between the two rival groups eventually forced both the natives and fur traders to make inroads into the more remote fishing regions (Judson 1961). Ultimately, the concern over depleted resources culminated with Samuel Wilmot, the Federal Superintendent of Fish Culture, being appointed to investigate the whitefish fishery. Based on his conclusions that gradual depletion of whitefish stocks were occurring in the heavily fished bays of Lake Winnipeg, additional regulations were imposed to assure continuance of the industry.

Although Lord Selkirk issued the first regulations concerning commercial fishing, it was apparent that as fishing activity expanded, indepth regulation of the industry would be required (Judson 1961). In 1874 the Dominion Parliament extended fisheries regulations to cover the province of Manitoba. According to Judson (1961), "...the regulations of September 15, 1877 set net size and contained the usual stipulations about barring channels, using dynamite, dumping refuse and building dams. In addition, in 1881 a very short "close season" (October 20-November 1) was established for whitefish, with the exception that Indians might take fish for their own use but not for sale". In this regard, it is interesting to note that whitefish stocks were the first species to be regulated by harvest quotas. Given

the requirement to enforce these regulations, in 1884, the first commercial fishing inspector was appointed and a commercial fishing licencing policy was established.

The growth and expansion of the commercial fishing industry in Manitoba was not achieved without the benefits of technological advances. The introduction of nylon nets, gasoline powered boats and net lifters had profound influences on the fishery and lead to substantial increases in the amount of fish harvested. These changes resulted in additional restrictions being placed on the utilization of fishery resources. Today, regulations are concerned with resource allocations; control of entry in specified fishing areas; gear restrictions (mesh size); licencing of fishermen and controling illegal fishing. In this regard, the authority and jurisdiction to regulate fishery resources is achieved from both federal and provincial legislation.

The Fisheries Act R.S.C. 1970 c. F-14, is the federal statute that specifies the control and management of inland and coastal fisheries. Under the Fisheries Act, the Manitoba Fishery Regulations (C.R.C., 1978 c.843) have been enacted to provide the controls and methods for the management and administration of Manitoba's fishery resources. These regulations control such matters as the timing, length and scope of fishing seasons; type of fish harvesting gear that may be used; catch quotas; protection of fish habitat and prohibitions concerning illegal fishing. The responsi-

bility for the administration of these regulations rests with the Minister of Natural Resources who is authorized to 1) set seasons, methods of capture, quotas or harvest limits and 2) establish licencing criteria. Amendments to the Regulations requires enactments by the Federal Government through an Order-in-Council. In practice however, Manitoba suggests Amendments to the Regulations and they are enacted by the Federal Government.

While the common-property aspect of commercial fishery resources in Manitoba has provided the rationale for government to entervene and regulate resource exploitation, the results unfortunately have been less than satisfactory. Despite the proliferation of regulations, many problems still remain. While this situation partly reflects the dynamic nature of the industry, it is also apparent that for various reasons, critical management recommendations to deal with the underlying cause of many of the problems have not been implemented. As a consequence, excess labour and capital, unstable income and employment prospects and overfishing are constant threats that have paralyzed the fishing industry today.

1.2 ORGANIZATION OF THE MANITOBA COMMERCIAL FISHING INDUSTRY

The Manitoba commercial fishing industry may be described as being organized into three levels (Figure 1): 1) the primary level, which represents fish harvesting; 2) the secondary level, which involves the transportation and processing of the catch and 3) the tertiary level, which corresponds to the marketing of the processed product. In the sections that follow, section 1.2.1 provides a historical and contemporary review of the primary level of the industry. To the extent that the secondary and tertiary levels of the industry are vertically integrated, Section 1.2.2 provides a discussion of the secondary and tertiary levels of the industry.

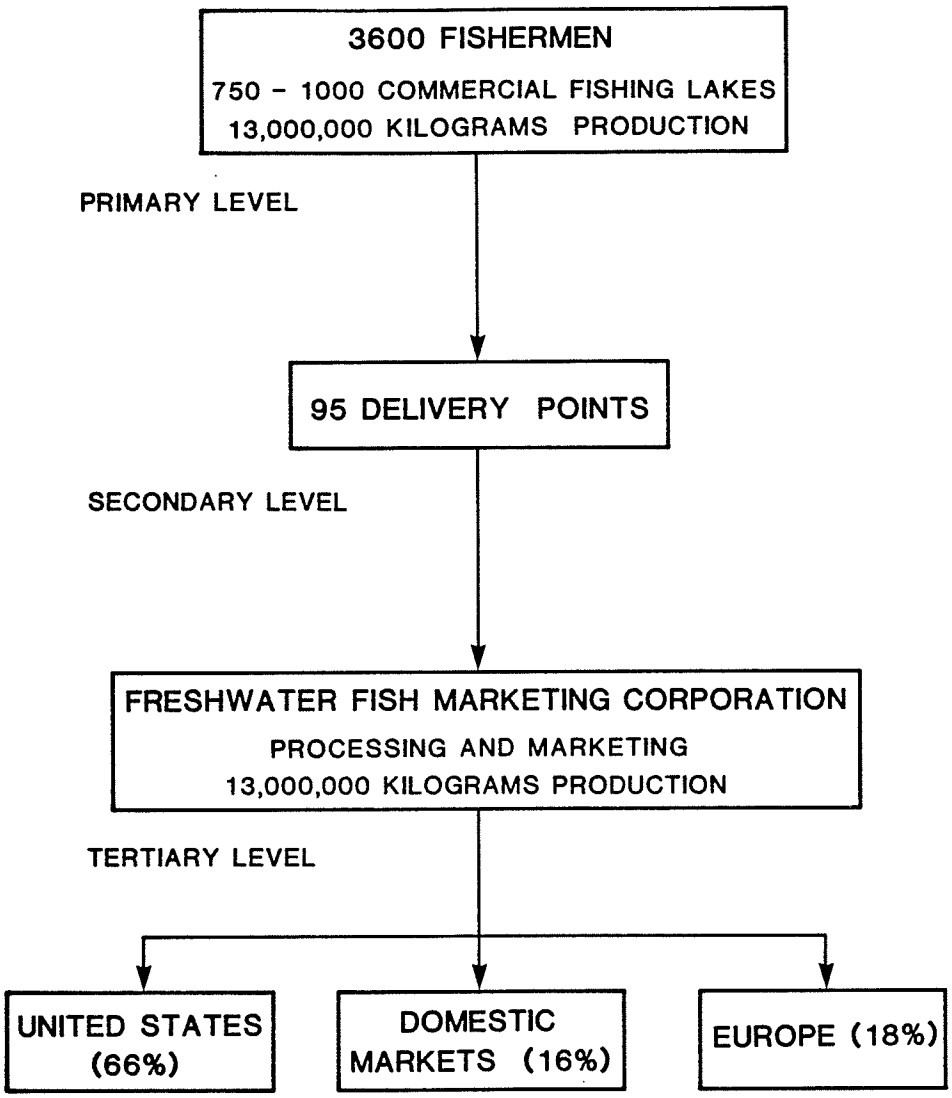

Fig. 1. Primary, Secondary and Tertiary Levels of Organization in the Manitoba Commercial Fishing Industry (1980).

1.2.1 Primary Level of the Industry

At the primary or fish harvesting level of the industry, government involvement has traditionally been concerned with the biology of the fisheries resource, the licencing of fishermen and enforcement of fisheries regulations. Given the complex array of social and economic difficulties that confront the primary level of the fishing industry today, government has recently intervened to regulate conditions of the fishermen as well. In this regard, government assistance programs in the form of equipment subsidies, transportation subsidies and other forms of monetary aid (Appendix A) have contributed, if not prolonged the economic and social problems confronting many commercial fishermen.

Open-access policies governing Manitoba's common-property fishing resources have contributed to most of the current problems. Under these conditions, an individual or group of individuals cannot legally exclude others from its exploitation and the resource attracts more labour and capital than is necessary to efficiently harvest the resource. The fact that by 1947 more than 7,200 commercial fishermen were participating in the commercial fisheries of Manitoba is ample evidence of the impact of open access fishing policies. While overfishing and reduced profits were prevalent, this situation was further aggravated due to the fact that most fishermen were employed only part-time in the fishery and relied on part-time jobs and government assistance to supplement their incomes. Consequently, few economic ben-

efits from fishing were realized by most fishermen and the industry was in a constant state of turmoil (Judson 1961).

Of several major studies undertaken of the fishing industry in Manitoba, the Report of the Commission on Targets for Economic Development (1969) observed that "...returns to fishermen have frequently averaged less than $1000 annually and have seldom surpassed $1500 (and) it is estimated that 10% of the fishermen harvest 40% of the catch and thus earn $5000-6000 annually. This being the case, the average income of the rest of the fishermen falls well below $1000".

Given the economic and social problems caused by low fishing incomes, studies were initiated to investigate the fishing industry and make recommendations to improve conditions to fishermen. To the extent that manpower and capital employed in the fishery greatly exceeded the value of the marketed production it was apparent that there was a need to balance the productive potential of the fishing fleet with the productive potential of fishery resources. Beckford (1966) recommended that in order for benefits to accrue to commercial fishermen, the number of fishermen engaged in the fishery would have to be radically reduced from 4500 full and part time fishermen to about 1400 better equipped fishermen. To the extent that the number of fishermen was declining, in 1969 the TED Commission noted that "...the Fisheries Branch is presently carrying out a programme of

attrition of fishing licences in an attempt to reduce the number of licences to 1,500". In this context, the Federal Minister of Fisheries and Forestry (1971) responding to similar problems being experienced in coastal fisheries stated (Dube' 1972) that:

> We have too many fishermen and too much gear chasing too few salmon...in order to trim our fishing effort back we will have to get rid of the moonlighters. Only those commercial fishermen who earn their livelihood principally by fishing will be retained in the salmon fishery. Those who have full-time jobs in other industries are now being given twelve months' notice. Only "bona fide" fishermen will be allowed to take Atlantic salmon commercially from 1972 onwards.

While this declaration pertains to the Atlantic salmon commercial fisheries, nevertheless it has relevance in view of the extensive manpower and capital employed in Manitoba's three major commercial fishing lakes. This principle has been acknowledged and it appears that some progress is being made towards this objective given that in 1980/81, there were 3,659 fishermen and in 1981/2, 3767 commercial fishermen engaged in fishing throughout Manitoba (Department of Natural Resources Annual Reports 1980-82).

The intent to achieve more rational use of manpower and better use of fishery resources, was noted by the Government of Manitoba, (Federal-Provincial Conference on Fisheries Development 1964) which expressed the need for government to:

> improve and revise its regulatory policy, embark upon an exchange program of research designed to increase productivity and develop new technology, disseminate technical information among fishermen

> and provide the educational background necessary to diverting fishermen to alternative employment. Secondly, the marketing system must be improved probably by government intervention and the energies and capital wasted in duplication of services conserved for more useful pursuits. In a word, the organization of the assembling, packing, exporting and sales of fish must be rationalized. Finally the fishermen must be educated in the technology and the management of their industry, assisted in improving their productivity and in some cases, encouraged to seek alternative employment.

After completing a series of hearings and investigations into the fishing industry, the McIvor Commission (1965) expressed similar concerns that supported the earlier findings. Citing the problems of income maintenance to fishermen, the duplication of services to fishermen, poor fish processing methods, the lack of product inspection, market uncertainties and financing difficulties as the basis of the problems facing the fishery, the Report of the Commission of Inquiry (1965) recommended a complete reorganization of the industry. The fundamental objective of this reorganization being the establishment of a central marketing agency for fish, that would function similar to the operation of the Canadian Wheat Board.

1.2.2 Secondary and Tertiary Level of the Industry

The report of the Commission of Inquiry into Freshwater Fish Marketing (1965) acknowledged that numerous problems confronted the Manitoba commercial fishing industry. Of several major recommendations made to improve the industry, per-

haps the most significant concerned the establishment of a single government owned fish marketing agency for the prairie provinces. While the common-property aspect of commercial fishery resources has provided the traditional rationale for government intervention, the intrusion of government into the marketing sector was a new development. Although vigorously opposed by the fish companies who were forced to withdraw from the industry, in 1969, agreements signed between the Government of Canada and the provinces of Manitoba, Saskatchewan, Alberta, the North West Territories, and Northwestern Ontario established the Freshwater Fish Marketing Corporation (FFMC) as the sole marketing agency for freshwater fish in the region (Figure 2).

Given current legislation, the Freshwater Fish Marketing Act (1969) and the complementary Manitoba Fisheries Act (1970), authorize the Freshwater Fish Marketing Corporation to act as the sole purchasing and marketing agent for freshwater fish in Manitoba. Consequently, the marketing structure of the fishing industry in Manitoba, is that of a monopsony. That is, there is a single buyer of fish. As a consequence other than direct sales to the final consumer, fishermen market their production through the Freshwater Fish Marketing Corporation. According to the Freshwater Fish Marketing Corporation Act, (1969) the FFMC, a Crown Corporation has:

> the exclusive right to market and trade in fish in interprovincial and export trade and shall exercise the right either by itself or by its agents with the object of

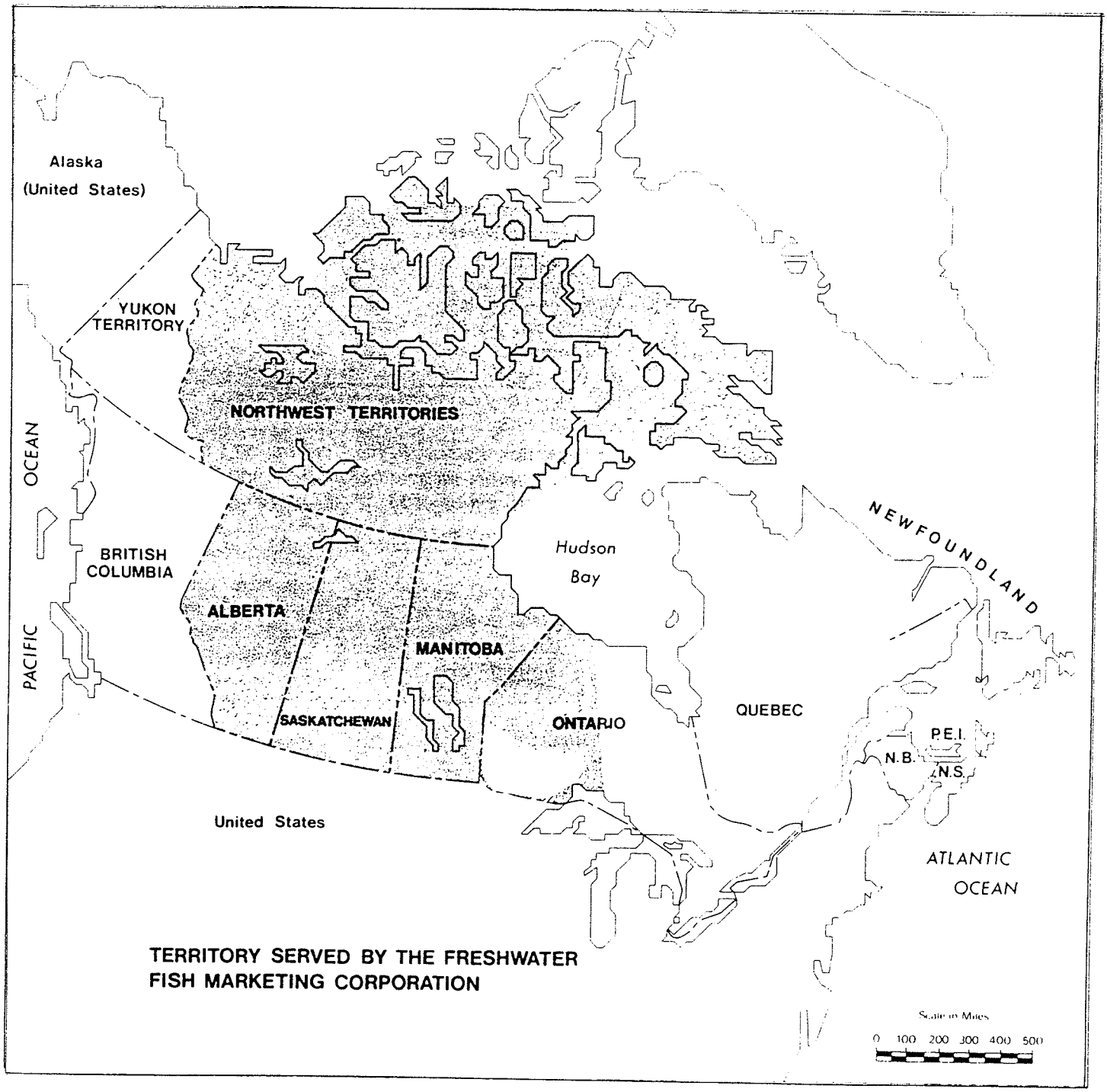

Figure 2: Jurisdiction of the Freshwater Fish Marketing Corporation in 1980

(a) marketing fish in an orderly manner;
(b) increasing returns to fishermen; and
(c) promoting international markets for, and increasing interprovincial and export trade in fish.

However, under the provisions of the Fisheries Act (1970), commercial fishermen are entitled to sell their fish directly to private consumers.

A major outcome of the numerous studies commissioned to investigate the fishing industry in Manitoba, was recognition of the financial difficulties facing commercial fishermen. The McIvor Commission (1965), recommended that as part of the reorganization of the industry, a credit fund was necessary to provide fishermen with a source of long-term low interest credit for major capital fishing expenditures such as boats and motors. Based on this recommendation, in 1970 the provincial government established a credit fund which was to be administered by the Manitoba Agricultural Credit Corporation. In addition, to improve the economic status of fishermen in the reorganized marketing system, provisions were made to provide fishermen throughout the province with a uniform fish pricing policy. In this regard, fishermen are offered the same price FOB Winnipeg for fish of the same species size and grade. However, fishermen do bear the costs of delivering their catch to the central FFMC processing plant in Winnipeg. Those fishermen transporting fish from remote northern locations have their transportation costs subsidized under the provincial freight assistance program.

The new market system also reformed the pricing policy for fish and the schedule of payments made to fishermen. Simply stated, the policy is based on the market price for fish, from which the FFMC establishes an initial price or "floor price" several months prior to the beginning of a fishing season. As a result, at the start of each season, fishermen are guaranteed at least that initial price for those species of fish being purchased. While the national and international market prices for freshwater fish may fluctuate during the season, fishermen receive a second or final payment at the end of the fiscal year if market projections of prices have increased and profits have been realized. To the extent that government has made a significant financial investment in the reorganization of the industry at the marketing level, fishermen have been the intended beneficiaries of the change. However, the financial returns from this investment remain to be seen.

The tertiary level of the Manitoba commercial fishing industry corresponds to established markets for Manitoba's commercial fishery resources. In this regard, markets commensurate with the productive potential of the resource have not been developed. That is, despite the mandate of the FFMC to expand markets the traditional US markets have not materially been expanded, while efforts to establish markets overseas have generally proven to be unsuccessful. Given this situation, of the 17 species of fish commercially

harvested in Manitoba, only 4 species are considered to be of major economic importance to the commercial fishing industry. Although in 1980/81 whitefish (Coregonus clupeaformis) was the most abundantly harvested species, the order in value to fishermen was pickerel (Stizostedion vitreum vitreum); whitefish; sauger (Stizostedion canadensis); and pike (Esox lucius). During the 1980/81 fishing season, the combined harvests of these fish totalled 11,682,633 kilograms, with initial payments to fishermen amounting to $12,994,300.00.

While the harvest of quota fish is considered to be at a level of maximum sustained yield, markets for non-quota fish species (NQFS) such as carp (Cyprinus carpio); sucker (Catostomus and Moxostomus spp.); burbot (Lota lota); and freshwater drum (Aplodinotus grunniens) are small relative to stock abundance. In 1980/81, the combined purchases of non-quota fish species by the Freshwater Fish Marketing Corporation totaled 4,491,294 kilograms, with fishermen receiving initial payments of $745,550. (Department of Natural Resources Annual Report 1980-1981).

1.3 PROBLEM STATEMENT

Fisheries resources have been described as common property resources. Fish belong to no single individual until caught. There is, therefore no incentive for one fisherman to conserve fish stocks because any fish left by one fisher-

man may be captured by another. The resultant competition among fishermen for a share of the harvest has contributed to the decline of fish stocks, excessive investments in fishing effort and dissipated returns to labour, capital and the resource. As a result, concern has been expressed regarding stated management objectives intended to ...maximize economic returns to the citizens of Manitoba.[1]

The "tragedy of the commons", as the concept applies to fisheries resources, has been compounded by conflicting management objectives. Fisheries management objectives have variously been described as:

(1) Protecting fish stocks.

(2) Maximizing employment

(3) Increasing incomes to fishermen

(4) Promoting regional growth and development

These objectives appear to be totally unexceptional and are desirable aspirations at first sight. However, when applied to the management of fisheries resources, conflicts become apparent, if for example the implications of maximizing fishermens' incomes and protecting fish stocks in a fishery which is being exploited to its maximum productive potential are considered. Increased employment might be achieved by increases of production and/or dividing the an-

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[1] (Department of Natural Resources Annual Report 1981-82)

nual allowable harvest between more fishermen. However, to the extent that the fisheries resource is being utilized to its maximum potential, this objective is in conflict with the objectives of protecting fish stocks and increasing incomes to fishermen.

Maximizing fishermens' incomes might be achieved by increasing production, by increasing prices to fishermen and/or by reducing the number of fishermen. To the extent that fisheries production will not clear the market at increased prices, this objective is in conflict with increasing fishermens' incomes and protecting fish stocks.

While the fish stocks in Manitoba are currently being harvested within allowable limits, in general, the economic performance of the commercial fishing industry is not satisfactory. Excess investments in fishing effort is considered to exist. As a result, returns to labor, capital and the resource have been largely dissipated. In addition, fisheries managers have expressed concern that excessive harvesting will reduce the sustainable yield. This concern is reinforced by the decline of such formerly productive fisheries as Lake Winnipegosis and Lake Manitoba. Conflicting objectives related to maximizing employment and protecting fish stocks are considered to have contributed to the current performance of the industry. Failure to resolve these conflicts will perpetuate the current poor performance of the industry.

1.4 RESEARCH OBJECTIVES

From an economic perspective, the primary objective of fisheries management should be to generate the greatest possible output (value) of fisheries production with the least possible inputs (costs). This primary objective might have to be compromised by secondary objectives related to employment and community stability. However, it is only by analyzing objectives on purely economic grounds in the first instance that it is possible to assess the costs of serving other objectives (Pearse 1971).

The purpose of this study is to measure the costs of serving the objective of maximizing employment against the objective of increasing incomes to fishermen and generating the greatest possible net value of production. This purpose will be served by focussing on the following research objectives.

> To provide an empirical assessment of the performance of a selected group of Lake Winnipeg and Lake Winnipegosis fishermen, constrained by management objectives. Break-even analysis of cash flows, for different levels of production and a range of prices, will provide the model for assessment.

> To provide an economic perspective of the costs of serving alternative objectives and the extent to which they are conflicting will be shown through an empirical assessment of the performance of a selected group of Lake Winnipeg and Lake Winnipegosis fishermen.

1.5 RESEARCH METHODS

To achieve the stated purpose of the study, the research methods included: 1) A literature review of commercial fisheries management principles as they relate to fisheries resources management. 2) A comprehensive retrospective search of journals, annual reports and technical studies. 3) Collection and collation of empirical data related to production, revenue, and production costs obtained from the analysis of questionnaire data supplied by the Economic Research Unit of the Freshwater Institute. 4) Development of a cash flow model to evaluate the viability of fishing enterprises under alternative fisheries management objectives.

1.6 PRACTICUM OUTLINE

This practicum is presented in 4 chapters including the present one which provides the history of development and rationale for the present investigation. Chapter 2 provides a review of selected concepts in fisheries literature that relate to the present study. Chapter 3 presents a full description of the study findings. Major topics included in this chapter are a description of the fisheries under study, the model used for empirical assessment of conflicting management objectives and a discussion of the implications of multiple management objectives. Finally in Chapter 4, an overview, summary, conclusions and recommendations for future policy decisions are discussed.

Chapter II

THEORETICAL ANALYSIS AND LITERATURE REVIEW

In the preceding chapter, the problem under study was defined. The purpose of this chapter is to relate the problem to the literature for comparative purposes and formulate conclusions.

2.1 INTRODUCTION

Economists in the field of fisheries resource management are concerned with the misallocation of resources that result when "too many fishermen chase too few fish". In this regard, a need to rationalize fish harvesting operations has been expressed for over a quarter of a century. The central theme of this need has been to balance the productive potential of the fishing fleet with the productive potential of fisheries resources by restricting entry and charging a price for the opportunity to fish.

In reviewing the literature, I would like to provide an economic perspective of the "tragedy of the commons" as the concept applies to the management of the fisheries resources. Second, a review is presented of the traditional biological rationale used for the management of fisheries resources, and the more recent economic rationale for the

management of fisheries resources. Third, the requirement to exercise control over fishing effort to protect fish stocks from depletion and the fishing industry from dissipated profits is presented. Fourth, optimism is expressed that economic rationalization of the industry could resolve many of the conflicts in fisheries management programs.

2.2 THE FISHERY: A TRAGEDY OF THE COMMONS

Biologists have observed that the success of a given species is related to its ability to adapt to changes in the environment. The territorial behaviour expressed by many species in the animal kingdom appears to be of adaptive significance in their success. Territoriality basically fulfills two functions. First, it ensures that adequate resources are available for reproductive capacity. Second, it prevents the resource from becoming depleted. Borgstrom (1973) indicated that primitive harvesting and gathering cultures spaced themselves according to the availability of resources, which in effect established territory or property rights. These observations do not appear to hold true today where the exploitation of common-property resources are concerned.

A common-property resource may be defined as a resource for which no single user has private rights to use or to prevent others from using. This situation will arise when the costs of enforcing such rights are greater than the

value that such ownership might bring. As a result, individual resource users are generally in competition with other users of the resource to get the largest share of the harvest. Therefore it is irrational for one individual to restrict levels of harvest because any benefits which might result will be captured by others.

Fisheries resources represent a prime example of a common-property resource. Uncontrolled access to harvest fisheries resources coupled with the rule of capture, forces fishermen to compete for the available harvest. As a result of this competition, there is little incentive to restrict fishing effort in the interest of maintaining fish stocks because any fish that one individual doesn't harvest may be harvested by another (Cauvin 1979).

If as Pigou (1952) believes "it is the clear duty of Government, which is the trustee for unborn generations as well as for its present citizens, to watch over and if need be, by legislative enhancement, to defend, the exhaustable natural resources of the country from rash and reckless spoilation...", then it follows that a governments' responsibility is to control fishing effort. However, as a general observation, the problem of "too many fishermen chasing too few fish" has been compounded by the failure or inability of government to exercise control over the harvest of fishery resources. The net result of this phenomenon has been the decline of fish stocks and an increase in the labour and capital engaged in harvesting fisheries resources.

In addressing the problems associated with the management of common-property fisheries resource, Gordon (1954) remarked that "wealth that is free to all is valued by none (and)...that everbody's property is nobody's property". Gordon (1954) explains that "common-property natural resources are free goods of the individual and scarce goods for society". Gordon (1953) also draws a comparison between the agricultural and the commercial fishery resources sectors. He noted that while both sectors are renewable resources, the incomes of people engaged in fishing are generally much lower. Gordon attributed this condition to the fact that the individual farmer possesses legally sanctioned control over the land he farms, while the fishermen has none. One farmer can't cut the other farmers grain a day or so before he intends to do so...the farmers fields are given the status of private property, unlike a fishery where fishermen have no control over when another fisherman will set his nets for the same fish (Gordon 1953). This has given rise to the type of competition where each fisherman exploits the resource with no incentive to conserve, with little concern over his effect on the resource and with negligible concern for his effects on other fishermen.

The competition to exploit common-property resources has important implications with respect to the amount of labour and capital engaged in harvesting fish. Uncontrolled access leads to an over expansion of the fishing capacity,

involving a larger fishing fleet and more lake-side handling facilities than are required to catch and handle the available harvest. This process of excessive investments has resulted in the decline of fish stocks in many of the worlds fisheries due to overfishing. Of equal concern, the process has resulted in the economic decline of the fishing industry as costs of fisheries production rise to equal the value of production and profits are dissipated. Further, if government subsidies are considered in the accounts, it is possible that the net value of fisheries production for many fisheries could be negative. These observations are substantiated by Pearse (1971) who noted that "in any fishery capable of sustaining an economic yield, competitive free access to the resource will in the long run, erode any return in excess of the costs of production. As long as the gross returns from the resource accrue to fishermen, any net gain will manifest itself in the form of above-normal profits and shares, which will attract new entry into the fishery. Entry will continue increasing the capacity of the fleet and raising the aggregate cost of fishing correspondingly with all net gains eliminated.... These perverse tendencies....arise from the common-property nature of the resource base".

The pervasive tendency for excessive fishing effort to erode profits and overexploit fish stocks, has been described as the "tragedy of the fishery" (Cauvin 1979). Har-

din (1968) comments that "ruin is the destination toward which all men rush. Each pursues his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all". As a result, common-property resources have been consistently abandoned in favour of other forms of ownership that respect their value. Ironically the common-property characteristics of the fishery remain intact. Bishop (1973) expands on the problem by noting "...fisheries are often described as common-property resources, meaning that a number of fishermen in each fishery share in the exploitation of a common fish stock. This system of ownership means that the production functions of individual firms may be interrelated in such a way as to create technological external diseconomies and operates under laissez faire, it will utilize more inputs than Pareto efficiency would dictate to be optimal. In other words, the common-property aspect of fish resources implies an interindustry misallocation of resources".

A feature of considerable concern in the tragedy of the fishery has been the overcapitalization of the commercial fishing fleet and industry. In Manitoba the basis for the overcapitalization of the fishing industry appears to be a result of "too many fishermen chasing too few fish." In a review of overcapitalization in the commercial fishing industry, Clark (1977) comments that overcapitalization constitutes a serious loss to society. For subsistence fisher-

men, overcapitalization becomes an economic and social trap where, disinvestment of fishery capital is usually far more difficult to achieve than was the original investment. The effects of overcapitalization have contributed to the decline of commercial fisheries as a result of overfishing.

Probably the most important factor leading to overcapitalization of commercial fisheries is that the initial exploitation of the fishery is highly profitable. The overcapitalization that follows may occur in several ways. The most obvious occurs with a significant increase in the number of boats in the fishing fleet. A more subtle form of overcapitalization takes place when the fishing power of an existing fleet is increased. For example, the addition of larger engines, increased storage capacity, the replacement of smaller vessels and the addition of electronic equipment contribute to increased fishing effort. This phenomena has been referred to as "capital stuffing". Often, this form of overcapitalization exceeds the original fishing pressure of a fleet even though the number of boats in the fleet have been effectively reduced earlier.

In many cases overcapitalization has caused serious depletion of fish stocks. Apparently the productive Peruvian anchovy fisheries became severely depleted after overcapitalization had occurred. There is also evidence that it is occuring in the herring fishery of British Columbia.[2]

[2] Personal Communication, D. Cauvin, December 8, 1980.

Considering that most fisheries are subject to harvests that exceed set quotas, fish stocks may become even more rapidly depleted in an overcapitalized fishery. A review of the overcapitalization process by Clark (1977) indicated that increased capitalization and indebtedness of the industry is likely to occur, when prices for fish are high or are on the increase. Conversely, when prices decline the marginal operators of boats and fishing capital are forced to drop out as a result of the inability to repay borrowed money. However government subsidization, under the guise of fisheries management may prevent this from happening entirely.

The tragedy of the commons as it applies to the fisheries resource is dramatized by the inability of government to exercise proprietary rights and restrict fishing effort. It is also apparent by the failure to charge a price for the right to fish. Cauvin (1980) noted that the many services provided by government are not public goods in the sense that they are "fully and equally consumed by all members of the relevant group. In reality, many goods and services are of a private good nature which governments choose to distribute free or at less than cost". While the discussion relates primarily to recreational fisheries, nevertheless it has relevance, in view of the considerable costs incurred and paid for by the public in the form of subsidies and management services that are provided, to the Manitoba commercial fishing industry. In addition, Cauvin (1979)

stresses, that it is important to note that the Canadian taxpayer incurs the tremendous costs of fisheries management, the benefits of which accrue to certain segments of society. Therefore the notion that goods and services are provided "free" or at less than cost consequently hastens the dissipation of fishery resources as continual pressure is placed on fisheries managers to expand the supply of "free" resources to satisfy the requests of beneficiaries. As acknowledged by Professor Cauvin (1979), without a system that places a value on services to the commercial fishermen, how can responsible decisions that respect society's ownership and value of the fishery resource be determined? Clearly, this is a tragedy of the fishery.

2.3 BIOLOGICAL AND ECONOMIC RATIONALE IN FISHERIES MANAGEMENT

2.3.1 Biological Rationale

In general, fisheries resources are perceived to be valuable natural assets that provide enormous benefits to the Canadian economy. However, according to Gordon (1953) "the form of competition which exists in fisheries for open resources not only dissipates any net yield that might have been obtained, but goes further and reduces the straight labour income of fishermen below that of other occupations. The immobility of fishermen, their attachment to their local communities and to their occupations, prevents an equilibrium of labour income from being established with that of oth-

er industries, and the result is that even in fisheries where the resource is rich, the fishermen are poor".

Until very recently the prime consideration of the commercial fishing industry has been to harvest the resource to the maximum sustainable yield (MSY). That is, to limit the catch from any one stock each year so that a good yield of fish is ensured the following season. Specifically, MSY refers to the largest annual catch (either in terms of weight or numbers of fish caught) of fish that can be sustained without harming the reproductive ability of the stock (Roedel 1975). MSY is based primarily on the natural mortality of the fish, fishing mortality, recruitment and growth estimates of fish populations. Larkin (1979) reviewed the contributions of various researchers to the concept of MSY commenting that the ten years following World War II were the golden age for the concept of maximum sustained yield. However MSY appears to have several limitations and perhaps is no longer justifiable as the basis for fisheries management. To quote Christie (1978) "...there are few freshwater fish stocks from which a maximum sustainable yield can be unequivocally specified. Generally speaking, the extreme reproductive variability and stock heterogeneity of these fish make them unsuitable candidates for the application of yield estimation models like those of Schaefer (1954)". In addition, obtaining accurate estimates of MSY is complicated since 1) The fish cannot be seen and

counted but only estimated; 2) Some species lay a great many eggs, some only a few; 3) Some species are migratory; 4) The interrelation of the species to the whole eco-system in which it lives, feeds and is fed on is a complicated and largely unstudied situation; 5) Unexplainable fluctuations in populations; 6) The change in species composition that may result with over fishing (Larkin 1979). Although, some models such as Ryder's (1965) morphoedaphic index (MEI) and methods which estimate the non-quota fish potential of lakes (Fernet 1975) appear to be adequate to estimate sustained yield, they nevertheless fail to ensure a sustained species balance in the harvest.

Invariably, biologists have advocated a general policy of fishing at levels below MSY to avoid the risk of overfishing. MSY is therefore acceptable as a preliminary guide for the management of a commercial fishery but once the level of MSY is attained it should be expected that the level will probably not be sustained (and)...there is little prospect of achieving MSY either for one species or for any number of species in the aggregate and from a biological stance, MSY is insufficient to be the sole basis for a management strategy of a commercial fishery (Larkin 1979). This is emphasized by Murphy (in Gulland 1977) who states that "...the problem of avoiding overfishing by the classical approaches of maximizing the yield per recruit and maximizing the numbers of surplus recruits may be insuffi-

cient". Accordingly, establishing population and potential harvest estimates require evaluating life history parameters, attention to competition interactions as well as monitoring possible alterations of the gene pool of fish stocks subject to commercial exploitation.

Government agencies have responded to the ecological limitations of MSY by adopting the concept of optimum sustainable yield (OSY), which emphasizes biological, economic and environmental criteria in fisheries management. Roedel (1975) defined the concept of OSY to mean "a deliberate melding of biological, economic, social, and political values designed to produce the maximum benefit to society from stocks that are sought for human use, taking into account the effect of harvesting on dependent or associated species". While this concept has recognized the broader concerns of fisheries management and optimum resource use, nevertheless OSY has shown to be only slightly more useful than the MSY concept. Consequently, a general consensus of fisheries managers appears to be that OSY is an eclectic ideology, being all things to all people. "A recipe for achieving heaven or hell, and what is achieved will depend on how the definition is variously interpreted" (Larkin 1979).

In recent years, the term fisheries management has been increasingly used to express more than simply conservation of resources such as fish. For example Pearse (1971) noted that "...if the term conservation were used broadly

enough to encompass a concern for avoiding wasteful use of labour and capital, as well as of natural resources, it would dictate precisely the regime advocated by economists". Therefore economic theory may have considerable application to resource management problems. In this regard, Gulland and Robertson (1973) note that "...the objectives of fishery management are essentially economic, and the effects of management action have repercussions on important economic magnitudes such as employment, income and the welfare of the fishing communities generally". In fact, economists have shown that by applying the laws of economics, the rate of fish harvesting could be controlled long before a fishery becomes impoverished. In this context, Mackenzie (1973) notes that a fundamental need in fisheries research is the development of models that take in to account both the biology and the economics of the fishery in an effort to optimize use of the resource for the benefit of the fishing industry, the consumer and the resource itself. However, according to Clark (1977) the theoretical framework of fishery economics is inadequately developed and based on models unsuitable for most economic management concerns of the fishery. Nevertheless, economic principles have introduced a new dimension to fisheries management providing an additional parameter for more objective fisheries management decisions.

2.3.2 Economic Rationale

Economists working in fisheries management, have argued that traditional measures to protect fish stocks, including closed areas, closed seasons, aggregate and not-transferable quotas, and gear restrictions have constrained the economic performance of the commercial fishing industry. In this sense, they have hypothesizes that a necessary condition for an economically healthy fishing industry, one which can compete on international markets in the absence of subsidy programs, is to control fishing effort at a level which wil permit "adequate" returns to all factors of production - labor, capital and the resource.

While many fisheries in Canada are regulated by some form of entry control, there is a concern that controls have been implemented only after excess fishing effort existed. As a result, the gross value of fisheries resources has been distributed over so many fishing enterprises that all factors of production are not receiving "adequate" returns. While this situations may serve the objective of maximizing employment it has not served the objective of increasing incomes to fishermen. Further, it has not served the primary economic objective of providing adequate returns to all factors of production.

Gordon (1953) advanced the proposition that the object of fisheries management policy should be to achieve an

intensity of exploitation based on an economic optimum degree of fishing. Stated simply, this requires balancing the size of the fishing fleet with the productive potential of the resource. This proposition is supported by Bell (1977) who states "...the purpose of management should be to promote the highest efficiency in the use of vessels and fishermen as is our purpose in every other sector of our economy". Despite the fact that this concept has been discussed for over thirty years, the economic status of many commercial fisheries seems indicative of mismanagement. That is, we find an industry that is characterized by production costs that are excessive relative to the value of production. Further, the potential economic value of the resource to society, a "resource rent" is essentially foregone.

The reasons for rejecting an economic perspective of resource management appear to center on the presumption that an economic optimum is not equal to a social optimum. As such, it may be preferable to have an economically inefficient fishery if the effects of organizing the fishery along economic lines are socially undesirable. And, this may be a rational decision as long as we know what we are doing and what is being foregone. If we can estimate the degree of departure from the optimum, the costs of that departure, and other relevant facts, we can still make a rational decision (Gordon 1953).

Based on the current requirement to subsidize the industry and the apparent economic inefficiencies within the industry, perhaps traditional management decisions have not been socially desirable. Certainly, they have not been totally successful. For example, the majority of commercial fishing regulations in Canada have been imposed pursuant to the basic objective of protecting fish stocks from a fishing fleet that is too large for the productive potential of fisheries resources. Usually, the regulations have been aimed at limiting fishing effort to prevent a decline in fish stocks. Unfortunately, it would appear that they have not protected the fishing industry, from declining profits. Essentially, traditional harvest control regulations, involving closed seasons, shortened seasons and gear restrictions, have constrained the ability of the fishing industry to adjust to changing costs, prices and technology. Given the recent escalation in costs of production, it would normally be expected that the industry would adjust by increasing production and by introducing new cost saving technology. Unfortunately, many regulations constrain these adjustments.

The impact of fisheries management regulations constraining technological innovations not only effects the primary level of the fishing industry (fish harvesting), but has implications for marketing as well. Continual pressure to increase the selling price of fish could conceivably

place Canada at a competitive disadvantage on international markets. That is, if the price of Canadian produced fish increases relative to alternative fish sources or substitute protein foods, it is possible that the extent of the market would contract.

The danger of mismanaged fisheries resources not only leads to declining fish stocks and dissipated profits in the industry, it can result in foregone rents to the resource. A resource rent may be broadly defined as a return to the resource after all other factors of production (ie labour and capital engaged in harvesting the resource) have been paid. The concept of a resource rent is more readily understood by studying the relationship between a biological production function and an economic production function.

Figure 3, provides a simplestic model of the relationship between fish stocks, commercial fishing effort and annual yield. At a very low level of fishing effort (point A), annual yield will be small and the stock of fish will be large (point A'). Individual fish in the stock experiencing natural mortality will be replaced by recruitment of new members to the stock. As fishing effort expands, yield will increase and fish in the stocks will be reduced. Natural mortality will gradually be replaced by fishing mortality and a new balance will be reached between fish stock abundance and yield.

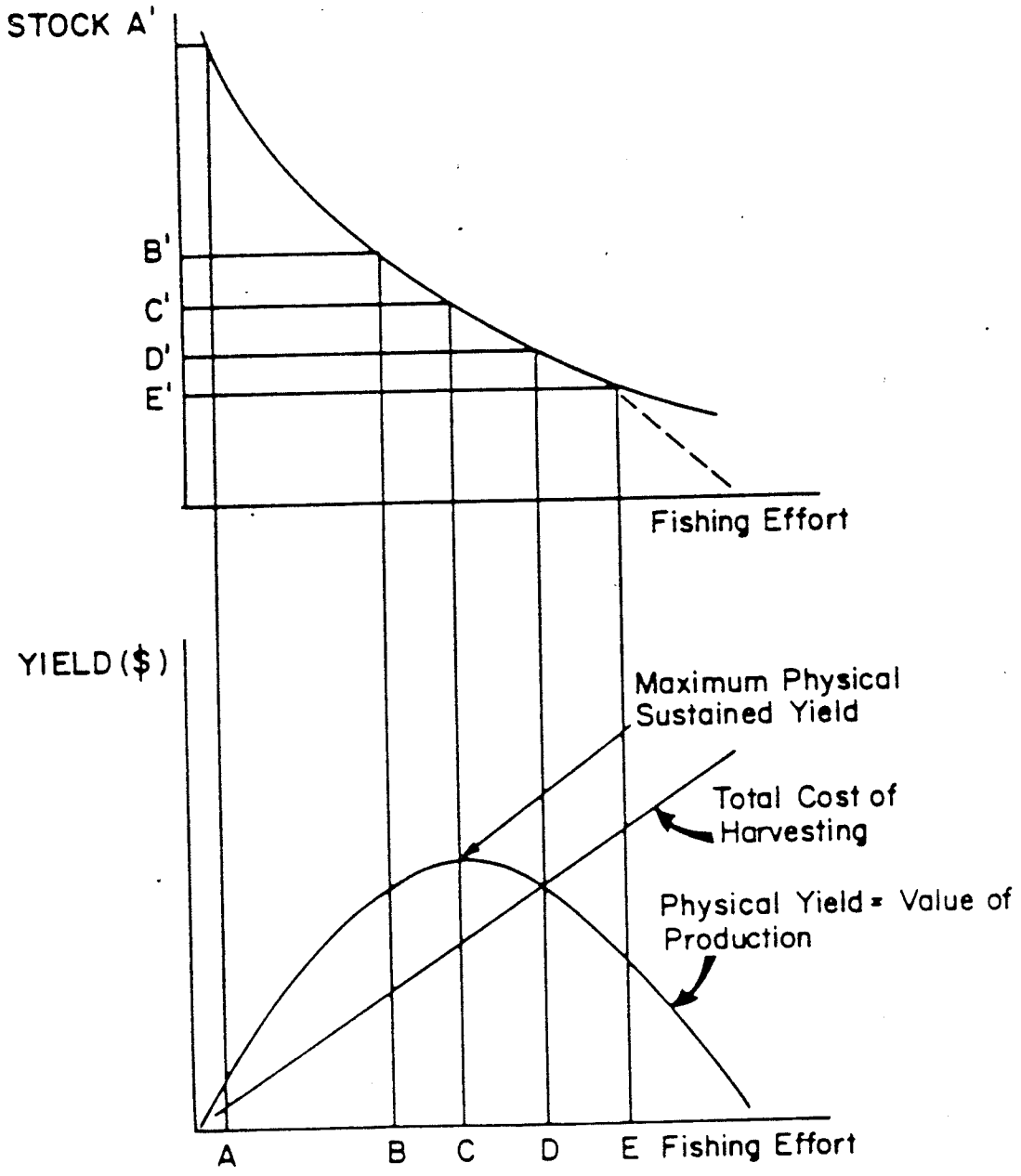

Figure 3: Relationship between fish stocks, fishing effort and yield (from Cauvin 1976)

From a biological perspective, the greatest physical level of harvest would occur when maximum sustained yield (MSY) is reached (point C). At this point, annual yield is balanced with a fish stock abundance and its ability to sustain itself (point C'). If fishing expands beyond MSY, yield will diminish (point E) and fish stocks will be reduced below an optimal level (point E'). At this point, fish stocks are in danger of collapse.

The tendency for fishing effort to expand beyond MSY and threaten the collapse of fish populations can be explained by translating the physical yield function into a value of production function and by superimposing a harvesting cost function (TC) on the model. At a low level of harvest (point A), the cost of production (which includes allowance for profit) is less than the value of production and an economic rent is generated.[3] This creates incentives for existing fishermen to expand operations and for new fishermen to enter the fishery.

If a single person had proprietary rights to manage the fishery, fishing effort would be expanded as long as the additional (marginal) revenue that was generated exceeded the additional (marginal) cost of expanding the fishing effort. Thus, the fishing effort would expand to a point be-

[3] (Economic rent: super profits - profits over and above those required to encourage or discourage exit. In the sense they represent the value of the resource after all other factors of production (labour and capital engaged in fishing) have been paid.)

low MSY (point B). At this point rents would be maximized and labour, capital and the resource would receive a return. In addition, fish stocks would be maintained at a level (point B') with a fair degree of buffering capacity.

Unfortunately, individual fishermen, in competition with each other for a share in the annual harvest, do not behave as a single proprietor. That is, individual fishermen in expanding their fishing effort or in entering a fishery do not perceive the marginal costs as it pertains to the aggregate fishing industry. Rather, each fisherman perceives only his expectations for the total value of his production and the total costs he would incur in achieving that production. No consideration is given to the fact that yield and thus marginal revenue declines as fishing effort expands or that marginal costs increase as new fishermen enter the fishery and existing fishermen expand operations. The result of this myopic vision is the expansion of fishing effort to the point where total costs equal total revenues (point D). At this point, rents will be dissipated and fish stocks eventually decimated. Further, if government subsidizes the industry, fishing effort could expand to the point where fish stocks are on the verge of collapse (points E and E'). The final result of this sequence is to reduce the value of fisheries in commercial production to zero or even less - negative.

Following this line of reasoning, Copes (1972) states that "...if at any given level of fishing effort the resource should yield a rent to the marginal operator, additional factor inputs of labour and capital will be attracted that will depress the catch per unit of effort and lower returns to all operators. This process will continue until the revenue per unit of fishing effort is reduced to the level of its marginal opportunity cost. Thus the rent attributable to the resource, that formerly accounted for the excess of revenue over marginal opportunity cost, is eliminated". Given that the commercial fishing industry of Manitoba is representative of this pattern, this then, is the tragedy of the fishery.

The solution to this problem of too many fishermen chasing too few fish which has been hypothesized for over thirty years, is to control fishing effort at that level that maximizes the rent (point B) and extract the rent as a payment for the resource. This will result in a level of fishing effort lower than MSY at which point total revenues (exclusive of the rent) to the industry will equal total costs (including a "normal" profit. Achieving this objective requires the control of entry into a fishery and the introduction of a price system, such as a royalty on landed value, to control fishing effort. While economic efficiency in the fishing industry seems desirable, recent experience in introducing control measures in Manitoba and the North-

west Territories has received opposition. The reasons for this opposition are understandable. They include the perception that such controls are an infringement on perceived rights of everyone to fish. They will also include a distrust of further government regulations, and a tax or royalty on fish landings is probably the least favoured form of regulation. Even though control measures may effectively minimize inefficiencies, they may be difficult to implement in view of other considerations in the management of commercial fisheries. For example, these considerations may include discretionary intervention by politicians with respect to the distribution of fishing licences and services. In this regard Christie (1978) comments that "the result has often been short-sighted decisions which favour employment in the short term by jeopardizing the resource in the long term".

2.4 COMMERCIAL FISHERIES MANAGEMENT CONTROLS

As Gordon (1954) has stated, "...common-property resources are free goods of the individual and scarce goods for society. Under unregulated private exploitation they yield no rent...". In view of the problems associated with unregulated private exploitation and the high costs associated with managing fisheries resources, perhaps the notion that access to fisheries resource should be free is no longer justifiable. There appears to be a requirement to review the management criteria for the commercial fishery. Cer-

tainly, present management criteria appear to be insufficient for the long term viability of the industry. Perhaps access control to the fishery and the requirement that fishermen pay for the special right to fish are feasible controls.

The function of access control should be "...to manage the fishery in the interests of all the people, to protect and conserve the stocks, and to remove the anarchy which previously prevailed in the industry. To remove the boom and bust situation which...was repeated in a constant cycle..." (Clarke 1975). Concern has been registered that the symptoms of uncontrolled fishing effort exist in Canadas' inland fisheries. In this regard, Cauvin (1980) has reviewed a number of access control measures for the commercial fishery of Great Sve Lake. These include 1) granting a specified amount of fishing effort (eg. nets set per year) to fishermen, 2) instituting a tax on fishing effort, 3) instituting a "grandfather" system of non- transferable licences to existing fishermen, 4) instituting a tax on landings and 5) granting individual transferable quotas to existing fishermen. The discussion concludes that the issuance of individual transferable quotas appears to be the best method of controlling access on Great Slave Lake. It would also appear that this method may have application to Manitoba lakes such as Lake Winnipeg. Further, this method appears to be similar to the proposed leasing of fishing

rights that the Government of Manitoba attempted to implement. In concluding his discussion on Great Slave Lake Dr. Cauvin states, "...individual transferable quotas appear to be the best method of generating economic benefits. Such quotas provide a relatively high degree of freedom to individual fishermen. Individual fishermen can fish during the summer and/or winter seasons. Individual fishermen can sell or buy quotas so that they may retire or expand their operations as they choose. New fishermen can enter the fishery as easily as in any other business...(and) individual transferable quotas can be expected to increase benefits to the fishing industry over time. These benefits will accrue totally to the initial fishermen on Great Slave Lake. If there is concern about who receives these benefits, license fees should be established to reflect the size of each quota...".

The potential benefits from access control to the fishery has been reviewed by Bishop (1973) who comments that to many economists and non-economists, the economics of fishing and access controlled entry into the fishing industry have almost become synonymous. Regardless, in order to evaluate the potential contribution of access controlled entry into the commercial fishing industry, there is the requirement to determine how many resources are presently being misallocated and what the productivity of these resources would be in alternative employment. If excluded

fishermen and gear become productively employed elsewhere, everyone benefits. But, if gear stands idle and excluded fishermen enter unproductive occupations, consumers will gain very little and may lose if fish catches decline. A study by Huq (in Bishop 1973) of the Maine Lobster Fishing Industry implied that limitation of entry could result in an increased income maintenance burden for society. Further, a concern was registered that while excess capital from access controlled fisheries may in time flow into other sectors, the same perhaps does not hold for labour. Socio-economic conditions, employment skills job satisfaction and mobility may inhibit the migration of displaced labour into regions with employment opportunities. Accordingly Bishop (1973) suggests that the reason fishermen are poor is not "...because the fishery resources are common-property, for there is nothing in the theory of common-property resources to justify such a conclusion but because fishermen are limited severely by their immobility and not the situations of tenure...".

While the observations of Bishop may be relevant in the short run, failure to control access in the long run can be expected to perpetuate social and economic problems. "The problems of the unemployed, immobile and inadaptable human resources are serious sources of concern. These problems are particularly acute where remote northern fisheries... are looked upon as a "spring-board" for regional

growth and development. I am concerned about the finite capability of fisheries resources to solve these problems" (Cauvin 1979). "The question at issue is fundamental: do we use the gains of the conservation program to support more marginal fishing units, or do we provide better incomes to those actually needed and produce more of other things?" (Crutchfield 1962). This places the resource manager on the "horns of a dilemma". That is, even though enormous gains can be expected from controlling fishing effort, access control, nevertheless, raises the spectre of fewer employment opportunities in fish harvesting. In this regard, there is a trade off between an economically efficient industry and the use of fisheries resource to provide more and more employment, which, in effect may simply disguise unemployment. Regardless, any attempt to rationalize the fishing industry must be done over time to minimize social dislocation.

Given the proposition that the productive potential of a fishing fleet should be balanced with the production potential of a fisheries resource, it is conceivable that fishermen and society as a whole could gain from controlled access to fisheries resources. Gains to fishermen would include increased profits, a greater degree of security in terms of an annual harvest and, as a result, a rational basis on which to invest in fish harvesting. Gains to society at large could include the generation of productive employment, a reduction in transfer payments and perhaps the gen-

eration of a resource rent. Clarke (1975) explains "...fishing to the maximum economic yield naturally means that the present method of raising costs of administration by government...would no longer be acceptable and would have to be met by those who had the privilege of being the exclusive users of the common resource...". This would require that fishermen pay for a major input into their industry - the fish.

A price for the right to fish, which could be levied as a royalty or as a license fee, would not simply generate money to offset management costs. A price system would also act as a control on fishing effort. According to Pearse (1971) "...a suitable price for licences would raise the private cost of fishing to the point where the fishery is in equilibrium at a fleet size and level of effort commensurate with rent maximization". While fees are bound to be unpopular measures initially, there are several reasons why license fees are required in access controlled fisheries. In a discussion paper relating to the Great Slave Commercial Fishery Cauvin (1980) cites several reasons which probably are applicable to most inland fisheries in Canada. He succinctly states that "...(i) The issuance of individual transferable quotas would confer special privileges to the initial fishermen exclusive rights to a share in the annual harvest. So to be fair, it would not seem unreasonable that the fishing industry should be expected to pay for the spe-

cial privileges as is the case with other public resources. ii) Governments spend a considerable amount of money managing fisheries resources. These expenditures are financed by public taxation. A payment for the right to fish could offset management costs. iii) the amount of revenue generated could be a guide to how much governments can afford to invest in the fisheries. iv) The revenue generated also provides a measure of what fisheries resources in commercial production are worth. This measure could be used for making decisions to allocate fisheries resources between commercial, recreational and domestic uses. v) A payment for the right to fish would ensure, that fishermen who are granted quotas free would not capture all of the benefits when a quota license is sold. vi) A payment for the right to fish assures that the fishing industry does not ignore the cost of a major input into the industry- the fish".

A price for the exclusive right to fish could be levied as a license fee on annual production. Obviously a license fee should vary in accordance with the volume or production included in the exclusive rights. In addition royalties could be levied on the value of production. In this manner a royalty could be varied in accordance to the market value of individual species.

As part of the requirement for efficiency within the commercial fishing industry the ability to freely transfer commercial fishing licences is essential (Meany 1978). In

this way the numerous administrative problems, that would arise in any system designed to stop the free transfer of licences would be avoided. A free transfer system managed by the licencing authority would result in greater efficiency than current methods which can't objectively measure the eligibility (wives of fishermen) or efficiency of a prospective entrant into the fishery. These problems are encountered regularly in the commercial fishing industry of Manitoba. Clarke (1975) comments that if licences are freely transferable, those who buy into the access controlled fishery are likely to be the most efficient operators since they can pay the highest price. That is, if the value of the license is high, then this reflects the value of the fishery resource and the potential profits. Arguments against the transfer of licences have been based on fears that this will ultimately lead to the development of company owned fishing fleets eliminating the independent operator. These concerns are easily dealt with by instituting regulations and restrictions on the size of single fishing operations (Meany, 1978)

Preliminary indications suggest that fishermen are concerned that access control measures and a price system could create financial distress for those fishermen who are caught in the middle of the rationalization process. As a result, suggestions have been made by fishermen that a conditional criteria in pricing the cost to fish, should be the

development of a "buy back" program to remove the excess fishing pressure (boats gear and equipment) from the fishery. Such a program was instituted in the British Columbia Salmon fishery as a means of reducing overcapacity. It was successful in terms of reducing the number of vessels. However, the subsequent reinvestment in fishing effort by the residual fleet is reported to have resulted in more fishing effort on fewer vessels than existed before the buy back program. As stated previously, this phenomena has been referred to as "capital stuffing". But, with respect to the Manitoba commercial fishery, Cauvin (1979) remarks that "...it is highly unlikely that a government "buy- back" program to reduce the size of the fleet could be justified...". No doubt, this reflects the tremendous financial costs of removing the excess capital from a fishery which could not finance these costs alone. As a result, the managers of the commercial fishery are extremely hard pressed to introduce any real measures of economic rationality into the fishery. However, this does not imply that what is now unlikely may not in time become more likely. The granting of individual transferable quotas may be a means of escaping from this dilemma.

2.5 CONCLUSION

The conundrum posed in managing the commercial fishery resources of Manitoba will not easily be resolved. Clearly, the current system leaves much to be desired. Although Cauvin (1979) has remarked that in spite of the observation that many of the problems confronting the commercial fishing industry are economical in nature, "it is highly unlikely that economic efficiency will ever become an integral part of management..." Cauvin's observation is considered to be excessively pessimistic. Considering that excessive capital and labour are being employed in the fishery today, the present system has failed to prevent economic waste. In view of the increasing costs of management programs and services to the fishing industry, progress towards economic efficiency appears inevitable. Unless initiatives are undertaken to correct the major obstacles to developing economically viable fisheries, the long run implications for the industry are grim.

Strategies to control entry and a price system appear to be the requirement for economic efficiency. While these management strategies may have to be modified to the existing socio-economic conditions of a fishery, the long run goals should be the same. Developing an efficient industry would offer prospects of increases in the net in landed value of fish harvests, provide a more secure future for fishermen, lead to extensive savings on capital and re-

duce regulatory costs associated with the resource. An economically viable fishery would also return a rent to the resource that would pay the cost of designated management programs.

Given the requirement to implement effective management programs for the commercial fisheries of Manitoba, the effectiveness of these programs will be judged on how well they succeed in achieving the stated objectives. To the extent that existing management objectives are in conflict it will not be possible to satisfy all objectives. However, an economic assessment of the costs of serving alternative objectives could provide a sound basis for decision making purposes.

Chapter III

ANALYSIS AND FINDINGS

This chapter is organized into eight sections. Following the introduction in Section 3.1, Section 3.2 presents the analytical model for evaluating fisheries management objectives using a hypothetical example. In section 3.3, the application of the model to the three fisheries under study is described. Section 3.4 presents an overview of the Lake Winnipeg fishery while Section 3.5 provides an empirical analysis of the Grand Rapids sub-fishery of Lake Winnipeg. Section 3.6 presents a parallel analysis of the Koostatak sub-fishery of Lake Winnipeg. In Section 3.7 an overview of the Lake Winnipegosis fishery is provided with the empirical analysis of the fishery being presented in Section 3.8

3.1 INTRODUCTION

A firm's primary business motivation and reason for being in business is usually to earn a financial profit. This primary consideration is thought to be applicable to the many one-man business operations involved with the harvest of Manitoba's commercial fish stocks. It is also apparent that there are secondary considerations related to a way of life that have particular relevance to those individuals engaged in commercial fishing as well. Nevertheless, it is on the

basis of the primary consideration that a business venture will be viable. Failure to earn a profit will, in the long run, result in bankruptcy.

To obtain a perspective of the performance of the commercial fishing industry, it is of interest to review the proforma statements of representative fishing enterprises. Assuming homogenous inputs of labour and capital and equal distribution of the annual harvest, an appreciation of the current and potential viability of the industry might be obtained. A proforma statement is, essentially, a projection of anticipated income receipts and expenditures. It can be broken into two components for analytic purposes: 1) an accounting statement, and 2) a cash flow statement.

The accounting statement presents a "snapshot" of the financial status of an enterprise for a given fiscal year. In this regard, it is important to differentiate between a short run and a long run assessment of viability. In the short run, an enterprise must cover its variable costs and certain fixed costs to stay in business. In the lon-run, however, an enterprise must cover all cost components if it is to be capable of reinvesting and remaining viable.

An accounting statement represents an intermediate judgement (one year) of performance. Since investment in fishing enterprises are generally made for a number of

years, there is a requirement to assess the returns on investment over time. An evaluation of cash flows (net income, plus interest plus depreciation) provides such an assessment. By discounting net cash flows, it is possible to relate the resultant present values with investments to determine if it is able to cover all cost components and obtain a return on investment.

3.2 MODEL FOR EVALUATING FISHERIES MANAGEMENT OBJECTIVES

The model used to analyze the performance of fishing enterprises and assess the policy implication of alternative fisheries management objectives is essentially a capital budgeting model (Table 2). Capital budgeting is one of the most important financial tools for choosing between alternatives that are expected to provide returns that extend beyond one year. Given the uncertainties of forecasting future events, capital budgeting provides a framework for ordering assumptions and analyzing likely outcomes.

The model, may be described as a proforma statement - a projection of anticipated income receipts and expenditures displayed in an accounting (income statement) format. The model also incorporates an annual cash flow, the summation of net income after tax, depreciation and interest costs on borrowed capital.

In the following sections, the components of the model are explained as follows:

TABLE 2

Proforma Statement for Hypothetical Fishing Enterprise

Skiff Operation	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	Present Value
Operation Year											
Interest Rate	15%										
Production	2778	2778	2778	2778	2778	2778	2778	2778	2778	2778	
Sales Price	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	
Gross Revenue	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$25569.88
Variable Costs											
Fuel	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$868.34
Repairs	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Provisions	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$1645.45
Hired Wages	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Owners Wages	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$4791.79
Transportation	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Supplies	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$1239.42
Raw Materials	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$2556.99
Total Variable Costs	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$11110.99
Gross Profit	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$14458.90
Fixed Costs											
Licence	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$301.13
Taxes	$0.00										
Rent	$0.00										
Overhaul	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$2694.97
Total Fixed Costs	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$2995.09
Gross Operating Profit	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$11462.80
Depreciation	$1183.50	$943.88	$902.69	$1125.24	$1334.47	$1118.08	$1318.85	$1445.66	$1213.60	$1375.12	$11460.80
Net Operating Profit	$1100.49	$1340.11	$1381.29	$1158.75	$949.51	$1165.91	$965.13	$838.32	$1070.39	$908.37	$5682.94
Increase Cost	$237.60	$224.91	$243.37	$290.00	$344.56	$336.03	$383.11	$422.11	$409.91	$447.00	$1528.11
Net Income Before Taxes	$862.89	$1115.20	$1137.92	$868.75	$604.95	$829.89	$582.02	$416.22	$660.47	$461.87	$4154.84
Income Taxes	$215.72	$278.80	$284.18	$217.19	$151.24	$207.47	$145.51	$104.05	$165.12	$115.47	$1038.71
Net Income After Taxes	$647.17	$836.40	$853.44	$651.56	$453.71	$622.41	$436.52	$312.16	$495.36	$346.41	$3116.13
Cash Flow	$2060.27	$2005.19	$1999.51	$2066.80	$2132.75	$2076.52	$2138.48	$2179.93	$2118.87	$2168.52	$10404.10
Investment	$5280.00	$246.00	$910.00	$1577.00	$1857.00	$576.00	$1793.00	$1718.00	$667.00	$1735.00	$9303.73
PV Investment	$5280.00	$213.91	$688.09	$1036.90	$1061.75	$286.37	$775.16	$645.86	$218.04	$400.20	
Amort Investment	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$10699.29
Net Cash Flow	($63.59)	($126.67)	($132.35)	($65.06)	$0.89	($55.34)	$6.63	$48.08	($12.99)	$36.66	($275.19)
BE Production	2844.28	2913.2278	2919.6013	2845.8451	2777.0896	2835.5024	2771.2709	2729.9032	2791.2838	2741.1708	$14234.75

TABLE 2

Proforma Statement for Hypothetical Fishing Enterprise

SKIFF OPERATION											
OPERATING YEAR	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	PRESENT VALU
INTEREST RATE	15%										
PRODUCTION	2778	2778	2778	2778	2778	2778	2778	2778	2778	2778	
SALES PRICE	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	
GROSS REVENUE	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$25569.88
VARIABLE COSTS											
FUEL	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$868.34
REPAIRS	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
PROVISIONS	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$1654.45
HIRED WAGES	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
OWNERS WAGES	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$4791.79
TRANSPORTATION	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
SUPPLIES	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$1239.42
RAW MATERIALS	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$2556.99
TOTAL VARIABLE COSTS	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$11110.99
GROSS PROFIT	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$14458.90
FIXED_COSTS											
LICENCE	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$301.13
TAXES	$0.00										
RENT	$0.00										
OVERHAUL	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$2694.97
TOTAL_FIXED_COSTS	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$2996.09
GROSS OPERATING PROFIT	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$11462.80
DEPRECIATION	$1183.50	$943.88	$902.69	$1125.24	$1334.47	$1118.08	$1318.85	$1445.66	$1213.60	$1375.12	$5779.86
NET OPERATING PROFIT	$1100.49	$1340.11	$1381.29	$1158.75	$949.51	$1165.91	$965.13	$838.32	$1070.39	$908.87	$5682.94
INTEREST COST	$237.60	$224.91	$243.37	$290.00	$344.56	$336.03	$383.11	$422.11	$409.91	$447.00	$1528.11
NET INCOME BEFORE TAXES	$862.89	$1115.20	$1137.92	$868.75	$604.95	$829.89	$582.02	$416.22	$660.47	$461.87	$4154.84
INCOME TAXES	$215.72	$278.80	$284.48	$217.19	$151.24	$207.47	$145.51	$104.05	$165.12	$115.47	$1038.71
NET INCOME AFTER TAXES	$647.17	$836.40	$853.44	$651.56	$453.71	$622.41	$436.52	$312.16	$495.36	$346.41	$3116.13
CASH FLOW	$2060.27	$2005.19	$1999.51	$2066.80	$2132.75	$2076.52	$2138.48	$2179.93	$2118.87	$2168.52	$10424.10
INVESTMENT	$5280.00	$246.00	$910.00	$1577.00	$1857.00	$576.00	$1793.00	$1718.00	$667.00	$1735.00	$9303.73
PV INVESTMENT	$5280.00	$213.91	$688.09	$1036.90	$1061.75	$286.37	$775.16	$645.86	$218.04	$493.20	
AMORT INVESTMENT	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$10699.29
NET CASH FLOW	($63.59)	($126.67)	($132.35)	($65.06)	$0.89	($55.34)	$6.63	$48.08	($12.99)	$36.66	($275.19)
BE PRODUCTION	2844.28	2913.2278	2919.6013	2845.8451	2777.0896	2835.5024	2771.2709	2729.9032	2791.2838	2741.1708	$14234.75

TABLE 2

Proforma Statement for Hypothetical Fishing Enterprise

SKIFF OPERATION											
OPERATING YEAR	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	PRESENT VALU
INTEREST RATE	15%										
PRODUCTION	2778	2778	2778	2778	2778	2778	2778	2778	2778	2778	
SALES PRICE	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	$1.83	
GROSS REVENUE	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$5094.85	$25568.89
VARIABLE COSTS											
FUEL	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$173.02	$808.34
REPAIRS	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
PROVISIONS	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$329.65	$1654.45
HIRED WAGES	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
OWNERS WAGES	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$954.77	$4791.79
TRANSPORTATION	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
SUPPLIES	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$246.96	$1239.42
RAW MATERIALS	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$509.49	$2556.99
TOTAL VARIABLE COSTS	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$2213.89	$11110.99
GROSS PROFIT	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$2880.97	$14458.90
FIXED COSTS											
LICENCE	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$301.13
TAXES	$0.00										
RENT	$0.00										
OVERHAUL	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$536.98	$2694.97
TOTAL FIXED COSTS	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$596.98	$2996.09
GROSS OPERATING PROFIT	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$2283.99	$11462.80
DEPRECIATION	$1183.50	$943.88	$902.69	$1125.24	$1334.47	$1118.08	$1318.85	$1445.66	$1213.60	$1375.12	$5779.86
NET OPERATING PROFIT	$1100.49	$1340.11	$1381.29	$1158.75	$949.51	$1165.91	$965.13	$838.32	$1070.39	$908.87	$5682.94
INTEREST COST	$237.60	$224.91	$243.37	$290.00	$344.56	$336.03	$383.11	$422.11	$409.91	$447.00	$1528.11
NET INCOME BEFORE TAXES	$862.89	$1115.20	$1137.92	$868.75	$604.95	$829.89	$582.02	$416.22	$660.47	$461.87	$4154.84
INCOME TAXES	$215.72	$278.80	$284.48	$217.19	$151.24	$207.47	$145.51	$104.05	$165.12	$115.47	$1038.71
NET INCOME AFTER TAXES	$647.17	$836.40	$853.44	$651.56	$453.71	$622.41	$436.52	$312.16	$495.36	$346.41	$3116.13
CASH FLOW	$2060.27	$2005.19	$1999.51	$2066.80	$2132.75	$2076.52	$2138.48	$2179.93	$2118.87	$2168.52	$10434.10
INVESTMENT	$5280.00	$246.00	$910.00	$1577.00	$1857.00	$576.00	$1793.00	$1718.00	$667.00	$1735.00	$9303.73
PV INVESTMENT	$5280.00	$213.91	$688.09	$1036.90	$1061.75	$286.37	$775.16	$645.86	$218.04	$493.20	
AMORT INVESTMENT	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$2131.86	$10659.29
NET CASH FLOW	($63.59)	($126.67)	($132.35)	($65.06)	$0.89	($55.34)	$6.63	$48.08	($12.99)	$36.66	($225.19)
BE PRODUCTION	2844.28	2913.2278	2919.6013	2845.8451	2777.0896	2835.5024	2771.2709	2729.9032	2791.2838	2741.1708	$14234.75

3.2.1 Fish Harvests

Referring to Table 2, production amounted to 2778 kilograms. Production was correlated with fishing effort, which was measured in terms of nets fished, days fished and the number of deliveries to the Freshwater Fish Marketing Corporation. The fact that regression analysis confirmed a high correlation between production and fishing effort (r^2= .8) provided the rational for establishing cost to production calculations.

3.2.2 Sales Price

The price fishermen receive for their landed catch is the lake side price established by the FFMC. In general, this is the market price less processing and marketing costs. Fishermen receive between 60-65% of the FFMC price for fish deliveries made FOB Winnipeg. As Table 2 illustrates, during the 1980/81 open water season, the weighted average lake side price shown for the hypothetical fishery is $1.83 per kilogram.

3.2.3 Variable Costs

By definition, variable costs refer to those expenditures that vary in proportion with the amount of fishing effort expended by the enterprise. With the exception of raw materials, variable costs were obtained from cost-earning surveys. Costs to production regression equations were calculated and inserted in the model to estimate variable costs

for different production levels. As listed in the model, variable costs correspond to those expenses incurred for fuel, repairs, provisions, hired wages, owners wages, transportation, supplies and raw materials. The sum total of variable costs for the hypothetical fishing enterprise was $2,213.89. In this regard, a brief discussion of each variable cost is provided for review purposes.

Fuel costs refer to expenses incurred in order to fuel and lubricate boat engines. These expenses do not include fuel taxes since fishermen are exempt from this taxation; Repairs correspond to expenditures which are of an ongoing nature such as basic maintenance, replacement parts and annual tuneups required to keep fishing equipment in good working condition; Provisions, relate to food costs that are incurred by fishermen when they are required to take meals away from home and according to income tax regulations are considered a deductible business expense; Hired wages represent the cost of wages paid by the fishing enterprise to hired employees; Owners wages may be estimated as a before tax business expense or as a residual payment to the owner after all other costs have been covered. For purposes of this model, owners wages have initially been imputed as a before tax business expense based on minimum wages for the time spent preparing for the fishing season, the time spent fishing and the time spent in post season clean up. Subsequently, owners wages will be illustrated as a residual pay-

ment to the owner after all other costs have been covered; Transportation costs corresponds to expenses fishermen incur while transporting landed production to FFMC assembly points; Supplies, relate to the cost of miscellaneous items such as rope, knives, and net repair items; Raw materials cost provides some sensitivity to the levels of production required to pay for a major input into the fishing industry - the fish. A hypothetical figure of 10% of gross revenue represents the royalty on fish harvests.

3.2.4 Fixed Costs

Fixed costs refer to those expenditures which are incurred after a decision has been made to fish and are considered to be constant. Fixed costs are independent of the number of days fished and nets lifted and in the model represent the licence fees and overhaul expenditures. Licence fees are based on the current rates for commercial fishing licences. Overhaul costs include major expenses such as rebuilding boats and motors and are considered to be of a major and recurring nature. Referring to Table 2, total fixed costs of $586.98 were incurred by the hypothetical fishing enterprise.

3.2.5 Depreciation

Depreciation is an accounting convention used to write off the value of an asset over time at zero rate of interest. The Capital Allowance Schedule of the income tax regulations

pertaining to farmer's and fishermen's capital assets were used to calculate depreciation rates.

3.2.6 Interest Rate

Interest costs represent the annual cost of borrowed money. The cost of the interest will be based on the amount of outstanding debt and the prevailing interest rate.

3.2.7 Income Taxes

Whether the performance of the fishery is measured on an "after tax" or "before tax" basis is open to debate. Despite the apparent implications concerning the assessment of financial viability, income taxes are an accepted fact and represent a basic cost to the enterprise. Failure to account for them, could result in a biased measure of economic performance. In the example, income taxes of $215.72 were paid on income generated from fishing.

3.2.8 Cash Flow

The cash flow is calculated as net income after (before) taxes plus depreciation plus interest expense. The rational for adding depreciation to net income follows from the fact that depreciation is a non-cash outlay that is available to cover the cost of an asset. Interest expenses are added because they represent the cost of borrowed money only. An analysis of the cash flow should include the interest cost on owner's equity in addition to debt. The resultant cash

flow represents the flow of funds available annually to cover the total investment (owners and borrowed) in an enterprise and, perhaps, provide a surplus to enhance the owner's wage. For an enterprise to be viable the cash flow must be sufficient to cover total investments. In this regard, the present value of the cash flow is $10,424.10.

3.2.9 Investment

A ten year schedule of investments in vessel, nets and other capital equipment underlies the annual disbursement of funds recorded as investments. Adjusting for the salvage value, the present value of investment totals $9,303.17. This value may be compared with the present value of the cash flow to estimate viability.

3.2.10 Present Value of Investment - Discount Rate

The present value of the annual investments, recorded to illustrate the value of money, is a function of the discount rate. Because expenditures may be incurred at a different time than income receipts (ie investments in a vessel are made in 1980-81) and revenues are spread out over ten years and because money has a time value (ie $1000.00 ten years from now does not equal $1000.00 today), it is necessary to reduce the cash flows and total investments to a common time denominator for comparison. This is achieved by calculating the present value (ie 1980-81) of future revenues and costs based at an appropriate discount rate. This process is var-

iously known as discounting (the inverse of compounding) cash flows to the present date.

Establishing the "appropriate" discount rate in calculating present values is subject to considerable controversy among economists. For private investment decisions, however, it might be argued that the appropriate rate of interest is the rate of return that an investor must receive in order to be induced to invest in an asset. This will vary among individuals but no doubt will likely reflect an individuals personal aspirations, alternative investment opportunities, cost of debt, the rate of inflation and risk. For purposes of illustration, a fifteen percent interest rate has been applied in this model. This is likely high in reference to the real (deflated) bank deposit interest rate. However, it could be equally low for the decisions of individual entrepreneurs.

3.2.11 Amortized Investment

The amortized investment illustrates the annual cost of writing off the total investment in a uniform stream of annual payments. For the hypothetical fishery, this represents a cost of $2,131.86. In this regard, it would be desirable that the annual cash flow equal or exceed the annual amortized investment costs of the enterprise.

3.2.12 Net Cash Flow

The net cash flow represents the "bottom line" in assessing the performance of a fishing enterprise. Calculated by deducting the annual amortization costs from the annual cash flows, the net cash flow represents the funds available after all costs are covered to allocate to expenditures such as the enhancement of wages. Obviously, a positive net cash flow is indicative of the financial viability of the enterprise. In relation to the performance of the hypothetical enterprise, the net cash flow was negative for six of the ten operating years. The present value of the cash flow is $275.19.

3.3 APPLICATION OF THE MODEL

Capital budgeting is a financial tool for assessing the feasibility of investment in a new or existing enterprise. Capital budgeting also has application in the public sector for evaluating the productivity of public funds in the private sector such as vessel subsidies and infrastructure development grants. It has also application for assessing policy issues designed for controlled fishing effort and for measuring the trade-off between employment and income objectives.

To assess the policy implications of alternative fisheries management objectives, cost and revenue data for the open water season were analyzed for the Grand Rapids and

Koostatak sub-fisheries of Lake Winnipeg and also for the Lake Winnipegosis fishery. The financial information for each group of fishermen was based on data obtained from questionnaire surveys administered to fishermen residing in the vicinity of their respective fishing grounds. Cost of production data extracted from the survey was subjected to regression analysis. The strength of a relationship between variables may be evaluated by the statistic r^2, the coefficient of determination, which varies from 0 to 1.0. The r^2 for variables under study were high (.8 or higher) and suggested a strong relationship. Given strong relationships between production and operating costs, regression equations were developed for each fishing cost and inserted into the model. Costs generated by the model at each level of production provided a estimate of financial viability. In the following sections, this capital budgeting model will be used to measure the degree to which employment and income objectives are in conflict in the Lake Winnipeg Grand Rapids fishery, the Lake Winnipeg Koostatak fishery and the Lake Winnipegosis fishery.

3.4 OVERVIEW OF THE LAKE WINNIPEG FISHERY

The Lake Winnipeg commercial fishery is the largest and most productive commercial fishery in Manitoba. Pickerel, sauger and whitefish are the species of primary economic importance in the fishery and current harvests are considered to be at the level of maximum sustained yield. For management pur-

poses, the fishery is divided into nine regulatory areas in the summer season, three regulatory areas in the fall, and three regulatory areas in the winter season (Manitoba Fishery Regulations, 1980). For most areas the open seasons for pickerel, sauger and whitefish extends from June 1-July 10, from the day after Labour Day to October 30. A whitefish season operates from June 1 to August 8, in designated fishing regions of the lake.

For licensing purpose, the Lake Winnipeg fishery is divided into 12 regional community divisions. Since 1970 a measure of access control has been introduced to the fishery. In 1981, 1232 licences were issued to 696 fishermen operating on the lake during the summer, fall, winter and summer whitefish seasons. As a result, the maximum number of licences a fisherman can possess is three licences. Vacated licences are allocated on the basis of a "points" system administered by the Department of Natural Resources, Fisheries Branch. Points are earned on the basis of experience and dependency. Usually the highest "points" holder who applies for the licence is the successful incumbent, provided that eligiblity criteria are met. These criteria require the prospective fisherman to be over 16 years of age and to live withing 20 miles of the community's lake shore. However, regardless of the points accumulated by fishermen, vacancies may be directly filled by parents transferring their licence to children who meet the above criteria. Un-

til quite recently, Lake Winnipeg fishermen holding summer fall and winter licences had the right to "roll over" unfilled quota entitlements to a later fishing season in that year. This administrative policy meant that within a fishing year (June 1-March 31) fishermen could harvest unfilled quota limits in a subsequent season and were also entitled to harvest the next season's quota in any preceding year. However, effective January 1981 this later option has been revoked.

Although, harvest quotas for pickerel, sauger and whitefish have been established for each community, in most cases, the aggregate quota has been divided into equal individual quotas according to fishing community preferences. In 1980, only the the communities of Grand Rapids, Gull Bay, Poplar River, and Black River still retained the competitive harvest of the summer area quota.

In the sections that follow, the economic performance of two sub-fisheries of the Lake Winnipeg regional fishery are examined. An empirical analysis of the Grand Rapids fishery provides the initial analysis, followed by a parallel analysis of the Koostatak fishery. These fisheries were chosen to illustrate the performance of fishing enterprises operating under competitive harvest conditions and a fishery where fixed quotas are assigned to the licence holder. Specifically, the Grand Rapids fishery is controlled by an aggregate area quota in which fishermen compete for the

available harvest. During the season, when the aggregate quota is taken, the fishing season is closed. In comparison, the Koostatak fishery is controlled by individual non-transferable quotas in which each individual fishermen is assigned by licence a specified share of the annual harvest. The season for each fisherman is finished when his individual quota is achieved.

3.5 EMPIRICAL ANALYSIS OF THE GRAND RAPIDS FISHERY

The Grand Rapids fishery is basically a skiff fishery located on the north western tip of Lake Winnipeg (Figure 4). In 1980, the area quota was competitively harvested by 65 fishermen who marketed a combined total of 262,774.6 kilograms of fish. While this level of production exceeded the 1980 open water aggregate quota of (106,000 kg) allocated for the fishery, this production included "rolled over" (carried over) quota entitlements and seasonal quota entitlements that were fished ahead.[4] Given the weighted average sales price of $1.83 per kilogram, gross revenues generated range from $1,465.37 to $19,260.67, with fishermen on the average earning a gross income of $7,414.58 (Table 3).

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[4] (According to the 1984 Manitoba commercial fishing regulations, the Grand Rapids open water fishery has adopted individual quota entitlements.)

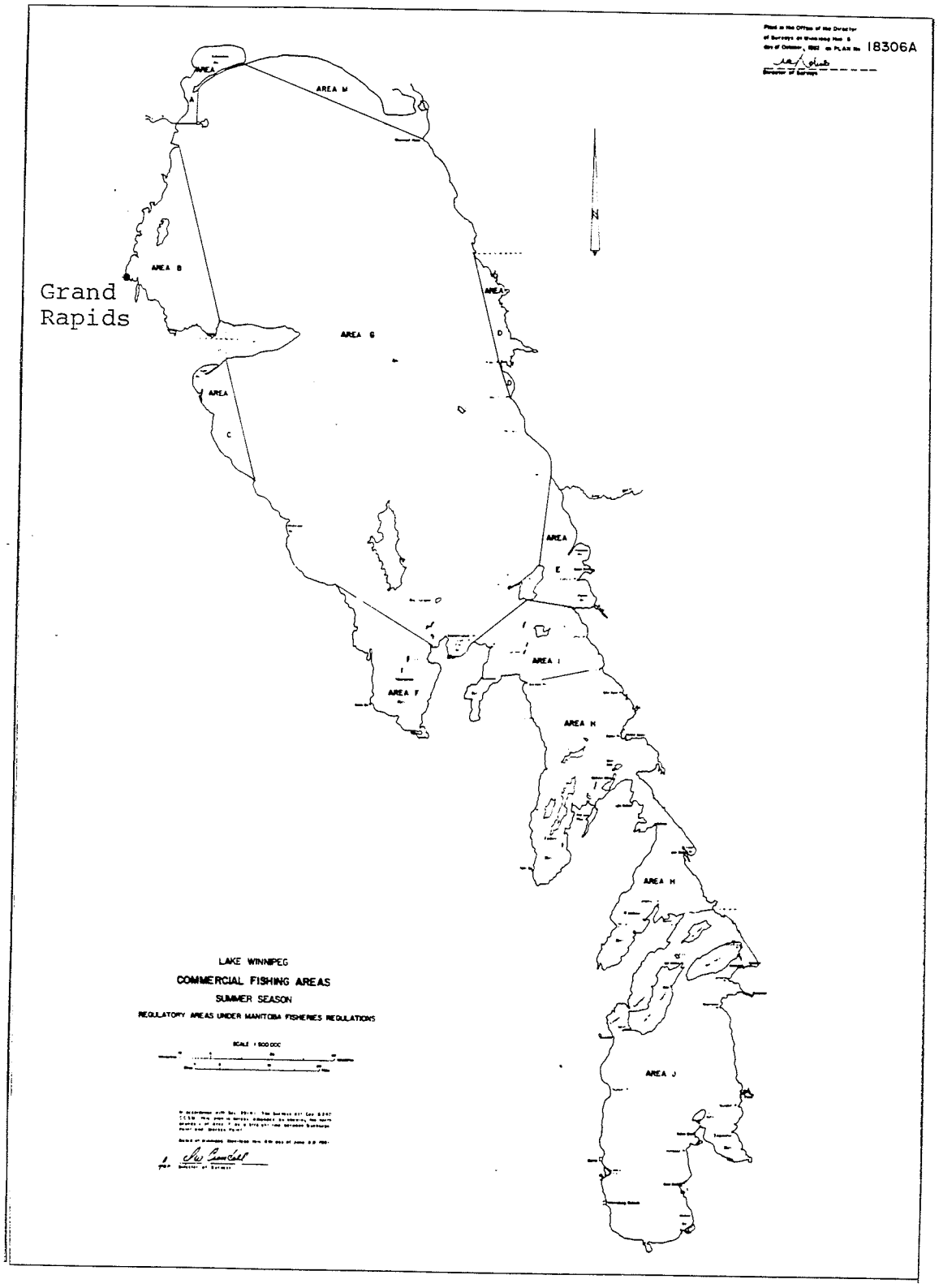

Figure 4: Location of the Lake Winnipeg Grand Rapids Fishery

TABLE 3

Production and Revenue Profile for Summer Grand Rapids Fishery 1980

PRODUCTION DATA

SPECIES	ACTUAL WEIGHT (kg)	VALUE ($)
WHITEFISH	132,514.7	143,305.41
PICKEREL	82,702.1	315,350.46
SAUGER	1,069.8	1,996.78
NORTH. PIKE	27,596.7	19,513.38
PERCH	14.0	22.20
SUCKER	18,877.3	1,759.36
TOTAL	262,774.6	481,947.59

DISTRIBUTION OF GROSS REVENUE

INCOME INTERVAL ($)	NUMBER OF FISHERMEN	CUMULATIVE PERCENT	INCOME PER FISHERMAN ($)	WEIGHT PER FISHERMAN (kg)
0.00 - 1999.99	11	16.9	1,465.37	799
2000.00 - 3999.99	8	29.2	3,900.92	2,127
4000.00 - 5999.99	14	50.7	5,094.92	2,778
6000.00 - 7999.99	12	69.2	7,046.23	3,842
8000.00 - 9999.99	1	70.7	9,978.79	5,441
10000.00 - 11999.99	6	80.0	10,371.27	5,655
12000.00 - 13999.99	4	86.6	13,206.63	7,201
14000.00 - 14999.99	3	90.7	14,213.50	7,750
15000.00 - 15999.99	1	92.3	15,213.50	8,417
18000.00 - 19099.99	3	96.9	19,025.92	10,374
19100.00 - 19999.99	2	100.0	19,260.67	10,502
FINAL - TOTAL	65		7,414.58	4,043

Source: Freshwater Institute - Fisheries Economics

3.5.1 Summary Analysis of Grand Rapids Cost-Earning Survey

Table 4, presents a summary of the distribution of production and the value of production for the 1980 Grand Rapids

TABLE 4

Performance of Grand Rapids fishing enterprises given fisherman wages: cash flow residual

HARVEST PER FISHERMAN (kg)	NUMBER OF FISHERMEN	GROSS REVENUE ($)	OWNERS WAGES ($)	CASH FLOW ($)	AMORTIZED INVESTMENT ($)	NET CASH FLOW ($)
799	11	1,465.37	723.35	-423.13	2.131.86	-2,554.99
2,127	8	3,900.92	878.65	1,393.47	2,131.86	-738.39
2,778	14	5,094.85	954.77	2,077.00	2,131.86	-54.83
3,842	12	7,046.23	1,079.20	3,060.89	2,131.86	929.05
4,043*	65	7,414.58	1,102.70	3,238.02	2,131.86	1,106.19
5,441	1	9,978.79	1,266.19	4,470.04	2,131.86	2,338.21
5,655	6	10,371.27	1,291.21	4,658.63	2,131.86	2,526.80
7,201	4	13,206.63	1,472.00	6,021.08	2,131.86	3,889.25
7,750	3	14,213.50	1,536.20	6,504.90	2,131.86	4,373.07
8,417	1	15,213.50	1,614.20	7,092.71	2,131.86	4,960.88
10,374	3	19.025.92	1,842.05	8,817.36	2,131.86	6,685.53
10,502	2	19,260.67	1,858.02	8,930.17	2,131.86	6,798.33

* mean

open water fishery. For each level of production, owners wages and cash flow data obtained from cost-earning survey and calculated in the capital budgeting model are presented to illustrate the performance of the industry. The net cash flow is calculated as a residual after all other costs, including owners wages have been covered.

Referring to Table 4, it is apparent that 33 of the 65 fishing enterprises are not generating a sufficient cash flow to cover the amortized investment costs. That is, the net cash flow of the 33 enterprises are negative. Further, the cash flow for 11 of these enterprises is negative suggesting that the fisherman are incurring losses and could face bankruptcy. The balance of the 33 enterprises might be considered as operating in the short run where investments are regarded as sunk. That is, these enterprises are covering short run (variable) costs and perhaps contributing marginally to long run (fixed costs) or to enhanced owners wages. To the extent that performance cannot be improved, these fishermen might be expected to exit from the fishery at such time as reinvestment in the enterprise is required. It is of interest to note that the imputed minimum wages for owners do not exceed $2000.00. However, the residual net cash flow is available to contribute to owners income. The extent to which the net cash flow contributes to owners wages is examined next.

3.5.2 Implicit Wages to Owners and Employment Implications

Table 5 presents essentially the same data. However, owners wages have been calculated as a residual after all other costs, including amortized investment costs, have been covered. This provides a perspective of the implicit wages available to fishermen. It is apparent that the implicit wages of 19 fishermen are negative under the restrictive assumption that owners wages be calculated as a residual.

Further, only 5 fishermen achieved a wage commensurate with the average income of Canadian fishermen ($10,795.00) filing

TABLE 5

Performance of Grand Rapids fishing enterprises given amortization cost: owners wages residual

HARVEST PER FISHERMAN (kg)	NUMBER OF FISHERMEN	GROSS REVENUE ($)	OWNERS WAGES ($)	NET CASH FLOW ($)
799	11	1,465.37	-2,056.88	0
2,127	8	3,900.92	-84.98	0
2,778	14	5,094.85	881.63	0
3,842	12	7.046.23	2,317.95	0
4,043*	65	7,414.58	2,577.64	0
5,441	1	9,978.79	4,383.83	0
5,655	6	10,371.27	4,660.31	0
7,201	4	13,206.63	6,657.72	0
7,750	3	14,213.50	7,367.02	0
8,417	1	15,213.50	8,228.77	0
10,374**	3	19,025.92	10,757.18	0
10,502	2	19,260.67	10,922.56	0

* mean
** harvest required to achieve wage commensurate with average Canadian fishermens' wages

income tax returns (Revenue Canada, 1981).

Given the annual allowable harvest, the trade offs between employment and incomes become apparent. For example, given the 1980 harvest level (262,800 kg), it would be possible to support 65 fishermen with a mean production of 4,043 kg and an average owners wage of $2,578.00. Similarly, it would be possible to support 25 fishermen with a mean

production of 10,502 kilograms and an average owners wage of $10,922.00. This illustrates the nature of the trade offs between generating employment and increasing incomes.

3.5.3 Price and Employment Implications

To the extent that the annual allowable harvest cannot be increased and a reduction in the number of fishermen is socially undesireable, it would appear that increased incomes can be achieved only by an increase in the prices received by fishermen. As an example, Table 6 illustrates the range of prices required in order to provide Grand Rapids fishermen with incomes equivalent to the average Canadian fishermens' income. It will be noted that two fishermen harvest a sufficient volume to obtain an income of $10,795.00 at the prevailing price of $1.83 per kilogram. As production decreases, prices must be continually increased to a level at which production would not be expected to clear the market.

Fish harvested in Manitoba must compete on national an international markets with similar species produced in Ontario and with fisheries production on the Atlantic and Pacific coasts. In addition, beef, pork and poultry represent alternative protein products. Thus, the price of fish produced in Manitoba must be competitive to avoid consumer resistance and lost markets. For example, the price of cod to fishermen in 1980 and 1981 approximated $0.32 to $0.34 per kilogram compared to a weighted average price to Grand Rapids fishermen of $1.83 per kilogram.

TABLE 6

Price required to cover total costs including average Canadian fisherman income

HARVEST PER FISHERMAN (kg)	NUMBER OF FISHERMEN	SALES PRICE PER KG ($)	GROSS REVENUE ($)	OWNERS WAGES ($)	NET CASH FLOW ($)
799	11	19.71	15,745.47	10,795.00	0
2,127	8	7.52	15,989.79	10,795.00	0
2,778	14	5.78	16,109.67	10,795.00	0
3,842	12	4.29	16,465.17	10,795.00	0
4,043*	65	4.09	16,545.26	10,795.00	0
5,441	1	3.14	17,102.31	10,795.00	0
5,655	6	3,04	17,191.20	10,795.00	0
7,201	4	2,47	17,803.09	10,795.00	0
7,750	3	2,32	18,022.37	10,795.00	0
8,417	1	2,17	18,288.15	10,795.00	0
10,374	3	1.84	19,067.93	10,795.00	0
10,502**	2	1.83	19,118.94	10,795.00	0

* mean
** harvest requited to achieve average Canadian fishermens' wages

Economic theory explains that as the price of a good increases, the quantity of the good purchased decreases as the consumer substitutes for less expensive goods. Thus as the price of freshwater fish species increased less would be purchased as consumers substitute freshwater fish for species such as cod. The net result of this sequence of events would be a smaller volume of sales, increased inventories and, very likely, reduced total revenues. In this regard, an increase in the selling price of Grand Rapids production would not necessarily serve employment or income objectives.

3.5.4 Conclusion

In 1980, the Grand Rapids open water fishery supported 65 commercial fishing enterprises. Unfortunately, more than fifty percent of fishing enterprises were unable to cover long run owning and operating costs. Given escalating costs of production, this figure will no doubt increase. While individual fishing production is competitively harvested, it is apparent that the majority of fishermen have production levels below that necessary to cover long run operating costs.

3.6 EMPIRICAL ANALYSIS OF THE KOOSTATAK FISHERY

The Koostatak fishery is also a skiff operated fishery located on the west shore of the northern basin of Lake Winnipeg (Figure 5). During the 1980 open water season, 27 fishermen were active in the fishery. Operating under a system of individual non-transferable quota entitlements, each fishermen in the fishery was entitled to 3,630 kilograms of pickerel sauger and whitefish (of which not more than 3000 kilograms may be pickerel and sauger) in the summer season and 3,810 kilograms of pickerel sauger and whitefish in the fall season.

Table 7, presents the production and revenue statistics for the Koostatak fishery of Lake Winnipeg. As shown, fishing production ranges from a low of 587 kilograms to a high of 8,567 kilograms, with combined production totaling

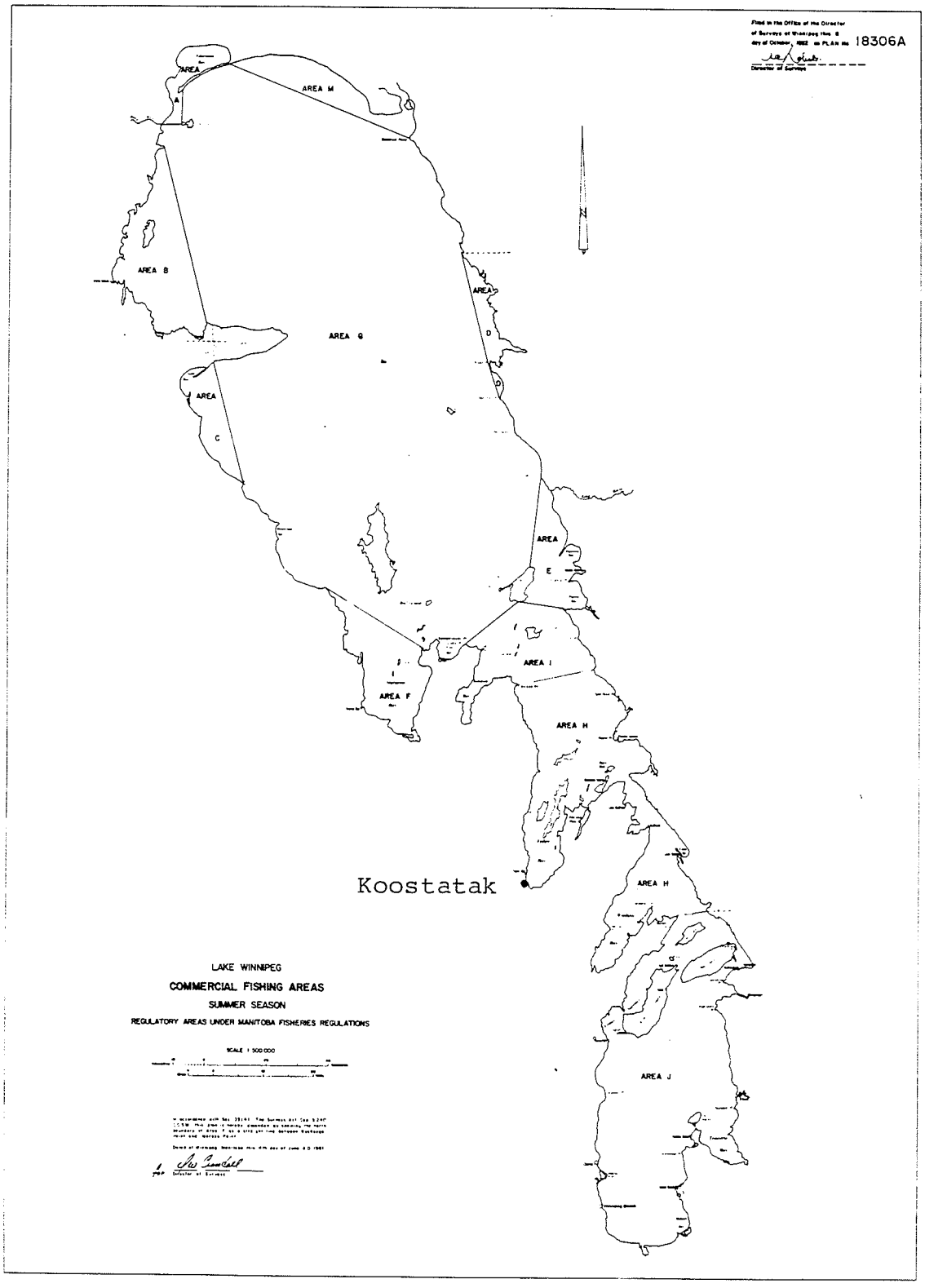

Figure 5: Location of the Lake Winnipeg Koostatak Fishery

TABLE 7

Production and Revenue Profile for Summer Koostatak Fishery
1980

PRODUCTION DATA

SPECIES	ACTUAL WEIGHT (kg)	VALUE ($)
WHITEFISH	53.9	52.62
PICKEREL	23,981.4	73,441.14
SAUGER	22,348.2	32,406.24
NORTH. PIKE	5,054.2	3,780.56
PERCH	11,496.4	17,579.66
CARP	434.7	76.64
SUCKER	794.3	139.92
TOTAL	64,163.1	127,476.78

DISTRIBUTION OF GROSS REVENUE

INCOME INTERVAL ($)	NUMBER OF FISHERMEN	CUMULATIVE PERCENT	INCOME PER FISHERMAN ($)	WEIGHT PER FISHERMAN (kg)
0.00 - 1999.99	10	37.0	1,166.19	587
2000.00 - 3999.99	6	59.0	2,785.25	1,402
4000.00 - 5999.99	1	63.0	4,887.28	2,460
6000.00 - 7999.99	3	74.0	7,400.46	3,725
8000.00 - 9999.99	4	89.0	8,870.62	4,465
9000.00 - 10999.99	2	96.0	9,756.68	4,911
16000.00 - 17999.99	1	100.0	17,020.06	8,567
FINAL - TOTAL	27		4,721.36	2,376

64,163.1 kilograms. Given the weighted average sales price of $1.98 per kilogram, gross revenue generated ranges from

$1,166.19 to $17,020.06, with fishermen on the average earning a gross income of $4,721.36.

3.6.1 Summary Analysis of Koostatak Cost-Earning Survey

Table 8 presents a summary of the distribution of production and the value of production for the 1980 Koostatak open water fishery. For each level of production, owners wages and cash flow data obtained from cost-earning survey and calculated in the capital budgeting model are presented to illustrate the performance of the industry. The net cash flow is calculated as a residual after all other costs, including owners wages have been covered.

TABLE 8

Performance of Koostatak fishing enterprises given fisherman wages: cash flow residual

HARVEST PER FISHERMAN (kg)	NUMBER OF FISHERMEN	GROSS REVENUE ($)	OWNERS WAGES ($)	CASH FLOW ($)	AMORTIZED INVESTMENT ($)	NET CASH FLOW ($)
587	10	1,166.19	663.25	-209.62	3,018.83	-3,228.45
1,402	6	2,785.25	878.75	789.98	3,018.83	-2,228.85
2,376*	27	4,721.36	1,135.90	1,926.71	3,018.83	-1,092.08
2,460	1	4,887.28	1,158.10	2,014.12	3,018.83	-1,040.58
3,725	3	7,400.46	1,492.31	2,888.08	3,018.83	130.75
4,465	4	8,870.62	1,687.81	3,337.51	3,018.83	318.68
4,911	2	9,756.68	1,805.65	3,608.38	3,018.83	589.25
8,567	1	17,020.06	2,771.25	5,921.04	3,018.83	2,902.24

* mean

As shown in Table 9, it is apparent that 17 of the 27 fishing enterprises are not generating a sufficient cash flow to cover total costs. Ten of these vessels are generating negative cash flows, suggesting that the fishermen are loosing money. The remaining seven might be considered s operating in the short run. That is, these enterprises are covering variable costs and contributing marginally to long run cots. To the extent that performance cannot be improved, these fishermen might be expected to exit from the fishery at such time as reinvestment in the enterprise is required. Although owners wages for all levels of production do not exceed $3000.00, at higher levels of production, residual cash flow is available which may be used to contribute to owners wages. For example, the residual net cash flow generated from production of 8,567 kilograms is $2,902.24. The extent to which implicit owners wages are available, after long run amortized costs are covered is examined next.

3.6.2 Implicit Wages to Owners and Employment Implications

Table 9 presents basically the same data as Table 9. However, owners wages have been calculated as a residual after all other costs, including amortized investment costs, have been covered. Again this provides a perspective of the implicit wages available to fishermen.

TABLE 9

Performance of Koostatak fishing enterprises given amortization cost: owners wages residual

HARVEST PER FISHERMAN (kg)	NUMBER OF FISHERMEN	GROSS REVENUE ($)	OWNERS WAGES ($)	NET CASH FLOW ($)
587	10	1,166.19	-2,900.01	0
1,402	6	2,785.25	-1,685.09	0
2,376*	27	4,721.36	-244.19	0
2,460	1	4,887.28	-120.09	0
3,725	3	7,400.46	1,441.07	0
4,465	4	8,870.62	2,235.81	0
4,911	2	9,756.68	2,714.80	0
8,567	1	17,020.06	6,641.25	0
12,435**	_	24,703.91	10,795.00	0

* mean
** harvest required to achieve average Canadian fishermens' wages

It is apparent that the implicit wages of 17 fishermen are negative under the restrictive assumption that owners wages be calculated as a residual. Further, it is of interest to noted that all Koostatak fishermen fell considerably short of the average wage earned by Canadian fishermen ($10,795.00). Although licence holders have individual non-transferable quota entitlements of 7,510 kilograms for the open water season, 26 out of 27 fishermen did not achieve this production. In fact only 10 out of the 27 fishermen in the fishery are able to harvest the summer quota entitlement. Refering to the highest level of production (8,567 kg), it will be noted that the fisherman's implicit

wage was $6,641.00. To achieve an income consistent with the average Canadian fishermens' wage, production would have to be increased to 12,435 kilograms. Given the total of individual quotas (200,880 kg), in order to provide fishermen with the individual quotas totalling 12,435 kilograms, the number of fishermen would have to be reduced to 16. This illustrates the trade off between employment and income levels.

3.6.3 Price and Employment Implications

Table 10 presents the selling prices required to provide fishermen wages equivalent to the average Canadian fisher-

TABLE 10

Price required to cover total costs including average Canadian fisherman income

HARVEST PER FISHERMAN (kg)	NUMBER OF FISHERMEN	SALES PRICE PER KG ($)	GROSS REVENUE ($)	OWNERS WAGES ($)	NET CASH FLOW ($)
587	10	27.90	16,382.87	10,795.00	0
1,402	6	11.87	16,652.12	10,795.00	0
2,376*	27	7.14	16,986.17	10.795.00	0
2,460	1	6.91	17,015.16	10,795.00	0
3,725	3	4.76	17,793.71	10,795.00	0
4,465	4	4.11	18,380.82	10,795.00	0
4,911	2	3.81	18,734.68	10,795.00	0
8,567	1	2.52	21,635.33	10,795.00	0
12,435**	-	1.98	24,703.91	10,795.00	0

* mean

** harvest required to achieve average Canadian fishermens' wages

mans income for each level of production.

Once again, given a weighted average price of $1.98 per kilogram, it would be necessary to allocate individual quota of 12,435 kilograms in order to achieve an income consistent with the average wage for Canadian fishermen. Given the actual range in production, prices to fishermen would have to increase appreciably. For example, based on the mean production (2,376 kg), the price received by fishermen would have to be $7.14 per kilogram. To the extent that fishermen receive approximately 62% of the Freshwater Fish Marketing Corporation selling price, the Corporations price would approximate $11.90 per kilogram. Considering the competitive nature of the market for fish, it is highly unlikely that any production could be sold at such prices. To achieve higher incomes, therefore, larger individual quotas are required.

3.6.4 Conclusion

The Koostatak fishery of Lake Winnipeg operates under a system of individual non-transferable quota entitlements. To the extent that the individual quota assignment has not changed recently and costs of production have escalated, it is questionable whether current entitlements are sufficient to generate adequate returns to fishing enterprises. Obviously, the existing quota entitlements are not sufficient to provide fishermen with wages approximating the Canadian av-

erage fishermens wage. Notwithstanding the individual quotas, it is of interest to note that only one fisherman achieved a production level consistent with the quotas. Further, 17 fishermen did not reach a production level sufficient to cover total costs. The reasons for this situation are not clear.

3.7 OVERVIEW OF THE LAKE WINNIPEGOSIS FISHERY

Until the mid 1960's, the Lake Winnipegosis commercial fishery was a major producer of pickerel with production in excess of 450,000 kilograms of pickerel being landed annually. Since then, the lake has experienced a drastic reduction in pickerel stocks, attributed primarily to overfishing.[5] To the extent that the species composition has changed to predominantly sucker, dwarf tullibee, pike and carp, the commercial value of the catch is low. This decline in the value of production has had adverse economic repercussions for the fishermen, the surrounding communities and the industry as well (Lake Winnipegosis - Issues and Information 1976). Although some research programs have been initiated to find ways of restoring the fishery, the success of these programs remains uncertain.

According to the Manitoba Fishery Regulations, the Lake Winnipegosis commercial fishing season operates from April 1 to March 31 and includes a summer/fall season, a

[5] (in 1980, landed pickerel production from Lake Winnipegosis was 198,974.6 kilograms.)

winter season and a special spring sucker spawning season. The summer season (which runs into the fall) opens in the period July 18 to 24 and runs for 8 weeks, providing a 55 day season. A maximum of 48 licences are issued and unless a vacancy has occurred, no new licences are issued. Applications for new licences are assessed by a 9 member board of directors of the Lake Winnipegosis commercial fishery. Open water fishing regulations on Lake Winnipegosis establish individual non-transferable quotas of 9,080 kilograms of pickerel or a lake quota of 435,840 kilograms. Since pickerel stocks have generally been depleted, the fishery essentially operates as an unrestricted fishery, allowing fishermen to catch all that is available in an open season.

3.8 EMPIRICAL ANALYSIS OF THE LAKE WINNIPEGOSIS FISHERY

In Manitoba, Lake Winnipegosis is the third largest body of freshwater and the communities along its western shore form the basis of the Lake Winnipegosis fishery (Figure 6). In contrast to the majority of commercial fisheries on Lake Winnipeg, a unique aspect of the Lake Winnipegosis fishery is that most commercial fishing enterprises use 40 foot fishing vessels generally referred to as Lake Winnipegosis boats.

During the 1980 open water season, 48 licenced fishermen were engaged in commercial fishing operations and marketed a combined total of 1,123,254.7 kilograms of fish pro-

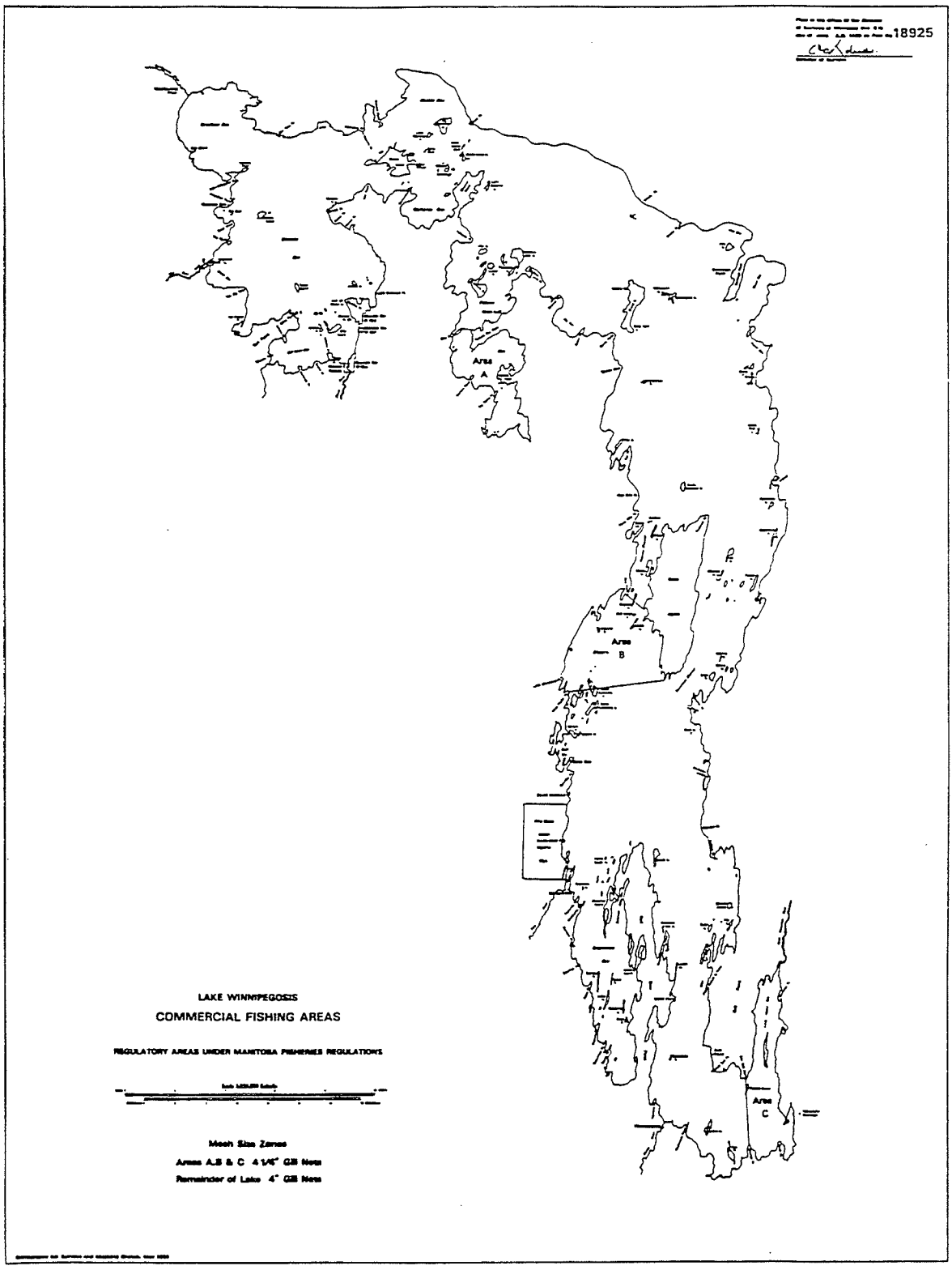

Figure 6: The Lake Winnipegosis Commercial Fishery

duction. Referring to Table 11, individual fishing production ranged from 6,498 kilograms to 41,185 kilograms, with the mean production being 23,401 kilograms of fish. While mean production is high, 80 percent of Lake Winnipegosis landed production consists primarily of non-quota fish species. for which markets are presently limited Given the relatively low weighted average sales price of $0.79 per kilogram, gross revenues range from $5,152.91 to $34,691.17, with fishermen earning, on the average a gross income of $18,558.15.

In 1980, less than half of the Lake Winnipegosis quota for pickerel was harvested despite the fact that licenced fishermen have individual non-transferable quota entitlements. Given the decline in pickerel production over the past 25 years, it is likely that the Lake Winnipegosis fishery is being harvested at a maximum level of production for pickerel. In fact, pickerel harvests are practically incidental to the major harvest of suckers and other non-quota fish species.

Sucker production from Lake Winnipegosis is an important source of income to Lake Winnipegosis fishermen. While suckers are not regulated by quotas on Lake Winnipegosis, commercial landings of suckers depend on the size of the market established by the Freshwater Fish Marketing Corporation. In this regard, the sucker production that the Corporation agrees to purchase from Lake Winnipegosis fish-

TABLE 11

Production and Revenue Profile for Summer Lake Winnipegosis Fishery 1980

PRODUCTION DATA

SPECIES	ACTUAL WEIGHT (kg)	VALUE ($)
WHITEFISH	28,656.6	19,106.86
PICKEREL	198,974.6	647,870.24
SAUGER	341.0	628.07
NORTH. PIKE	118,347.3	84,825.25
PERCH	91.3	297.85
CARP	1,639.4	297.85
SUCKER	774,500.4	137,543.93
GOLDEYE	715.1	378.00
TOTAL	1,123,254.7	890,791.42

DISTRIBUTION OF GROSS REVENUE

INCOME INTERVAL ($)	NUMBER OF FISHERMEN	CUMULATIVE PERCENT	INCOME PER FISHERMAN ($)	WEIGHT PER FISHERMAN (kg)
1000.00 - 5999.99	2	4.1	5,152.91	6,498
6000.00 - 11999.99	1	6.3	11,389.86	14,363
12000.00 - 12499.99	1	8.3	12,326.39	15,544
12500.00 - 12599.99	2	12.5	12,476.27	15,733
12600.00 - 12699.99	4	20.8	12,655.49	15,959
12700.00 - 12999.99	1	22.9	12,973.48	16,360
14000.00 - 14499.99	5	33.3	14,033.72	17,697
14500.00 - 14999.99	2	37.5	14,798.17	18,661
16000.00 - 16999.99	2	41.7	16,961.48	21,389
18000.00 - 18699.99	4	50.0	18,734.63	23,625
18000.00 - 18999.99	1	52.0	18,737.63	23,628
19000.00 - 20999.99	1	54.1	20,563.28	25,237
20000.00 - 20999.99	2	58.3	20,893.17	25,931
21000.00 - 21999.99	1	60.4	20,935.99	26,347
22000.00 - 22999.99	1	62.5	22,652.05	26,401
23000.00 - 23999.99	12	87.5	23,474.39	28,565
24000.00 - 24999.99	1	89.5	24,912.10	29,602
28000.00 - 28999.99	1	91.6	28,323.58	31,415
32000.00 - 32999.99	3	97.9	32,659.70	35,717
34000.00 - 34999.99	1	100.0	34,691.17	41,185
FINAL TOTAL	48		18,558.15	23,401

Source: Freshwater Institute, Fisheries Economics

ermen is mainly harvested on a competitive basis. Given the exclusive marketing jurisdiction of the Corporation, the extent of the Corporation's success in developing markets for suckers plays a very important part in the financial accounts of Lake Winnipegosis fishermen. Assuming that markets for suckers can be sustained by the Freshwater Fish Marketing Corporation, owners wages will depend largely on each fisherman's share of the production that will be bought.

3.8.1 Summary Analysis of Lake Winnipegosis Cost-Earning Survey

Table 12 provides a summary of the distribution of production and the value of production for the 1980 Lake Winnipegosis open water fishery. For each level of production, owners wages and cash flow data obtained from cost-earning survey and calculated in the capital budgeting model are presented to illustrate the performance of the industry. The net cash flow is calculated as a residual after all other costs, including owners wages have been covered.

It is apparent that 22 of the 48 fishing enterprises are not generating a sufficient cost flow to cover the amortized investment costs. Once again, these fishermen might be considered as operating in the short run where investments are regarded as sunk. In the short run these enterprises are covering short run (variable) costs and perhaps contributing marginally to long run (fixed costs) or to enhanced owners wages. To the extent that performance cannot

TABLE 12

Performance of Lake Winnipegosis fishing enterprises given fisherman wages: cash flow residual

HARVEST PER FISHERMEN (kg)	NUMBER OF FISHERMEN	GROSS REVENUE ($)	OWNERS WAGES ($)	CASH FLOW ($)	AMORTIZED INVESTMENT ($)	NET CASH FLOW ($)
6,498	2	5,152.91	1,123.59	2,452.14	6,652.29	-4,200.15
14,363	1	11,389.86	1,312.08	3,737.85	6,652.29	-2,914.44
15,544	1	12,326.39	1,340.39	4,169.52	6,652.29	-2,471.94
15,733	2	12,476.27	1,344.92	4,238.99	6,652.29	-2,413.23
15,959	4	12,655.49	1,350.33	4,322.05	6,652.29	-2,330.17
16,360	1	12,973.48	1,359.94	4,466.02	6,652.29	-2,186.20
17,697	5	14,033.72	1,391.98	4,918.82	6,652.29	-1,733.40
18,661	2	14,798.17	1,415.09	5,280.10	6,652.29	-1,422.12
21,389	2	16,961.48	1,480.46	6,100.79	6,652.29	-551.48
23,401*	48	18,558.15	1,528.68	6,652.29	6,652.29	90.65
23,625	4	18,734.63	1,534.05	6,742.87	6,652.29	162.14
23,628	1	18,737.63	1,534.12	6,815.32	6,652.29	163.10
25,237	1	20,563.28	1,572.68	7,328.83	6,652.29	676.61
25,931	2	20,893.17	1,589.32	7,550.32	6,652.29	898.10
26,347	1	20,935.99	1,599.29	7,683.08	7,683.08	1,030.86
26,401	1	22,652.05	1,600.58	7,700.32	6,652.29	1,048.09
28,565	12	23,474.39	1,652.44	8,390.96	6,652.29	1,738.73
29,602	1	24,912.10	1,667.29	8,721.91	6,652.29	2,069.69
31,415	1	28,323.58	1,720.74	9,300.53	6,652.29	2,648.31
35,717	3	32,659.70	1,823.84	10,673.51	6,652.29	4,021.28
41,185	1	34,691.17	1,954.89	12,418.61	6,652.29	5,766.39

* mean

be improved, these fishermen might be expected to exit from the fishery at such time as reinvestment in the enterprise is required. Imputed minimum wages for owners at all levels of production is less than $2000.00. In this regard, the low value of production ($0.79/kg) and the considerably higher fishing costs associated with operating 40 foot in-

board Lake Winnipegosis boats are factors that contribute to the low incomes for owners. It is noted however, that production at or greater than the average generates a residual net cash flow which may be used to offset owners wages. The extent to which the net cash flow contributes to average wages will be examined in the next section.

3.8.2 Implicit Wages to Owners and Employment Implications

Although Table 13, presents essentially the same data, owners wages have been calculated as a residual after all other costs, including amortized investment costs, have been covered. This provides a perspective of the implicit wages available to fishermen. Under the restrictive assumption that owners wages be calculated as a residual, it is apparent that the implicit wages of 18 fishermen are negative. Given the average Canadian fishermens income of $10,795.00, it is apparent that all Lake Winnipegosis fisherman wages are below the national average.

It will be noted that for the highest level of production (41,185 kg) that the fishermen's wages were $9,643.48. To achieve an income at parity with the average Canadian income for fishermen, production would have to be increased to 43,746 kilograms. Based on the total harvested production of 1,123,254 kilograms, in order to provide fishermen with the individual quotas totalling 43,746 kilograms, the number of fishermen would have to be reduced to 23.

TABLE 13

Performance of Lake Winnipegosis fishing enterprises given amortization cost: owners wages residual

HARVEST PER FISHERMAN (kg)	NUMBER OF FISHERMEN	GROSS REVENUE ($)	OWNERS WAGES ($)	NET CASH FLOW ($)
6,498	2	5,152.91	-6,004.34	0
14,363	1	11,389.86	-2,413.04	0
15,544	1	12,326.39	-1,882.18	0
15,733	2	12,476.27	-1,797.22	0
15,959	4	12,655.49	-1,695.65	0
16,360	1	12,973.48	-1,515.39	0
17,697	5	14,033.72	-914.40	0
18,661	2	14,798.17	-481.08	0
21,389	2	16,961.48	745.15	0
23,401*	48	18,558.15	1,649.55	0
23,625	4	18,734.63	1,750.23	0
23,628	1	18,737.00	1,751.58	0
25,237	1	20,012.94	2,474.83	0
25,931	2	20,563.28	2,786.78	0
26,347	1	20,893.17	2,973.78	0
26,401	1	20,935.99	2,998.05	0
28,565	12	22,652.05	3,966.73	0
29,602	1	23,474.39	4,436.91	0
31,415	1	24,912.10	5,251.85	0
35,717	3	28,323.58	7,185.61	0
41,185	1	32,659.70	9,643.48	0
43,746**	-	34,691.17	10,795.00	0

* mean
** harvest required to achieve average Canadian fishermens' wages

Once again, this illustrates the trade off between employment and income levels.

3.8.3 Price and Employment Implications

Although increased production of non-quota fish species offers a potential opportunity to improve incomes to fishermen, this is subject to the success of the Freshwater Fish Marketing Corporation establishing additional markets. Since comparatively few markets have been established to date, it is doubtful that production will be expanded beyond current levels. Consequently, this will not result in increased incomes to fishermen. Due to the social problems associated with reducing the number of fishermen, it would appear that increased incomes are possible only through an increase in the prices received by fishermen.

Table 14, illustrates the range of prices required in order to provide Lake Winnipegosis fishermen with an income at parity with the average income of Canadian fishermen. It is apparent that given a weighted average price of $0.79 per kilogram, it would be necessary to allocate individual quota of 43,746 kilograms to achieve an income consistent with the average wage of $10,795.00. Production less than this level, will require that the selling price be continually increased. For example, based on the mean production (23,401 kg), the price required by fishermen would have to be $1.23 per kilogram. Since this price is approximately 62% of the Freshwater Fish Marketing Corporation selling price, the Corporation price would approximate $3.60 per kilogram. Given an earlier discussion concerning the

TABLE 14

Price required to cover total costs including average Canadian fishermens income

HARVEST PER FISHERMAN (KG)	NUMBER OF FISHERMEN	SALES PRICE PER KG ($)	GROSS REVENUE ($)	OWNERS WAGES ($)	NET CASH FLOW ($)
6,498	2	3.30	21,466.53	10,795.00	0
14,363	1	1.81	26,065.47	10,795.00	0
15,544	1	1.69	26,412.15	10,795.00	0
15,733	2	1.68	26,467.64	10,795.00	0
15,959	4	1.66	26,533.98	10,795.00	0
16,360	1	1.62	26,651.69	10,795.00	0
17,697	5	1.52	26,044.17	10,795.00	0
18,661	2	1.46	27,327.16	10,795.00	0
21,389	2	1.31	28,127.97	10,795.00	0
23,401*	48	1.23	28,718.61	10,795.00	0
23,625	4	1.22	28,784.36	10,795.00	0
23,628	1	1.21	28,785.24	10,795.00	0
25,237	1	1.15	29,257.57	10,795.00	0
25,931	2	1.13	29,461.30	10,795.00	0
26,347	1	1.12	29,583.41	10,795.00	0
26,401	1	1.11	29.599.26	10,795.00	0
28,565	12	1.05	30,231.87	10,795.00	0
29,602	1	1.03	30,538.93	10,795.00	0
31,415	1	.98	31,071.14	10,795.00	0
35,717	1	.90	32,334.01	10,795.00	0
41,185	3	.82	33,939.16	10,795.00	0
43,746**	-	.79	34,691.17	10,795.00	0

* mean

** harvest required to achieve average Canadian fishermens' wages

competitive nature of the market for fish, at this price production would not likely clear the market. Therefore, to enable fishermen to earn higher incomes, greater production is required.

3.8.4 Conclusion

The commercial fishery of Lake Winnipegosis operates under a system of individual non-transferable pickerel quota entitlements issued to a maximum of 48 licenced commercial fishermen. The decline in pickerel stocks however, has meant that in practice the majority of individual quotas for pickerel are not filled, leaving the lake quota as an impossible target of pickerel production. As a result, when markets for non-quota fish species such as sucker are available, fishermen actively compete with each other to maximize their share of the sucker production that will be purchased. To the extent that sucker harvests represent the major species production from Lake Winnipegosis, the fishery actually operates on a competitive basis. Given the escalating costs of operating 40 foot Lake Winnipegosis boats and the shortage of premium priced pickerel stocks, it is impossible for licence holders to generate satisfactory returns from fishing. Assuming that markets for the current composite species production from Lake Winnipegosis can be maintained, it is apparent that the existing harvests are insufficient to provide fishermen with the average wage for Canadian fishermen without reducing the size of the fleet.

Chapter IV

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND CONCLUDING COMMENTS

4.1 OVERVIEW

In spite of public assistance and incentive programs to improve the economic performance of the fishing industry and the development of the Freshwater Fish Marketing Corporation to improve the marketing of fisheries products, the commercial fishing industry of Manitoba may generally be characterized as operating on the margin of financial viability. Low incomes to fishermen remain a serious concern to the industry and to governments.

A major constraint to improving the economic performance of the fishing industry appears to be an implicit policy objective of generating employment benefits through commercial fishing activity. Given the productive capacity of Manitoba's lakes, this objective appears to be in conflict with an objective of increasing fishermens incomes. In this regard, a capital budgeting model was developed to illustrate the trade-offs between serving the objectives of generating employment and increasing fishermens incomes. To this end, the model permitted analysis of the levels of production and range of prices required for a fishing enter-

prise to break-even financially. This, in turn, provided the basis for assessing the number of fishing enterprises that a fishery could economically support. The Lake Winnipegosis fishery and Lake Winnipegs' Grand Rapids and Koostatak fisheries were used to empirically illustrate the trade-offs between the number of fishing enterprises which could be employed and the resultant incomes to fishermen.

4.2 SUMMARY

Commercial fishing in Manitoba has a relatively short history. Beginning soon after Europeans settled in the region, fish harvesting assumed an economic role in the production of food. In this regard, Manitoba's growth and settlement was closely tied to the establishment of the commercial fishing industry.

Technological innovations, which resulted in the introduction of gas engines, motorized fishing gear and nylon gill nets revolutionized fish harvesting and substantially increased production. The increased productivity of individual fishing enterprises coupled with unrestricted access to the fishing grounds led to concerns that fish stocks were being depleted. To control overexploitation, therefore, regulations, including gear restrictions, closed seasons, closed areas, aggregate quotas and individual non-transferable quotas were instituted. While these control measures may have been relatively successful in protecting fish

stocks, they have not been entirely successful in controlling excessive investments in fish harvesting. Further, to the extent that fisheries resources have been used as a "spring-board" for regional growth and development and for generation of employment, management objectives have contributed to the phenomenon of "too many fishermen chasing too few fish." The solution to this problem hypothesized by economists over the past thirty years, has been discussed extensively in the literature review.

Despite the extensive literature on the "tragedy of the commons", as the concepts applies to fisheries, entry controls were not instituted until excess fishing effort had been permited to develop. And, in an effort to mitigate this situation, a fundamental restructuring of the marketing and processing sector of the commercial fishery in 1969 was considered to be a requirement to improve the performance of the industry. This lead to the establishment of the Freshwater Fish Marketing Corporation, a federal Crown Corporation with and exclusive mandate to market fish. This marketing structure plus a number of public assistance programs, designed to improve the welfare of fishermen, have undoubtedly provided some benefits to fishermen. However, the majority of fishermen in 1980 still earned incomes below the average income earned by Canadian fishermen.

From an economic perspective, the solution to this problem continues to be to control the number of vessels at

a level that will permit the greatest value of production at the least possible cost. In this regard the empirical analysis of the Lake Winnipegosis, Grand Rapids and Koostatak fisheries provides guidance as to the trade-offs between policy decisions related to income and employment.

4.3 CONCLUSIONS

Obviously, the selling price that fishermen receive for landed production, and the limits placed on the volume of allowable production, contribute to the current conflicts in income and employment objectives in Manitoba's commercial fisheries. The ability to forecast the financial viability of fishing enterprises, at different levels of production and for a range of prices provides a means of evaluating conflicting policy objectives. Based on an empirical analysis of the Lake Winnipeg Grand Rapids fishery, the Lake Winnipeg Koostatak fishery and the Lake Winnipegosis fishery, the objective of maximizing employment in these fisheries is in conflict with the objective of increasing incomes to fishermen and generating the greatest possible net value of production.

Given limits to the price that the market is prepared to pay for fish and given harvest quota limits it is apparent that a remedy to improve fishermens' earnings will necessitate a fundamental decision between employment and income objectives. Failure to make adjustments in the size

of fishing fleets harvesting Manitoba's fisheries will likely perpetuate conditions associated with non-economically viable fishing enterprises.

4.3.1 Grand Rapids

In the Grand Rapids fishery, individual fishing production is competitively fished by 65 commercial fishermen and the majority of fishermen are unable to cover long run operating costs. Gross incomes range from $1,465.37 to $19,260.67, with fishermen earning an average income of $7,414.58. Given the price of fisheries production and the annual allowable harvest, it is apparent that an increase in the average income can be achieved only by a reduction in the size of the fleet. For example, the fishery has a production potential to support a fleet of 25 or 26 vessels with an average income to fishermen of $10,795.00 after all other costs have been covered.

4.3.2 Koostatak

The Koostatak fishery operates under a system of individual non-transferable quotas assigned to 27 fishermen licenced in the fishery. Gross incomes to fishermen range from $1,166.19 to $17,020.06, with fishermen earning an average of $4,721.36. In this regard, the majority of fishermen are unable to cover long run operating expenses. Considering the price at which fisheries production will clear the market and the fixed annual allowable harvest, it is apparent

that an increase in the average income of Koostatak fishermen can be achieved only by a reduction in the size of the fleet. That is, the fishery has a production potential to support a fleet of 15 or 16 fishing enterprises, with an average income to fishermen of $10,795.00, after all other costs have been covered.

4.3.3 Lake Winnipegosis

In the Lake Winnipegosis fishery, although individual non-transferable quotas for pickerel are assigned to 48 licenced fishermen, the fishery is essentially competitively fished for pickerel and the majority of fishermen are unable to cover long run operating costs. Gross incomes to Lake Winnipegosis fishermen range from $5,152.91 to $34,691.17, with fishermen earning an average income of $18,558.15. Due to the scarcity of pickerel stocks, fishermen are unable to fill quota entitlements for pickerel. As a consequence, when markets are available, fishermen competitively resort to the harvest of non-quota fish species. Given the price of fisheries production and the annual allowable harvest, it is apparent that an increase in the average income can be achieved only by a reduction in the size of the fleet. Assuming that current markets and species composition can be maintained the fishery could support a fleet of 23 or 24 vessels with an average income to fishermen of $10,795.00 after all other costs have been covered.

4.4 RECOMMENDATIONS

It has been said that profit is the cost of ensuring that a business has a future. Thus, investments in harvesting fisheries resources should generate sufficient profits to cover long run owning and operating costs. Unfortunately, this situation does not appear to hold for the fisheries under study. Given the prices and the production potentials of the respective fisheries, it is apparent that the size of the fleets must be reduced if profits are to be made.

The requirement to reduce the size of the fleets to permit profits to emerge places the fisheries manager on the "horns of a dilemma". On the one hand, such a reduction could be expected to create unemployment and opposition from fishermen. On the other hand, failure to rationalize the size of the fleets would undoubtedly perpetuate the current performance of the fishing industry. In this regard, a licencing system is required that will permit adjustments in the size of the fleet over time to minimize social dislocation.

On the basis of the literature review and the empirical analysis presented in this study, two recommendations are made:

(1) Establish a system of individual transferable quotas for a share of the annual harvest on those fisheries where there is a danger of excessive fishing effort.

(2) Establish a royalty system on fisheries production reflecting the value of the species harvested.

4.4.1 Individual Transferable Quotas

A system of individual transferable quotas presents a management option to rationalize the size of the fleet and mitigate social dislocation with a minimum of government involvement. Essentially, individual non-transferable quotas, where they currently exist could be made transferable for a share of the annual harvest. Where individual quotas do not currently exist, transferable quotas for a share of the annual harvest could be assigned individual fishermen based on historic production levels. Such a licencing system would provide fishermen with quasi property rights to a share of the fisheries resources. In this regard, individual fishermen could invest in his fishing enterprise in accordance with the value of his quota volume. Individual fishermen would be free to adjust the size of his annual harvest by negotiating the transfer of quotas from other fishermen. Fishermen could enter into or exist form the fishery as is done in other businesses. The tragedy of the commons, as the concept applies to fisheries resources would be mitigated. Government could minimize its involvement in determining who is a fisherman and who is eligible to fish. Finally, to the extent that the analysis presented in this study is correct, it is expected that an adjustment in the size of

the fleets would take place in the direction of fewer vessels. Further, the adjustments would take place over time which would minimize social dislocation.

4.4.2 Commercial Fishing Price System

The equity of assigning quota property rights to existing fishermen may be called into question. That is, should existing fishermen be assigned special benefits to the exclusion of other members of society. It is recognized that new entrants could enter the fishery by negotiating the transfer of quota shares. However, as the size of the fleet adjusts and rents (super profits) emerge, these profits may be capitalized into the assets of individual enterprises and captured by the original fishermen as "wind-fall" profits at the time that a quota is transferred. That is, the original fishermen would be able to transfer a quota at a price that would include the value of the super profits. As a result, rents would be eroded in much the same manner as that which occurs in an open access fishery. Further, Manitoba tax payers, who pay the cost of public management, would forego a direct return from the resource. The recommended solution to this problem would be to charge a royalty on fish harvested as is done with such public resources as timber and oil. This would be equitable to fishermen in the sense that they would pay for the special privileges granted them. At the same time, by taxing some of the rents away annually, the erosion of the rents at the time a quota is transfered

would be mitigated. Finally, the licencing system would be equitable to the fisheries resources stock holders, the Manitoba taxpayers, who could receive a direct return from the resource - a Heritage Fund.

4.5 CONCLUDING COMMENTS

The concept of individual transferable quotas has been discussed, not without a little apprehension, over the past few years. In Manitoba, the proposal has been presented to commercial fishermen for consideration and their reluctance to fully endorse the concept is quite understandable. The fishing industry has been subjected to numerous regulations designed to protect fish stocks, and individual fishermen have accommodated to these regulations. The introduction, of a new licencing system, no matter how beneficial it may appear in the long run, introduces an element of uncertainty. That is, it raises the question of how the "new rules of the game" would affect them and how they will adjust to them. In this regard, the conclusions registered by fishermen and fisheries managers must be given careful consideration.

4.5.1 Monopolistic Control

A concern has been registered that an individual transferable quota licencing system would permit a few individuals to gain a major share of a fisheries annual allowable harvest. As a consequence, there is a fear that other fishermen would become indentured to a corporate entity in a manner similar

to that which is said to have occured between fishermen and fish buyers, prior to the advent of the Freshwater Fish Marketing Corporation. To the extent that the present structure of the fish harvesting level of the fishing industry may be described as destructive competition, the transition to a monopolistic structure may appear remote. Nevertheless, if there is a danger of a high level of concentration (ie control of a large share of the annual harvest by a few persons), regulations governing limits to the quasi property rights confered in the licencing system should be given careful consideration. This is a topic for further discussion.

4.5.2 Liability for a Reduction in the Annual Harvest

The liability placed on a fisheries management agency in the event of a decline in fish stocks, having conferred specific quota shares to individual fishermen, has also been registered as a concern. In the event of a catastrophic loss in fish stocks, would the management agency be liable for compensation for such losses to fishermen? It should be stressed that an individual transferable quota licencing system cannot be expected to eliminate all risk to the fishing industry. Certainly, the logging industry is confronted by the risk of a forest fire. Similarly, the farming industry is confronted by losses resulting from drought. Thus, while the proposed licencing system cannot be expected to eliminate the risk of a loss of fish due to natural causes,

it will also reduce the risk of economic loss by permitting the industry to adjust to changing markets, costs and technology.

Given the legal implications of liability however, it is suggested that individual quota shares should be assigned as a percentage of the annual allowable harvest of individual quota species rather than a specific volume of production. Thus, in the event of a natural disaster, fishermen would still retain a share of the available harvest. It might also be possible to establish the annual allowable harvest at a level which would provide a fair degree of buffering capacity. In this regard, surplus harvests in any particular year might be auctioned off. This would provide the basis for establishing a royalty on fish harvests.

4.5.3 Allocation of Quota Shares

The question of how quota shares would be allocated among existing fishermen has been raised. Where non-transferable quotas currently exist, the answer is quite straight forward. Non-transferable quotas for specified quota species could be simply converted to transferable quotas for a share of the annual harvest of quota species. In the event that no quota shares exist, individual transferable quota shares may be calculated as a percentage of historic annual production.

4.5.4 Allocation of New Quota Shares

Interest has also been expressed how a system of individual transferable quotas might be adjusted over time to accommodate increased demand for utilized species resulting from new technology and/or markets. At least two options for future consideration appear feasible. First, quota shares could be granted to existing fishermen based on a percentage of historic production. Second, following the precedence set in the management of other public resources, quota shares could be auctioned off to the highest bidder.

4.5.5 Extracting a Resource Rent

The ability to charge the commercial fishing industry a price for the fish it harvests, when the industry cannot currently cover the owning and operating costs has also been seriously called into question. Notwithstanding the observation that the industry is not currently generating any rent, failure to initiate a pricing system immediately would permit the industry to capitalize super profits into its assets as they emerge. Thus it is suggested that a nominal price, based on a percentage of the landed value of quota species, be considered. More significantly, quotas should be transfered only with the understanding of the new quota holder that an increased percentage of the landed value will be charged commencing at the time of a quota transfer. This would reduce the possibility of "wind fall" gains and eroded rents. The question of the appropriate price to charge, might be analyzed by the model presented in this study.

4.5.6 Market Control of the Harvest

Finally, it has been noted that fisheries harvests are controlled, unlike a milk marketing board or an egg marketing board, on the basis of the biological production capacity of the resource rather than on the extent of the market. Thus, there is an implicit assumption that the market will always absorb fisheries production at current prices. This is not always true. For example, in the event of a market decline, there is a danger of harvesting too many fish which can clear the market only at a reduced price and a loss in total revenue. Conversely, depending on the elasticity of demand (ie the degree of responsiveness of the quantity of a good demanded to changes in market price), it might be possible to generate a greater total revenue by selling a smaller volume of fisheries production at a higher price. Thus the question has been raised whether managing the annual harvest on the basis of market criteria rather than biological criteria might be a more appropriate strategy. From this perspective, will the issuance of individual transferable quotas constrain a market approach to regulating annual harvests? Further, would a reduction in the annual harvest to take advantage of market forces require subsidy payments to affected fishermen?

In responding to the first question, it should be noted that the marketing structure that currently exists in Manitoba cannot limit the volume of fish harvested. The

Freshwater Fish Marketing Corporation is legislatively required to purchase all fish offered for sale and cannot curtail output in the manner of an egg or milk marketing board. Further, while the Freshwater Fish Marketing Corporations is confronted by inelastic demands for certain species at certain times of the year, it must compete for the balance of the year on international markets with identical fish produced in Ontario and with alternative fish products produced in the Atlantic the Pacific and the rest of the world. In this case, the Freshwater Fish Marketing Board is a price taker. Thus, notwithstanding the opportunities to exploit markets, by restricting ouptut, this option does not currently appear to exist. Of equal importance, it should be noted that the issuance of individual transferable quotas will not necessarily result in increased production that would disrupt existing market leverage. Rather, the proposed licencing system will simply place the existing volume of production under a different system of control. In this instance, production and existing markets may be regarded as a given. This does not negate the relevance of controlling production in accordance with market factors. Certainly, these factors should be given careful consideration when the development of new fisheries and/or the subsidization of increased harvests from existing fisheries is being contemplated.

Referring to the second question, it is doubtful whether a system of individual transferable quotas would confer any more of a liability on a management agency to guarantee a given level of production than the system currently in place. To the extent that individual quotas confer quasi property rights to a share of the annual harvest, quotas could be adjusted downwards in a manner similar to that which might occur through a catastrophic decline in fish stocks. Further, to the extent that total revenues might be increased by a reduction in the total harvest, fishermen could benefit with high prices per unit of production and, perhaps, lower total operating costs. Regardless, this is a legal-political consideration which cannot readily be answered in this study.

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Appendix A

GRANTS LOANS AND SUBSIDIES TO FISHERMEN

1) Manitoba Agricultural Credit Corporation

2) Fisheries Improvement Loans - Fisheries and Oceans

3) Vessel Subsidy Program - Fisheries and Oceans

4) Ice Chilling Assistance Program - Fisheries and Oceans

5) Special ARDA

6) DREE Facility Improvement Grants

7) LIP Grants Construction of on shore facilities

8) Industrial Development Bank

9) Communities Economic Development Fund

10) Manitoba Development Corporation

11) Northern Fisherman's Freight Allowance

12) Canada Manpower Industrial Training Program

13) Co-operative Loans and Loan Guarantee Board

Appendix B

DEFINITION OF TERMS

Commercial Fishery

A commercial fishery refers to a fishery, in which the primary function of the participants is the capture and sale of fish for profit.

Commercial Operator

A commercial operator refers to a licensed commercial fishermen who has helpers or other fishermen working for him.

Common-property

The term common-property refers to resources that are not privately owned but are owned by everyone. In this study a common-property resource refers to the fisheries resources of Manitoba, owned in common but are exploited under conditions of individualistic competition.

Fisheries Rationalization

Fisheries rationalization refers to the reorganization of government policies and regulations that affect the management of fisheries resources. The object of rationalization is to attain greater economic efficiency and optimum benefits from fisheries resources.

Limited Entry

The term limited entry refers to a commercial fishery where the entry of commercial fishermen to the fishery is regulated or restricted. In this study limited entry is also synonymous with restricted entry.

Market

In this study, market refers to a commercial outlet for fish commodities that are achieved through trade as determined by supply and demand.

Maximum Sustainable Yield

The maximum sustainable yield (MSY) refers to the largest annual catch of fish that can be sustained without harming the reproductive ability of the stock (Roedel 1975).

Morphoedaphic Index

The morphoedaphic index (MEI) is a measure of the capability of a lake to produce fish. The MEI is obtained by measuring the mean depth of a lake and expressing it against the measured amount of total dissolved solids in the water. The MEI may then be used to determine the total amount of fish biomass produced per acre per year.

Open Access

In this study open access refers to a commercial fishery where there are no restrictions or controls regulating entrance to the fishery - that is everyone who wishes to fish can do so.

Overcapitalization

Overcapitalization describes a process that results in an excessive use of capital in comparison to what is required to produce the same level of output using less capital. This phenomenon has been referred to as "capital stuffing".

Resource

A resource may be defined as any commodity that meets a need now or in the future.

Resource Rent

A resource rent may be broadly defined as a return to the resource after all other factors of production (ie labour and capital engaged in harvesting the resource) have been paid.

Royalty

A royalty (e.g. tax on fish landings) is a compensation or share of the proceeds from fisheries resources paid to the owner (in this case society) for the right to use the resource.