PROPERTY RIGHTS AND THE LAKE WINNIPEG COMMERCIAL SKIFF FISHERY: A CASE STUDY

BY

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A practicum submitted to
the University of Manitoba in partial fulfillment of the
requirements of the degree of

MASTER OF NATURAL RESOURCES MANAGEMENT

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ABSTRACT

As ideas, philosophies, issues and management goals change over time there arises a need to review, analyze, and evaluate the utility of resource allocation mechanisms.

The introduction of a commercial fishery allocation system combining restrictive licensing and individual quotas to Lake Winnipeg removed incentives to exploit the resource to the point of "bionomic equilibrium" . Individual quotas on Lake Winnipeg represent a right in property. However, the relevance of these property rights with respect to resource allocation is limited because property rights are not combined with rights of ownership. Experience and dependency were chosen as criteria to allocate harvest rights in order to achieve the goal of equalizing potential income opportunities among fishermen.

The system of licenses and associated individual quotas has failed to achieve the goal of equalizing potential producer income. What has resulted is a stratification of fishermen among three distinct production categories. The effects of the allocation system on the distribution of fishermen among these categories were different between the two chosen community areas (Berens River, and the Gimli Region) during the 1972-1979 period. In Berens River the distribution of licenses and associated quota entitlements among fishermen remained relatively constant during this period. In the Gimli region the proportion of fishermen in the smaller production categories declined while the proportion in larger categories increased. An economic analysis of skiff operations by production category indicated that in both communities the economic viability of skiff operations appeared to increase as an operator acquired additional quota entitlements. Income and economic viability were limited by maximum

allowable quota limits.

The ability of the current allocation system to achieve the present management goal of "establishing and maintaining a viable commercial fishing industry wherein participants can earn a reasonable return on investment and time, and with limited social disruption" is doubtful. The terms economic viability and reasonable returns are subject to interpretation, definition and perspective. Therefore evaluation and analysis with respect to achievement of management goals in absolute terms is difficult. However, the degree to which an allocation system based on existing criteria may improve upon current individual or industry economic performance is limited. These limitations are due to: (1) maximum allowable quota limits and, (2) the inability of resource managers to manipulate the current system in a direction that would decrease participation and result in a more concentrated distribution of fishing rights among fishermen.

An alternative would be to allow fishermen to purchase or sell all or portions of individual quotas at their own discretion. A properly structured and active system of marketable property (harvest) rights may enhance the achievement of economic goals for commercial fisheries management. Skiff operators would be able to decide to what extent production could be expanded (or contracted) to take advantage of what appear to be open-water production economies. Initially, this alternative may involve high information and communication costs, although once these have been met, the system would likely be less complex and costly to administer than the current mechanism. The ability of this system to decrease participation in the industry is not guaranteed, but is dependent upon the nature of ownership rights issued.

The marketable property rights alternative is attractive because there need be no involuntary dislocation of individuals from the fishery and it is flexible enough to address either employment or income objectives. The major constraint of the alternative is that it requires the accumulation of a cash surplus by fishermen. In areas such as Berens River, income levels may not be sufficient to generate a surplus after meeting living expenses. In areas such as Gimli where income levels are higher and employment opportunities more abundant, the cash surplus "problem" may be less of a constraint.

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GLOSSARY

Bionomic Equilibrium - The simultaneous equilibrium of fish populations and fishing effort. The long-run equilibrium position is the condition toward which the fishery and fish stock will always tend, in the absence of intervention. At equilibrium, the level of effort established will incur costs just equal to total receipts. The net value generated is zero.

Bootleg - To produce or sell illicitly. Harvesting fish in excess of the legally allowable individual quota entitlement.

Commercial Fishery - A fishery in which the participants may use a variety of gear to capture quantities of fish in which the principle purpose is the sale of fish for profit.

Devise - The act of giving or disposing of real property by will; to bequeath.

Economic Rent - The amount of income in excess of the minimum amount required to induce a factor to remain in its present occupation. Economic rent is said to exist when the revenue generated exceeds the amount strictly necessary to assure the existence and continuance of services for which it is payment.

Efficiency - The maximum consumption of goods and services given the available amount of resources, or what is logically equivalent, the use of a minimum amount of resources to produce or make available for consumption a given amount of goods and services.

Externality - The essence of externalities, whether in production or consumption is that their costs or benefits are not reflected in market prices, and so the decision of the consumer or firm creating the externalities on the scale of the externality-creating activity generally does not take its effect into account.

An external economy is defined as a favourable effect on one or more persons that emanates from the action of a different person or firm; it shifts the cost or utility cure if each it benefits, and such an externally caused shift should be distinguished from any internal movement along the affected individual's own cost curve.

An external diseconomy is defined in the same way, except that it refers to external harm that is done to others. The case where expansion of fishing by others in limited waters serves to shift up each boat's cost curves would be an example of an external diseconomy. Economists have argued that social welfare would be increased if the private consumption or production decision were modified so as to take the external effect into account.

Firm - For the purposes of this report, the term will refer to a licensed skiff operation on Lake Winnipeg consisting of a licensed operator, skiff, twin outboards and associated gear.

Fisheries Management - The analysis of alternative decisions and implementation of a decision or decisions to meet human goals and objectives through the use of the aquatic resource.

Fishery - A system composed of habitat, aquatic, animal and plant populations and man. A "fishery" refers to the location in which fish occur, the fish themselves and the equipment that is used to capture them. A fishery may differ with season, species or group of species.

Goal - The end toward which a strategy tends; an ideal or aim which is usually in general or abstract terms. Goals provide general direction to agency programs and are useful in public relations.

Lease - A lease is a relationship created by a contract that gives a tenant or lessee the right to posses and use property held or owned by a landlord or lessor. A contract of lease must be for a definite period, having a certain beginning and ending. It must also confer exclusive possession on the lessee and reserve to the lessor a consideration called rent.

License - According to English law, a license is merely permission granted to a person to do some act which but for such permission it would be unlawful for him to do so. When the word "license" is found in a statute the presumption is that it is intended to designate a purely personal privilege not capable of being assigned or transferred by the licensee to anyone else and which comes to an end on the death of the licensee.

Limited Entry (Access) - Refers to a fishery where everyone who wants to fish may not necessarily have the right to fish commercially. In a limited entry fishery, the undue competition which results from excessive entry might be effectively controlled.

Metric Equivalents - 1 kilogram = 2.2 pounds (lbs.)
1 kilometer = .625 miles
1 meter = 39 inches (3.25 feet)

Model - An abstraction of the structure, dynamics and function of a fishery or fisheries component. Models may be verbal, graphical, physical or mathematical. A formalization of a theory.

Objective - A statement of the desired result of a decision or set of decisions; aspirations for preferred or desirable conditions; end prints to be reached which are attainable and measurable.

Open Access - Is used to refer to a commercial fishery in which everyone who is able to fish is allowed to fish. There is no control on the number of entrants into the fishery, and the amount of competition is not controlled.

Ownership - Ownership in property, whether by private party or estate, is understood to consist of the right to use, to change form and substance, and to transfer all rights in property (through sale) or some rights (through rental, lease). The rights of ownership are implicitly dependent upon the right of exclusion. Ownership of property rights allows the holders of the rights to use property in the ways conferred in the concept of ownership to the exclusion of all other persons.

Policy - Decisions related to objective or goal determination which a group sets for itself plus the selection of methods to achieve goals and objectives. The goal may be concrete, abstract, narrow or general. The term, public policy, refers specifically to government decisions and is usually used to define several decisions related to a general purpose.

Policy instrument - Specific programs, projects and institutions designed to achieve policy goals and objectives. The vehicles through which policy goals and objectives may be reached.

Property rights - The set of rules within society which regulates the relationships among individuals towards the use of scarce resources. Property rights do not refer to relations between men and materials or objects, but rather to the sectional behavioural relations among men that arise from the existence of things and pertain to their use. Property rights assignments specify the norms of behaviour with respect to things that each and every person must observe or bear the cost of non-observance.

Rationalization - The reallocation of resources under open-access to a controlled system designed to maximize the net value of production from the economy as a whole.

Resource rent - A residual payment to a particular resource (fish in this case) after all factors of production have been paid for their contribution to the production process.

Resource rent is a specific kind of economic rent.

Roll-over option - The option which until June 1, 1981, allowed Lake Winnipeg fishermen to harvest a seasonal quota entitlement (summer, fall, winter) or portion thereof during any fishing season within a fishing year, regardless of the season designation attached to the quota. As of June 1, 1981, the option of "fishing ahead" was removed. In other words, following seasons quota could no longer be harvested during preceding seasons (During a fishing year, the summer season precedes fall which precedes winter). Fishermen are still allowed to harvest uncaught quota from a preceding season in a subsequent season. Uncaught quota from any season in a fishing year cannot be harvested (rolled over) in a succeeding year.

CHAPTER ONE

BACKGROUND, PROBLEM AND RESEARCH OBJECTIVES

1.0 INTRODUCTION

A commercial fishery is an industry unlike others. While newly developing fishing operations sometimes show brief periods of extraordinary profitability, mature fisheries frequently are found in depressed states.[1]

Average economic returns to fishing, which are usually low relative to the surrounding regional economy have been attributed to the open accessibility of the fishery resource. With unlimited and unrestricted access to the resource, an exploited fish stock yielding a resource rent--i.e. a return over and above the necessary cost of operation--attracts additional fishermen to share in these benefits.[2] New entrants increase aggregate industry costs and further deplete stocks.[3] Eventually, net benefits are dissipated thus halting the influx of manpower and equipment. The result is a "mature" fishery characterized by depleted stocks and low average returns.

The "maturation" of the Lake Winnipeg commercial fishery followed closely the events described above. Within the last 10-12 years, Provincial and Federal governments have introduced measures to mitigate the economic and biological damage caused by open access. Entrance into the Lake Winnipeg commercial fishery is limited by a system of restrictive licensing. Licensees have been allotted individual shares or quotas of the fishery. Primary criteria used to allocate quota entitlements among licensees and prospective licensees are experience in and dependence upon the fishery.[4] An alternative to using the experience and dependency criteria for allocational purposes would be to allow fishermen to buy,

sell, or otherwise trade all or a portion of quota entitlements among themselves. Lake Winnipeg commercial fishery harvest rights currently allocated by government, would become marketable property rights allocated by the market institution.

The study is directed primarily toward fishery managers confronted with developing consistent decision-making criteria when evaluating and analyzing alternative methods of commercial fishery allocation. Hopefully, this report will aid the fishery manager whose training is predominantly biologically based, to incorporate non-biological principles into management goals, objectives and strategies. The writer's intent will be to evaluate and analyze the marketable property rights allocation alternative relative to the current system of allocating commercial fishery harvest rights on Lake Winnipeg.

A more detailed discussion of the research problem, objectives, outline and design will be preceeded by a brief discussion of the environment within which the Manitoba and Lake Winnipeg commercial fisheries operate.

1.1 Jurisdiction and Governance

There are two sources of fisheries jurisdiction; (1) legislative authority and (2) proprietary rights. Legislative authority over fisheries was placed in the Parliament of Canada mainly because the waters of one province may flow into another and because fish in their feeding and spawning migrations do not respect provincial boundaries.[5] By Head 12 of Section 91, of the British North America (BNA) Act the Parliament of Canada is given exclusive legislative authority over "Sea Coast and Inland Fisheries." Provincial proprietary rights are derived by virtue of

Section 109 of the BNA Act which provides for provincial ownership of "All Land, Mines, Minerals and Royalties," and by Heads 5 and 13 of Section 92 which provide for provincial legislative authority in the "Management and Sale of Public Lands" and "Property and Civil Rights" respectively. Manitoba, Saskatchewan and Alberta did not receive legislative jurisdiction over management of public lands until 1930 when the Natural Resources Transfer Agreement was ratified. The Agreement stated in part, as follows; "Except as otherwise provided, all rights of fishery shall belong to and be administered by the province. The right to dispose of fishery by sale, license, or otherwise, subject to the exercise by the Parliament of Canada of its jurisdiction over sea-coast and inland fisheries."

While the federal legislative authority is an obvious source of management authority the matter of proprietary rights is less obvious. Under British common law, the owner of the bed of a water course has the exclusive right to "Catch fish and the right to grant, rent, or lease, this privilege to others."[6] The beds of all Manitoba lakes and rivers have been, since 1930, Provincial Crown Land. The province holds the right to take or use the resource which is an effective source of ownership jurisdiction. The Province's direct legislative competence for management of lakes and rivers as public lands gives it the power to indirectly manage the fish resource produced on the land, which results in an overlapping with federal legislative powers. The reason(s) such a confusing overlap is permitted is explained by Dawson.[7]

> ...Unless a clear conflict between the two jurisdictions exists, both federal and provincial legislation can occupy the same field, with the courts deciding each case on its merits; and not necessarily recognizing the federal power as paramount.

The present situation is that the federal government is understood to be responsible for the protection of fisheries and their development for the profit of all Canadians.[8] It fulfills this responsibility through the legislative power to regulate on fishing seasons, quotas, size limits, and tackle. The central government's legislative authority appears to have the potential to seriously impinge on the province's property rights. Federal authorities could prohibit the right to take fish entirely by a season closure. Use of legislative authority in this manner, that is, as a means of virtually confiscating the province's property rights, would constitute an abuse of this power.[9] The central government has never "abused" such authority in this manner.

Section 34 of the Fisheries Act (R.S.C.1970, Chapter F-14) empowers the central government to set regulations "for the proper management and control of the sea coast and inland fisheries." Regulations under this section may affect a province's exercise of proprietary rights, but do not infringe directly upon them. The regulations under Section 34 of The Fisheries Act pertaining to Manitoba are known as the Manitoba Fisheries Regulations (C.R.C., 1978, C.843). Appendix A provides a general description of some of the regulations and administrative procedures currently applied to the Lake Winnipeg fishery.

The Canadian government has delegated the formulation and administration of these regulations to Manitoba. Thompson[10] has described the formal process of governance as follows:

> ...The provincial government may recommend that changes be made to the federal fisheries regulations made under Section 34 of the Federal Fisheries Act (R.S.C. 1970 Chapter F-14). Upon receipt of request for amendment of legislation, the federal government will review the changes and examine the legalities before approval of amendments to fisheries regulations. Approved amendments are passed by the Privy Council as Orders-in-Council and are gazetted to become law.

1.2 Background

Manitoba's commercial fishery can be divided into four distinct areas, the Lake Winnipeg, Lake Manitoba, Lake Winnipegosis and the Northern fisheries (Fig. 1). The species of primary commercial importance are pickerel (walleye), sauger, and whitefish, although northern pike tulibee (ciscoe), perch, suckers, carp, trout, goldeye, sturgeon, catfish and bullheads, are also marketed.

During the 1979/80 season, Manitoba's commercial fishery produced 36,665,400 lbs. of fish with a landed value of $12,796,450.[11] Approximately 3,213 persons were engaged in the primary sector of the industry.[12] More detailed summaries of production and primary employment by area are found in Tables 1 and 2.

1.2.1 *History*

The commercial fishery in Manitoba started on a large scale in the 1880's at the time of the construction of the Canadian Pacific Railway and the arrival of Icelandic immigrants on the west shore of Lake Winnipeg.[13] The fishery developed quickly in terms of catch and resource inputs of capital and labour in the primary sector. The majority of commercial production was, and is currently exported to the United States, particularly the North Central and North Eastern markets.

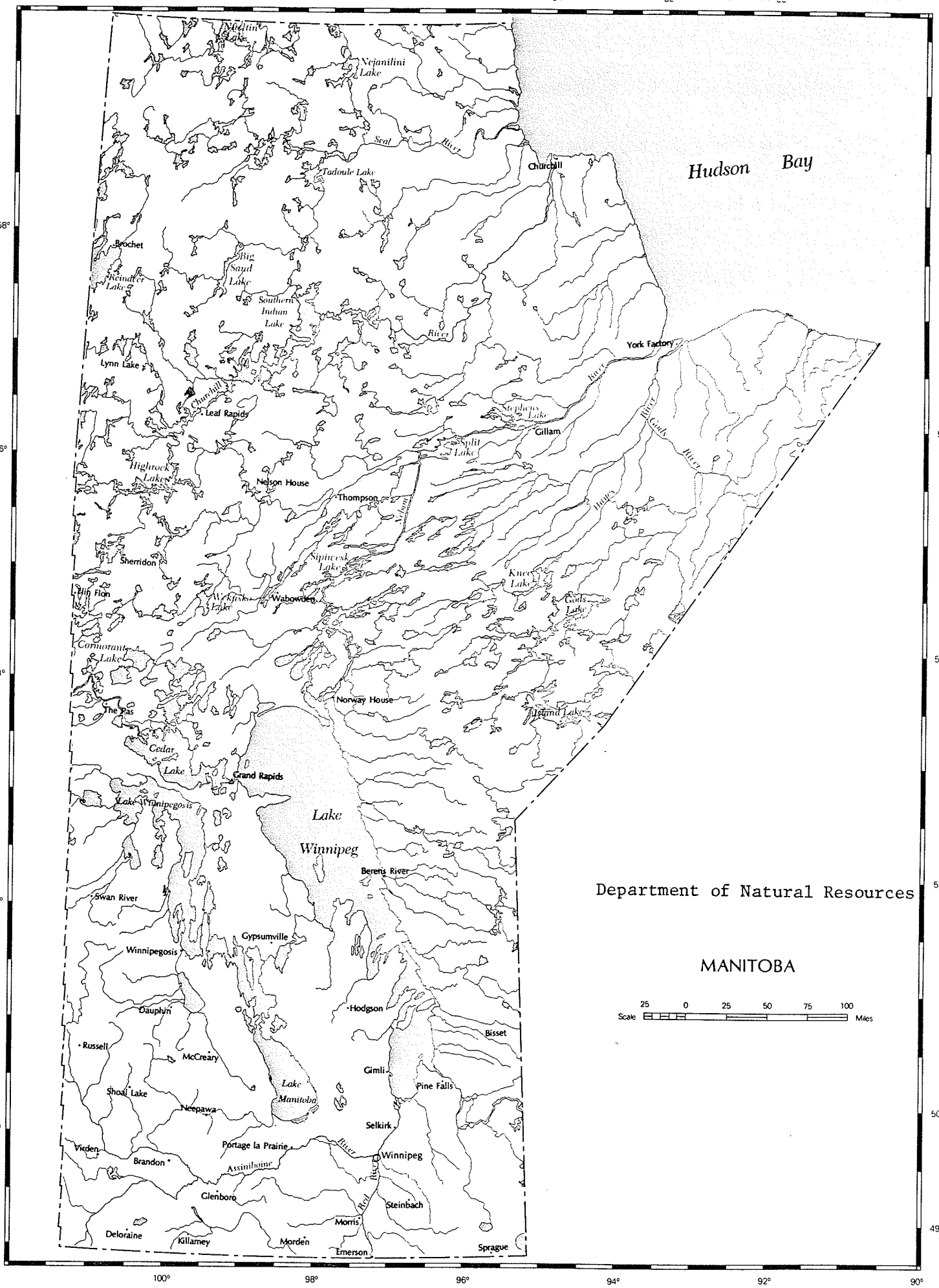
Nejanilini Lake
Seal River
Tadoule Lake
Churchill
Hudson Bay
Brochet
Reindeer Lake
Big Sand Lake
Southern Indian Lake
Lynn Lake
Churchill River
Leaf Rapids
York Factory
Stephens Lake
Gillam
Split Lake
Gods River
Highrock Lake
Nelson House
Thompson
Nelson River
Hayes River
Sherridon
Sipiwesk Lake
Knee Lake
Gods Lake
Pin Flon
Wekusko Lake
Wabowden
Cormorant Lake
Norway House
Island Lake
The Pas
Cedar Lake
Grand Rapids
Lake Winnipegosis
Lake Winnipeg
Berens River
Swan River
Gypsumville
Winnipegosis
Dauphin
Hodgson
Bisset
Russell
McCreary
Gimli
Pine Falls
Lake Manitoba
Shoal Lake
Neepawa
Selkirk
Virden
Portage la Prairie
Winnipeg River
Brandon
Assiniboine River
Winnipeg
Glenboro
Steinbach
Red River
Morris
Deloraine
Killarney
Morden
Emerson
Sprague
Department of Natural Resources
MANITOBA
Scale
25 0 25 50 75 100
Miles
58°
56°
54°
52°
50°
49°
100°
98°
96°
94°
92°
90°

TABLE 1
PRODUCTION (ROUND WEIGHT) AND INITIAL LANDED VALUE OF FISH
TAKEN BY COMMERCIAL FISHING IN MANITOBA, 1979/80

SPECIES	Northern Lakes		Lake Winnipeg		Lake Manitoba		Lake Winnipegosis		Other Lakes		Total Production and Value to Fishermen	
	lbs.	$	lbs.	$	lbs.	$	lbs.	$	lbs.	$	lbs.	$
Whitefish	3,860,500	1,078,200	3,848,850	1,784,850	34,700	13,300	260,800	81,100	1,374,800	546,950	9,378,800	3,504,400
Pickerel	1,575,800	1,017,300	3,168,600	2,038,050	1,557,500	1,412,250	592,500	397,500	650,800	519,900	7,565,200	5,385,000
Sauger	2,200	800	2,732,000	1,484,950	445,400	269,800	5,500	2,500	9,500	5,250	3,194,600	1,763,300
Pike	1,631,700	263,550	870,900	186,050	511,600	113,550	1,634,500	332,750	1,292,000	291,200	5,940,700	1,187,100
Tullibee	305,300	43,950	70,900	7,250	300	50	Tr	Tr	349,600	80,250	726,100	131,500
Trout	113,000	35,900									113,000	35,900
Mullet	587,900	38,300	461,100	29,150	3,097,600	247,250	3,926,200	255,550	378,800	36,650	8,451,600	606,900
Goldeye	17,700	3,550	200	50			7,200	2,050	1,200	350	26,300	6,000
Perch	900	350	103,600	43,700	10,000	4,500	1,100	500	9,800	4,650	125,400	53,700
Carp			269,200	28,300	763,500	59,750	22,800	1,850	4,000	350	1,059,500	90,250
Maria			900	200							900	200
Sturgeon	16,800	23,450	200	250							17,000	23,700
Bass			41,200	5,350							41,200	5,350
Catfish			25,100	3,150							25,100	3,150
TOTAL:	8,111,800	2,505,350	11,591,900	5,611,300	6,440,600	2,120,450	6,450,600	1,073,800	4,070,500	1,485,550	36,665,400	12,796,450

SOURCE: Government of Manitoba, Department of Natural Resources, Annual Report, 1979/80. p. 105.

TABLE 2

FISHERMEN EMPLOYED IN MANITOBA'S COMMERCIAL FISHERY, 1979/80

	Northern Lakes	Lake Winnipeg	Lake Manitoba	Lake Winnipegosis	Other Lakes	Overall
SUMMER						
Licencees	629	668	45	47	80	1448
Hired men or helpers	82	173	0	125	0	380
Total	711	841	45	172	80	1828
WINTER						
Licencees	215	251	395	101	251	1207
Hired men or helpers	71	116	341	113	189	824
Total	286	367	736	214	440	2031
ANNUAL						
Licencees	698	694	418	112	275	2163
Hired men or helpers	122	221	340	191	189	1050
Total	820	915	758	303	464	3213

Those fishermen who fish more than one area or season or who fish both as hired men and licencees are counted only once in the appropriate "total" column. (The hired man - licencee duplicate is counted as a licencee). Since duplications are eliminated, the table does not add horizontally or vertically.

SOURCE: Government of Manitoba, Department of Natural Resources, 1979/80 Annual Report. p. 103.

Initially, fishing occurred during the summer season only.[14] Sailboats were used on Lakes Winnipeg, Manitoba and Winnipegosis, to transport fishermen to and from fishing grounds.[15] Fishing was restricted to the southern lakes because of their proximity to the transportation networks required to move the product from lakeside to market. Around 1900, a winter fishery developed, with the invention of a jigger, which made setting nets under ice easier.[16] In the early 1900's, summer fishing was discontinued on Lake Manitoba to encourage individuals to farm.[17] The internal combustion engine was first introduced and universally accepted in the 1920's. Nylon gill nets replaced cotton in the 1950's resulting in an estimated three-fold efficiency increase.[18] With improved transportation networks and increase in demand, commercial fisheries were initiated in the North in the 1940's.[19]

In the early years, species of commercial importance included whitefish, goldeye, and sturgeon. The sturgeon and goldeye fisheries were quickly depleted and today are of only minor economic importance. Whitefish could be salted or smoked and hence were less subject to spoilage than other species such as pickerel. The ability to preserve fish in this manner was important due to the time lag between harvesting and delivery. As transportation systems improved and refrigeration techniques were perfected, other species increased in commercial importance. Eventually, pickerel and sauger surpassed whitefish in importance and today are the most economically significant commercial species.

1.2.2 *Lake Winnipeg Administrative Procedure and Guidelines*

Only the most salient features of the Lake Winnipeg licensing and

administrative procedures will be outlined here, as a more detailed discussion is found in Appendix A.

The fishery is divided into four distinct seasons, summer, fall, winter and summer whitefish. An individual may not hold concurrently a summer and summer whitefish license, nor may an individual hold more than one license for any one season. Therefore, the maximum number of licenses any operator can legally fish is three.

The lake is divided into 12 community areas for licensing purposes (Fig. 2). The majority of the 12 community licensing areas are regulated by an individual quota system, while three areas employ area or aggregate quotas during the summer season only.

Vacated licenses are allocated primarily on the basis of a "points" system based on experience and dependency. The individual who has accumulated the most points in the season the vacancy is created, is usually awarded the license. Only individuals from within the community area are allowed to compete for a vacant license from within that area. A license may be transferred from parent to child irrespective of the points accumulated by the child providing the child meets minimum eligibility criteria.

The summer whitefish fishery is concentrated in the north-end of the lake and is limited to 44 licenses. A summer whitefish license entitles the holder to harvest 35,000 lbs. of whitefish. The boats used in this fishery are usually 39 ft. or more in length, and have much greater harvesting capacities than the smaller 18-20 ft. skiffs used in the other open water fisheries. License vacancies in this

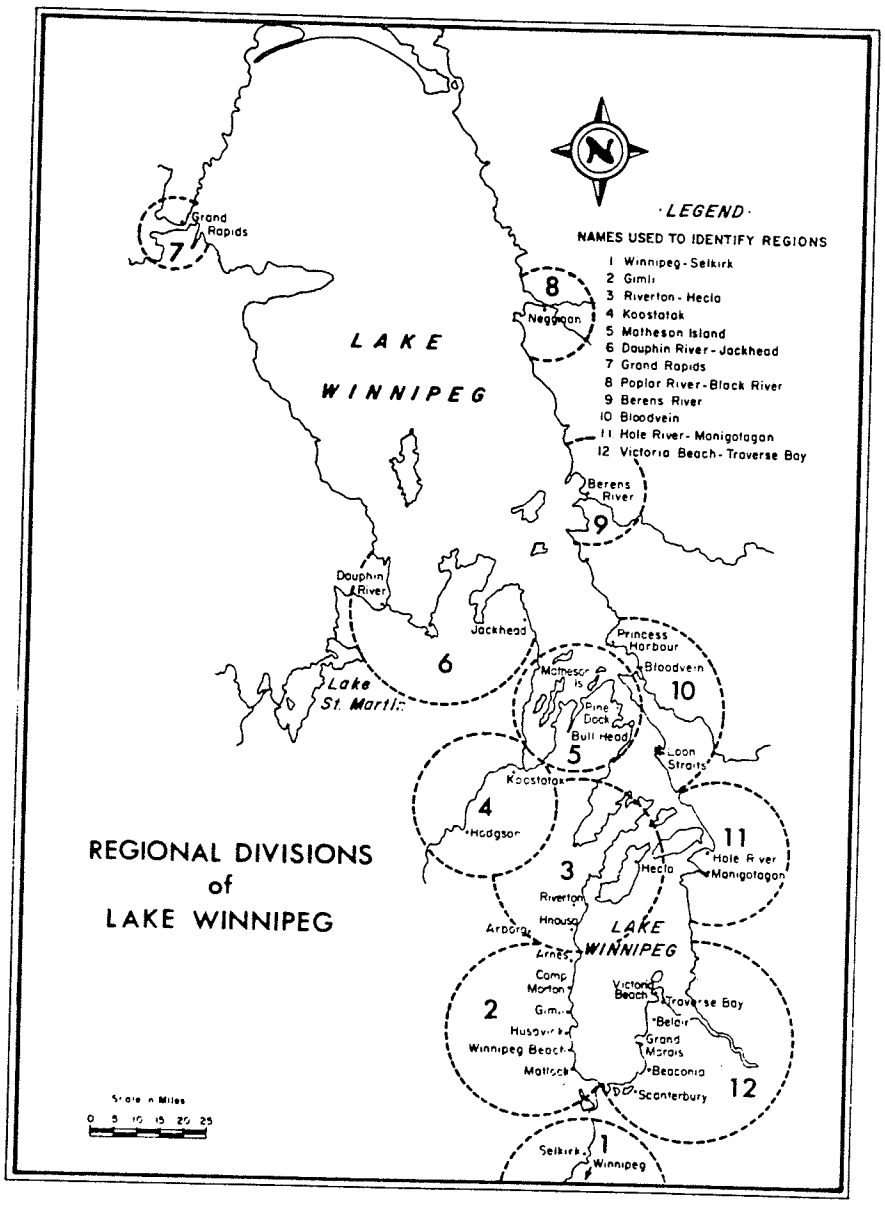

Fig. 2 Lake Winnipeg Community Licensing Areas
Source: England R. E. and Peters, R. 1971 "Fisheries Adjustment Study," (Department of Mines, Resources and Environmental Management).

fishery are filled through established criteria, but not on a community area basis. Competition for entry is on a lake-wide basis.

A unique aspect of the Lake Winnipeg administrative procedure was that an individual holding either a summer, fall or winter license, or any combination of these could choose to harvest the sum of the individual seasons in any season that year. Should a portion of a seasonal quota not be harvested during that season, the unharvested portion could be "rolled-over" to a subsequent season in that year, or the operator could choose to harvest a subsequent season's entitlement in any preceeding season. Unharvested portions could not be "rolled-over" into another fishing year. (A fishing year extends from June 1 - March 31 over two calendar years.) Recently, (January, 1981) the option of fishing ahead (harvesting a subsequent season's quota in a preceeding season) was revoked and only unharvested entitlements of preceeding seasons may be harvested in subsequent seasons.

1.2.3 *Marketing*

Initially (1880's), private individuals caught and marketed fish. Gradually, seven major fish companies gained control of the marketing industry. These companies purchased fish from the primary producer and then handled, processed, and distributed the product to market. With problems of increasing disparity between fishing and non-fishing income, a duplication of services provided by the existing fish companies and the weak bargaining position experienced by the Canadian exporters and fishermen in selling freshwater fish, a commission of inquiry was formed to investigate the fishing industry of western Canada.[20] The McIvor Commission called

for the formulation of a government controlled monopoly to act as a selling agent for freshwater fish.[21] In May, 1969, the Freshwater Fish Marketing Corporation (FFMC) was created and given exclusive jurisdiction over inter-provincial and export-trade in freshwater fish. The FFMC's area of jurisdiction includes an area of Northwestern Ontario and all of Manitoba, Saskatchewan, Alberta and the Northwest Territories (Fig. 3). The formation of the FFMC induced the demise of the marketing function of fish companies.

The objectives of the Corporation as stated in Section 23 of the Freshwater Fish Marketing Corporation Act (R.S.C.1970, Chapter F-13) are as follows:[22]

a. Marketing fish in an orderly manner.
b. Increasing returns to fishermen.
c. Promoting international markets for, and increasing inter-provincial and export trade in fish.

The same legislation requires that all fish commercially harvested, other than fish sold directly to the consumer, must be sold through the FFMC.[23] Section 21 of the Freshwater Fish Marketing Act specifically states:

> Except in accordance with the terms and conditions set forth in any license that may be issued by the Corporation in that behalf, no person other than the Corporation or an agent of the Corporation shall:
>
> a. export fish from Canada.
>
> b. send, convey or carry fish from a participating province to another participating province or to any other province.
>
> c. in a participating province, receive fish for conveyance or carriage to a destination outside the province; or
>
> d. Sell or buy, or agree to sell or buy fish situated in a participating province for delivery to another participating province, or any other province, or outside Canada.

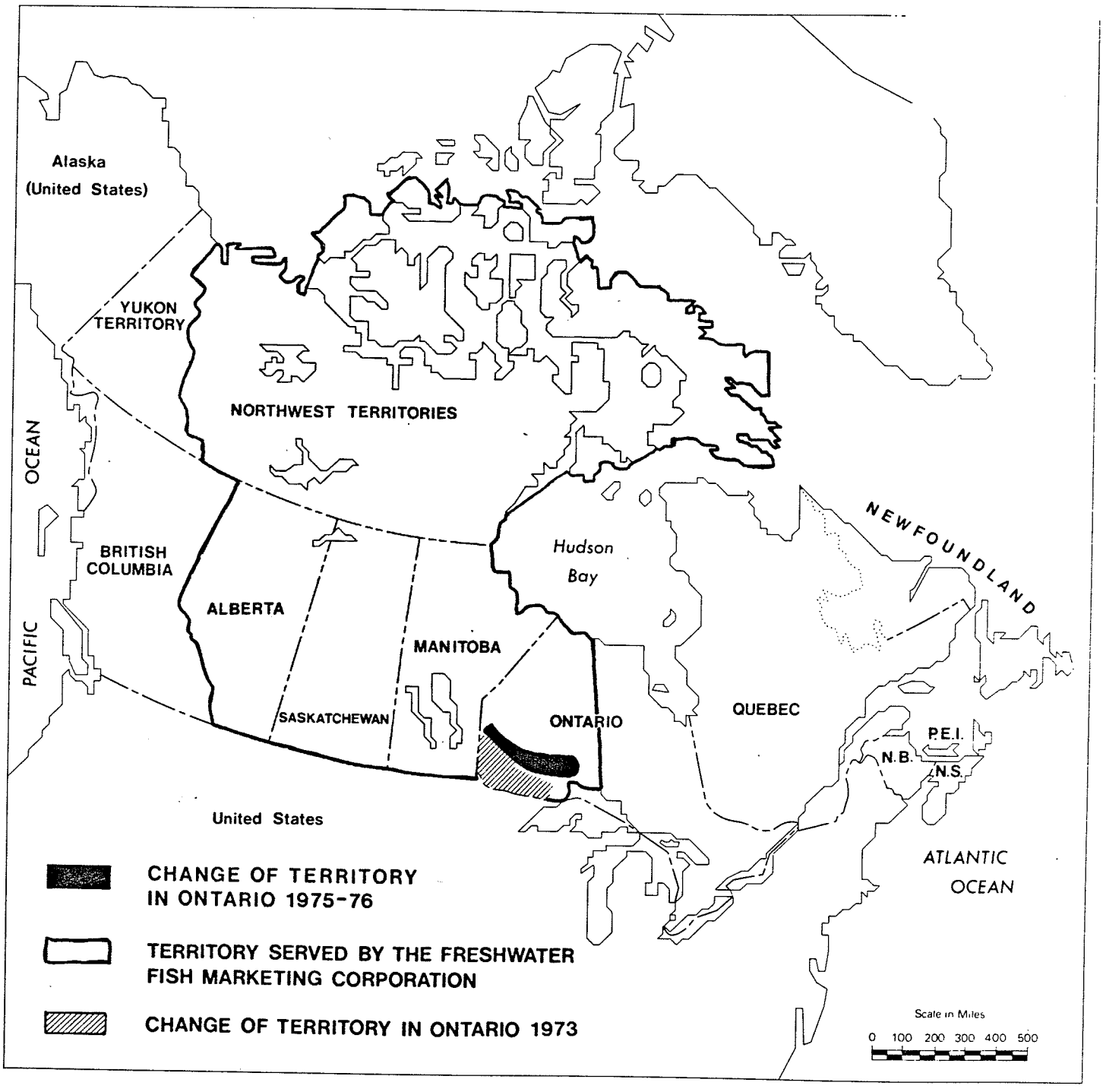

Fig. 3 Freshwater Fish Marketing Corporation Area of Jurisdiction
Source: Freshwater Fish Marketing Corporation Annual Report, 1977-78.

Regulations under the Manitoba Fisheries Act (R.S.M.1970, Chapter F-90) are complementary to and reinforce the exclusive authority of the FFMC to market fish within the Province.

1.3 Goals in Fisheries Management

1.3.1 *The Variety of Choices*

Early measures of fisheries control tended to aim directly at conservation of fish stocks. The fisheries problem was viewed as a biological phenomenon requiring scientific solution. Consequently, the primary goal of the first fishery managers was conservation of fish stocks.

During the past two decades, the focus of government involvement in the fishery has changed from one of conservation to one of management. Those vested with management authority, have been required to incorporate goals other than conservation, into management strategies in order to meet specific human needs and objectives. Biological terms and conditions are paramount though in that the non-biological components of management cannot even be considered unless the biologist can ensure a continued supply of the quantity and quality of the resource. Once the biological conditions have been met, other components of the fisheries management problem may be addressed.

As fisheries management evolved from a biological science to an interdisciplinary field of study, problems confronting management authority became more complex. The present-day fisheries resource manager is aware that the "output" of any management program may be the consequence of a multiple objective function.[24] The very nature of such a function destroys simplicity in modelling or policy formulation.

There are a broad range of different desirable outcomes (goals) of any fisheries management system. These goals are usually considered to be:[25]

1. Conservation of fish populations
2. Maximization of net economic output
3. Increased incomes to fishermen
4. Income redistribution
5. Balance of payment equilibrium
6. The promotion of regional development and stabilization of communities
7. Generation of employment opportunities
8. Freedom from arbitrary Government action

Obviously, to the extent that the above are mutually exclusive or otherwise conflicting, it would be impossible to maximize all. Further, goals may be ranked ordinally, but each cannot be compared or measured on the basis of a single common denominator.[26] Regardless of whether fisheries' policy is formulated at the political or administrative level, the decision-makers will be forced to choose, either implicitly or explicitly, among conflicting goals.

1.3.2 *Provincial Goals*[27]

Presently, the Fisheries Branch, Department of Natural Resources, is guided in the management task by a series of policies, legislation, and unwritten guidelines. The major goal of Fisheries Branch is to manage the fishery resource in a manner "that will result in the greatest long-term benefit to Manitobans and ensure survival or improvement of fish stocks." To enhance this major goal, two additional goals are recognized. The first is "to establish and maintain a viable commercial fishing industry wherein participants can earn a reasonable return on their investment and time, and with limited social disruption." The

second is, "to maintain, enhance, and diversify angling opportunities for Manitobans to meet existing and future demands."

Fisheries Branch has identified a number of issues relating to the utilization of the resource and more directly to the allocation of the resource between competing uses and users. The development of a set of fundamental principles and criteria are required to improve consistency in allocative decisions. Relative to this basic issue is the need to evaluate current licensing criteria and procedures for all commercial net fisheries in the Province. The economic viability of the commercial fishery has also been identified as an important issue. Associated with this issue is the need to develop a system of access rights which would allow for the transfer and exchange of such rights thus permitting opportunities for business development and providing commercial users with a secure form of resource access.

Future management of the fishery in a manner which will achieve Provincial goals will involve responding to these issues relating specifically to methods and criteria for allocating the resource.

1.4 Problem Statement

The Lake Winnipeg commercial fishery encompasses a range of geographic locations, each subject to a variety of physical, biological, economic, cultural, and political factors. The ability of policy instruments to achieve management objectives will be affected by these diversities. Conversely, the range of effects due to the use of alternative management schemes upon the individuals and communities involved may be as great as the diversities.

Policy instruments should be designed to move the industry in the direction of management goals and be capable of addressing current issues. Before deciding to alter the existing management scheme, the evolution of current circumstances as they have developed within the present mechanism of fishery resource allocation must be reviewed. A framework should be developed to evaluate and analyze the limitations of the current administrative system to achieve management goals relative to the limitations of the marketable property rights alternative. Finally, the potential effects of utilizing the marketable property rights alternative require identification and analysis.

1.5 Research Objectives

The purpose of this study is to evaluate and analyze the current mechanism of allocating the Lake Winnipeg commercial fishery resource (based on experience and dependency criteria) relative to allowing fishermen to buy, sell, or trade, all or portions of existing quota entitlements (the marketable property rights alternative). The research will attempt to identify potential effects upon institutions and individuals of utilizing the marketable property rights alternative. More specifically, the research will focus upon the objectives of:

1. Determining the structure of the commercial fishing industry as it has evolved under the current system of resource allocation, within two distinct Lake Winnipeg communities (the Gimli region and Berens River) with respect to: (1) the number of skiff operations; (2) production, (3) the relative size of the operations; (4) the distribution of fishing rights and production among operators and; (5) the economic viability of skiff operations.

2. Developing an analytical framework within which evaluation, analysis, and identification of potential effects may be enhanced.

3. Establishing a set of criteria to evaluate the two alternative methods of allocating the commercial fishery resource.

4. Drawing conclusions and developing recommendations which will aid decision-makers in choosing between the two alternatives of allocation.

1.6 Research design

The basic design of the research is that of a case study. Knowledge of the particular cases provided the basis for the interpretive application of general ideas and theoretical concepts. Such an arrangement allowed for a more flexible and open-ended approach to the problem.

Case study is associated more with action objectives than those of pure knowledge.[28] The utility of case studies in identifying problems, proposing solutions, and determining the validity of alternative solutions has been recognized.[29] This association with adjustive action is based on the assumption that policy and programs can hardly proceed without something approximating full knowledge of its subjects.[30] However, such an assumption does not discount the interpretive power of general theoretical propositions for proceeding from case knowledge to appropriate action.

The reliability of recommendations based on case knowledge may be improved if the cases are considered "especially revealing for sets of phenomena.[31] An allocation system for The Lake Winnipeg commercial fishery must be flexible enough to accommodate the diverse nature of the industry and could not be expected to be "successful" widely, if it did not show some chance of working in the specific cases.

The two community areas, Berens River and Gimli, were chosen for the

purpose of illustrating diversity. The choice of communities unlike each other, allowed for the incorporation and consideration of unique and particular variables that might otherwise be overlooked. By emphasizing diversity, a more critical and rigorous analysis of the two allocational alternatives was possible.

Information from the Department of Natural Resources, Fisheries Branch and Freshwater Fish Marketing Corporation production records provided the data base from which the basic structure of the fishing industry within each community could be developed. The inclusion of data relevant to the 1972-73 through 1979-80 fishing periods allowed identification of changes and trends in industry structure. Net revenue calculations were limited to production attributed to open-water skiff activity and provide a preliminary indicator of economic viability. Information gathered from various Federal and Provincial reports and personnel provided the data base for community profiles.

The analytical framework consisted of a three-level hierarchy of conceptualized decision systems (the policy level, the institutional level, and the operating level).

1.7 Outline of the Study

Following this introductory chapter is a review of the related literature which provides the theoretical economic basis for fisheries management and the relationships between the concepts of property, the market institution and fisheries management. The third chapter consists of a discussion and summary of the findings as they relate to the structure of the fishing industry in each community. The fourth chapter

incorporates the findings into the analytical framework. Chapter five consists of a summary of the report and conclusions and recommendations drawn by the writer based on the research.

LITERATURE CITED

1. Copes, P., 1979 "Rational Resource Management and Institutional Constraints: The Case of the Fishery," School of Business Administration and Economics. Discussion Paper Series, (Simon Fraser University). p. 1.

2. Gordon, H.S., 1953 "Optimum Utilization of Fisheries Resources," Journal of the Fisheries Research Board of Canada, 100: 442-457, p. 448

3. Ibid., p. 450

4. Government of Manitoba, Department of Renewable Resources and Transportation Services, 1978, "Administrative Procedure and Guidelines for Lake Winnipeg Commercial Fishery."

5. Levelton, C.P., 1979, Toward an Atlantic Coast Commercial Fisheries Licensing System, (A report prepared for the Department of Fisheries and Oceans, Government of Canada). p. 22.

6. Thompson, A.R. and H.R. Eddy, 1973, "Jurisdictional Problems in Natural Resource Management in Canada" in Essays on Aspects of Resource Policy. (Ottawa, Information Canada). p. 76.

7. Dawson, R. 1970, The Government of Canada (Toronto, University of Toronto Press) p. 89.

8. Thompson, P.C., 1974, "Institutional Constraints in Fisheries Management" Journal of the Fisheries Research Board of Canada, 31. 1965-1981. p. 1979.

9. The opinion of the Privy Council in the Fisheries Reference Case of 1898, Atty.-Gen. of Canada vs. Atty.-Gen. of Ontario et al. (1898) A.C. 700

10. Thompson, P., 1974, op.cit., p. 1979.

11. Government of Manitoba, Department of Natural Resources, 1979/80 Annual Report. p. 105.

12. Ibid., p. 103.

13. Carruthers, B., 1976, "A History of Commercial Fishing in Manitoba" Conservation Comment, (Manitoba Department of Renewable Resources and Transportation Services). p.10.

14. Ibid., p. 11.

15. Ibid., p. 13.

16. Judson, T. A., 1961. "The Freshwater Commercial Fishing Industry of Western Canada" (unpublished Doctoral Dissertation, University of Toronto), p. 142.

17. Carruthers, B., 1976. op.cit., p. 15.

18. Lawler, G.C., 1950, "The Use of Nylon Netting in the Gill Net Fishery of Lake Erie Whitefish" The Canadian Fish Culturist 7: 22-24 p. 23.

19. Gislason, G.S., MacMillan, J.A. and J. Craven, 1976. "Economic Analysis of the Manitoba Commercial Freshwater Fishery" (University of Manitoba, Department of Agricultural Economics, unpublished draft) p.43.

20. McIvor, G.H., (Undated) "Report of Commission of Inquiry into Freshwater Fish Marketing" p. VII

21. Ibid., p. VII.

22. Freshwater Fish Marketing Corporation Act 1968-69, Chapter 21, 17-18, Elizabeth II Section 21, p. 465.

23. Ibid., Section 23, p. 466

24. Crutchfield, J.A., 1972, "Economic and Political Objectives in Fishery Management" in World Fisheries Policy Multidisciplinary Views, Rothschild, B.J., ed. (University of Washington Press, Seattle), p.76.

25. Ibid., p. 76.

26. Ibid., p. 77.

27. Government of Manitoba, Department of Natural Resources, Fisheries Branch, 1981, "Toward a Provincial Strategy for Manitoba Fisheries" (unpublished draft)

28. Eckstein, H., 1975, "Case Study and Theory in Political Science" in Strategies of Inquiry Handbook of Political Science, Vol.7 Greenstein, F. and N.W. Polsby, ed. (Addison-Wesley Pub. Co.) p. 82.

29. Ibid., p. 97.

30. Ibid., p. 82.

31. Ibid., p. 107.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 INTRODUCTION

This review is representative rather than comprehensive and primarily theoretical in nature. The economic discipline is borrowed from heavily, in addition to those of law and public policy.

The first section of the review will consist of a representative survey of the literature leading to the development and refinement of the basic economic models of fish production. Once an understanding of the models has been developed, the economic policy prescriptions become self-evident.

These prescriptions are of two distinct, but not mutually exclusive categories; one favouring the introduction and application of property rights to the fishery, and the other favouring government intervention in the industry through taxation. The use of taxes as a basis for fisheries rationalization programs will receive only cursory treatment in this review. Property rights and their application being a concept of primary importance to the study, will receive more extensive treatment and constitute the second major section of the review.

2.1 The Economic Theory of Fish Production

F. H. Knight's response to Pigou's critique of the competitive system of organization provided the initial foundation for the formulation of the economic theory of fish production. Pigou[1] used the example of two roads, one broad enough to accommodate traffic without crowding, but poorly graded and surfaced and the other a narrow road limited in capacity, but better graded and surfaced. The conclusions reached by Pigou were that "if trucks

were free to choose either road, they would tend to distribute themselves between the roads in such proportions that the cost per unit of transportation, or effective result per unit of investment, would be the same for every truck on both routes."[2] Whenever there is a difference in cost, to an additional truck, of using the two roads, the driver of any truck has an incentive to use the narrow road until the advantage is reduced to zero for all trucks. "Individual freedom in a competitive economy results in a bad distribution of investment between industries of constant and increasing cost and the case for social interference appears justified."[3]

Pigou's remedy was a government administered tax levied on the superior road. The tax would be adjusted "so the number of trucks on the narrow road would induce maximum efficiency in the use of the two roads taken together."[4] The revenue obtained from such a tax would be a clear gain to society since no individual truck would incur higher costs than if no tax had been levied.

Knight countered Pigou by arguing that Pigou had "reversed the most essential feature of competitive conditions."[5] The feature is that requiring private ownership of factors significant for production. "If the roads were subject to private ownership, a situation identical to that established by the imaginary tax would occur. The owner of the narrow road would charge a toll for the use of this road. The toll would exactly equal Pigou's ideal tax."[6] Knight contended the social function of ownership being to prevent an excessive investment in superior conditions.

Thirty years later H. Scott Gordon and Anthony Scott applied these basic theoretical concepts to the fishery. H. Scott Gordon substituted fishing grounds of different qualities for Pigou's roads. Such an analogy was used to explain the nature of equilibrium in the fishing industry "as

it occurs in the state of uncontrolled or unmanaged exploitation of a common-property fishery resource."[7] Gordon contended the "bionomic equilibrium" that exists in an exploited fishery "is such that the net yield (total value of landings minus total cost) is zero."[8]

The superior ground will yield a greater average product at every level of fishing effort (intensity). The inferior ground would yield nothing more "than outlaid costs plus opportunity income."[9] On such a ground average costs would equal average productivity. The better quality ground would be exploited to the point where the average yield obtained would equal that obtained from the inferior ground. The reason being every fisherman has an incentive to exploit the superior ground until superiority no longer exists, leaving the average productivity of both grounds equal. "The superior ground will be exploited to the same point as the inferior ground (where average product equals average cost) and the rent that should reflect the ground's superior capabilities would be reduced to zero."[10]

When access to the fishery is unrestricted the rent it may yield is capable of being appropriated by anyone. If gains resulting from conservative (efficient) use of the fishery cannot be captured by individuals, "it will pay every fisherman to enter the industry so long as he can earn something above his cash expenses plus opportunity costs."[11] Individual freedom in a competitive economy results in the dissipation of the rent in the superior (or any) fishing grounds in the same way the cost-savings of the superior road were eliminated in Pigou's example.

Scott's subsequent article agreed with much of Gordon's treatment of the fishery, although he chose to interpret the decision-making of individual fishermen with respect to marginal and average revenues and costs somewhat differently. However, the conclusion drawn was much the same; "the

optimal utilization of the fishery would occur when the difference between total revenues and total costs (rent) was maximized."[12] Scott proceeded a step further than Gordon by requiring the "allocation of common-property resources to maximizing owners, associations, cooperatives or governments" in order to reach such a social optimum.[13]

Crutchfield and Zellner proceeded to synthesize these initial concepts into a coherent analysis of the fishing industry. Their treatment of the relationship between biological and economic factors allowed for the deduction of the general function relating yield to effort (the input-output relationship). (Fig. 4)

Although the interactions between fishing effort and population dynamics may be very complex, the essential point can be made with a simplified model. Growth of fish populations will tend toward an equilibrium in which recruitment and growth are exactly offset by mortality.[14] The introduction of a commercial fishery simply means a higher loss to a new predator-man- and hence a smaller population. Given certain parameters such as water temperature, food supply and the level of activity of natural and human predators, the fish population will grow to a definite equilibrium size. At this population level there will be a determinate steady-state yield of fish to the given level of fishing effort. This is the "sustainable yield" in the sense that, in the long run, this rate of yield to the fishing industry will be exactly offset by the natural increase in the population.[15] If we assume no interaction between fishing effort and the rate of natural increase, the fish population is in equilibrium when the industry is catching fish at the same rate nature is replacing them.[16] Both population and yield will remain stable if none of the parameters change.

If the level of fishing effort is very low, the population will grow

to a large equilibrium size, but sustainable yield will be small. At high levels of fishing effort the population will have been so depleted that sustainable yield will also be low. Thus, it is argued, the sustainable yield is first an increasing, then a decreasing function of fishing effort.[17] Sustainable yield will achieve a maximum at some level of population between zero and that which would be established in the absence of fishing by man.[18] The yield effort relationship is dependent upon adjustment to a "steady-state". The effort consistent with a given population size must be applied over a sufficient length of time to allow for the equilibrating biological factors (recruitment, growth, mortality) to respond.[19]

Even if the exact relationship between yield and effort were known, the level of effort actually applied could still be dependent upon prices received and costs incurred. "Given the basic biological and technical relations between effort and yield, different combinations of costs and product prices will result in different levels of fishing activity by profit-seeking enterprises."[20] The adjustment process of individual enterprises will differ from other industries due to two significant factors: (1) the size and composition of the natural resource input (fish populations) varies with the level of production; (2) the resource input is not privately owned.[21]

The long-run equilibrium relationship (the simultaneous equilibrium of fish populations and fishing effort known as the bionomic equilibrium), between yield, revenues, effort, and costs is represented graphically in Fig. 4. At equilibrium the level of effort established will incur costs just equal to total receipts (pt. A, Fig. 4). The net value generated is zero. "With no restriction on new entry efforts to increase profits by reducing fishing effort, individually or collectively, would simply result

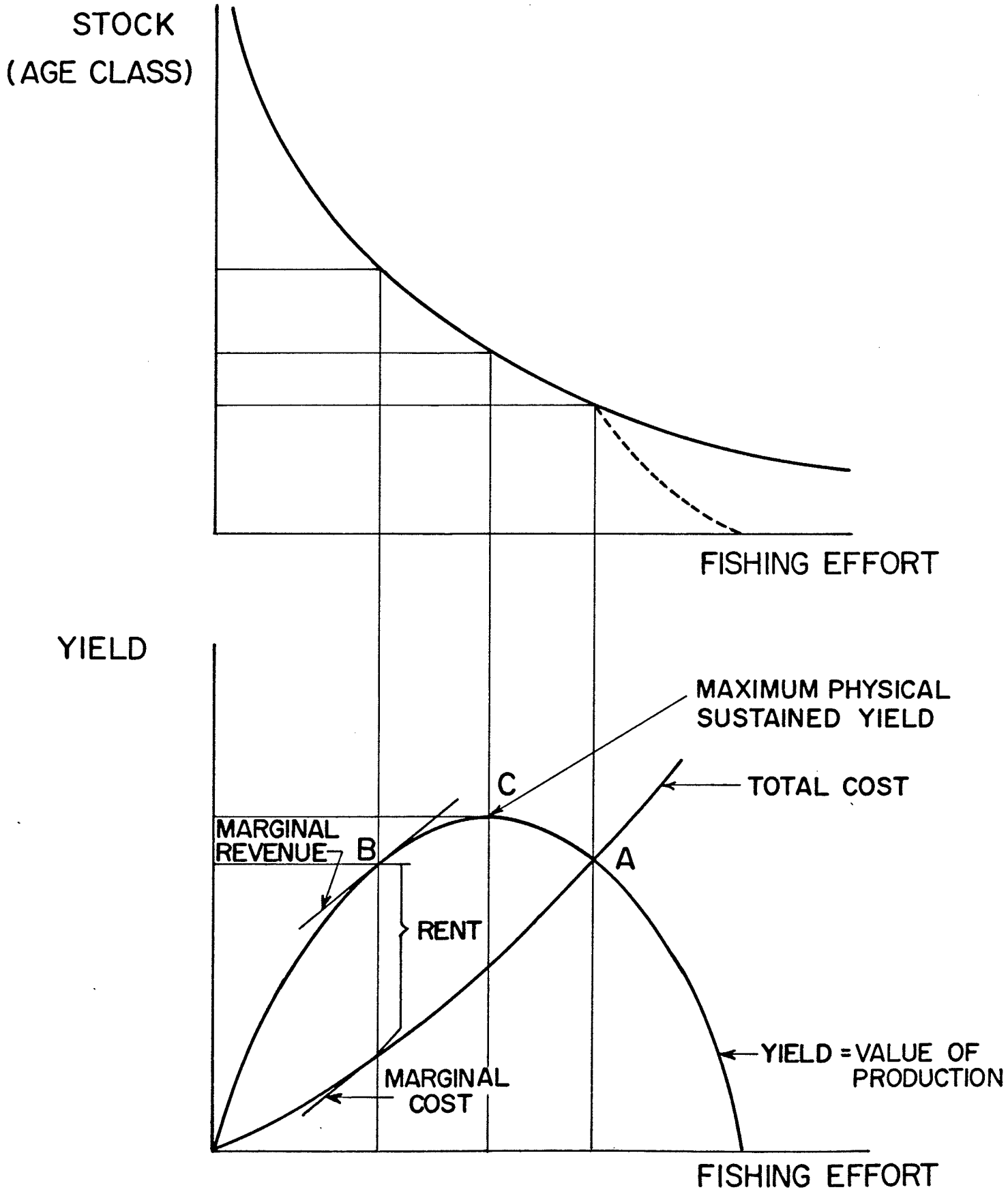

FIG. 4 BIOLOGICAL-ECONOMIC PRODUCTION FUNCTION

Source: Cauvin, D. 1976. A Management Strategy for Lake Winnipegosis, Freshwater Institute. Unpublished.

in more new vessels entering the grounds until all but minimum profits are wiped out."[22] An increase in effort beyond B (Fig. 1) is undesirable because for each additional unit of effort the additional revenue generated will be less than additional costs incurred, so that a marginal loss will be sustained. Thus, equilibrium conditions are associated with "sub-optimal" economic effects. At any point in time, the level of effort being applied is likely to be above or below the long-run bionomic equilibrium. The equilibrium position is the condition "toward which the fishery and the fish stock will always tend; and any other condition is unstable in the long-run without special controls."[23]

Crutchfield and Zellner required the following conditions for long-run equilibrium in a commercial fishery:[24]

(1) The price of the end product must be such that amounts supplied and demanded are equal.

(2) At that price net returns to fishing units are just sufficient to maintain the existing level of fishing effort.

(3) The catch at that level of output must be such that aggregate weight and composition of the exploited population are equal.

Any change in the basic determinants of population yield, cost, or price will involve interacting adjustments in both biological and economic factors until these conditions are again restored.

The long-run equilibrium position illustrated by the basic model provides the economic rationale for intervention on the fishing industry. Such rationale is based upon two objections to inefficient resource harvesting.[25] The first being the dissipation of or extremely low level of profits and rents; the second being the reduced production of other goods which under the relative prices prevailing are favoured by the market over the product of the resource industry.

Turvey recognized the importance of the long-run equilibrium position with respect to industry adjustment to external factors. An equilibrium position beyond the point of maximum sustainable yield (pt. C Fig. 4) when adjusting to a general fall in costs or an increase in demand for fish, will result in a greater employment of resources in the industry, but a smaller product.[26] Also, the efficiency of regulation aimed toward maximizing the difference between total revenues and total costs will be dependent upon the pre-regulation equilibrium position.[27] If such a position is to the left of maximum sustainable yield (pt. C Fig. 4) regulations attempting to reduce effort would lower both total costs and total catch. Equilibrium positions to the right of maximum sustained yield would respond to effort-reducing regulations with lowered total costs and increased catch.

2.1.1 *Model Deficiencies*

Scott tempered the case for optimum utilization (Pt. B Fig. 4) (maximization of net value) advocated by the basic model by explicitly revealing the concept's underlying assumptions.[28] The optimum advocated by the bionomic equilibrium assumes actual expenses and earnings to measure social costs and benefits. When such market values do not represent social values or "when there are special (non-commercial) social policies favouring the employment, income or wealth of special groups of people, (or people in the future), the general optimum simply does not apply without numerous quantifications." The treatment of the industry leading to the deduction of the basic model confines itself not only to more or less hypothetical fleets that buy, sell, borrow and lend in acceptably competitive markets, but is also based upon an assumption that catches are distributed among seasons and vessels in reasonably predictable frequency distributions.

The cost of waiting was also raised by Scott as an important consideration in striving for optimum utilization.[29] The steady-state represented by the sustainable yield curve in the model arises only after a series of years. "The maximum sustainable yield curve is an equilibrium relationship and when incorporated into models of fisheries, gives only long-run equilibrium solutions."[30] During interim periods yields will be lower and costs/unit landed greater than before. "The product of fish-growing must be greater than the sacrifice needed to produce it by an amount equal to the compounding of the going rate of interest on the cost of the sacrifice over the period of waiting for the entire stream of the eventual reward."[31] The present value of the benefits must exceed or equal the present value of the costs.

The failure of the basic model to fully consider such intertemporal aspects of fisheries exploitation was noted by Butlin who identified explicitly four basic limitations of the original bionomic model. Those being:[32]

(1) the model was essentially static;

(2) the problem of factor misallocation due to the pervasiveness of externalities was not adequately handled;

(3) the problem of incorporating the uncertainty inherent in fishing was not tackled, the model being deterministic; and,

(4) that the model as developed was not potentially able to provide an adequate basis with which to formulate policies toward particular fisheries.

2.1.2 *Dynamic Theory of Fish Production*

Academic theorists responded to these deficiencies by attempting to incorporate dynamic analytical techniques into the theory of economic fish production. An extensive dynamic treatment of the fishery was done by Quirk & Smith although Plourde and Thompson et al. utilized similar

approaches.[33] Dynamic modelling allowed the behaviour of a fishery to be examined out of equilibrium, thus allowing the stability of certain input-output combinations to be explored. This treatment allowed for easy recognition of the conditions under which fishing pressure could lead to commercial extinction of a species. Quirk and Smith also contributed to theoretical advancement by attempting to integrate species interaction into an economic model of a fishery.

Smith identified specifically the sources of external economies inherent in open-access resource problems and incorporated them into his model. The sources of effects external to individual fishermen are identified by Smith as:[34]

(1) stock externalities which arise if the cost of catching fish increases as the fish population falls;

(2) gear externalities, which result if the type of fishing gear used affects the rate of growth of the population;

(3) crowding externalities resulting from congestion of vessels on grounds where the stock is concentrated in a small area;

(4) fish-stock externalities, which result from the fact that, in many cases, predation by man is a disturbance in the trophic chain, or food cycle of a complex ecological system.

These analyses by Smith, and Quirk and Smith specifying and incorporating externalities demonstrated that stable equilibrium in the fishery depends upon the effect of the particular externality(ies). Certain input/stock combinations may or may not lead to equilibrium situations depending upon the nature of the externality.[35]

Butlin summarized the advances made by dynamic theory as follows:[36]

(1) The use of certain formal techniques of dynamic analysis has made it possible to examine the fishery in disequilibrium states.

(2) There has been a more precise definition of the conditions under which inefficient competitive exploitation can be remedied.

(3) Explicit stock growth functions have been incorporated into the models.

(4) Dynamic modelling reduced the problem of modifying theoretical models to approach real world situations.

(5) Attempts have been made to incorporate into the problem of optimal rates of exploitation of a particular stock; the fact that fish comprising any particular stock are of different vintages.

Most recently work on the dynamic management of fishery resources has employed (successively) calculus, the calculus of variations, programing and control theory formulations. The work of such authors as Clark, Clark and Munro, Neher, Bell and Lewis, is concerned primarily with the numerical solution of policy problems involving both biological and economic sub-models. A detailed review of these complex bioeconomic studies is not within this author's boundaries of comprehension; however, these works are cited should the interested reader wish to pursue this area of research.[37]

2.2 Economic Prescriptions for Regulations

The theoretical basis for intervention with regulation is well documented and described with reference to both static and dynamic states in the aforementioned literature. The second body of literature deals with economic recommendations for regulation. Such recommendations can be broadly divided into two distinct categories;[38] one favouring the intervention and application of property rights similar to those that had brought to an end common land use, and the other favouring taxes or subsidies to bridge the gap between private and social net marginal products.

The use of taxes to control the evils of common property was not surprisingly first discussed by authors responsible for the original static and dynamic models. The variables on which taxes could be levied may be categorized as either measures of inputs to the fishery normally denoted by the term effort or measures of output denoted by the term catch.[39]

A tax on effort produces a parallel shift in the cost line when effort is the total cost of hiring the inputs of labour and capital. With a tax on effort, equilibrium occurs at a lower level of total cost (effort).[40] Similarily a tax on catch incorporates fish as a priced input to the production process thus raising the cost of production. At a certain tax rate, fishing costs would increase until the taxed fish were no longer valuable enough to justify harvesting.[41] The tax would make fishing completely unprofitable for some existing fishermen and potential fishermen. Again equilibrium will occur at a lower level of effort (total cost).

Practical problems encountered when attempting to determine the ideal tax on effort are foretold by production theory. Scott explains this concept most clearly;[42]

> "The theory is simple enough. If profit is to be made by exploiting some production function in which input characteristics are substitutable, then restricted access or high price of one input or characteristic will cause the entrepreneur to use more of others. Thus, if a tax or restriction is placed on the number of vessels, it will pay to design vessels larger, faster, or more labour or gear intensive. This substitution, weakening the attainment of the original purpose of the restriction, will then induce authorities to increase the tax or to tax or restrict another feature, such as number of tons, length or some weighted index of vessel effort characteristics."

A tax on any component of effort alters the relative scarcity of factor inputs, as perceived by the fishermen, and causes the adoption of production methods that emphasize the use of non-taxed components of effort.[43]

Regulations of output via taxation suffer from a similar problem, in that catch usually consists of a number of products. A tax on landings will only bring about appropriate adjustment if fees are assigned to each fish caught according to its age, stock, species, place and time of capture. Tax rates would have to be adjusted to stock densities as well as to the damages the catching of fish from each stock imposes on the future availability of other stocks.[44]

A system of property rights which would take the form of a fixed catch-quota per input units could also be used to regulate output. At a sufficiently high level of abstraction taxes and property rights lead to identical analytical conclusions for both stationary and dynamic harvesting models. "In the stationary model, one could indifferently price the fish and let the market decide on the catch, or set the total and individual quota, and let the market determine the value and fees."[45]

More specifically, individual fishing enterprises would be granted the right to harvest specific quantities of fish. These rights would be freely transferable and marketable. Under such a system both access to the resource and each user's share of the resource would be restricted (stinted). The concepts of property and property rights and application to the fishery are discussed in greater detail on the following section.

As stated earlier, at an abstract theoretical level, both a tax on catch, and a property rights system, work in identical fashions. Recent literature has tended to favour the property rights scheme over a system of output taxation. Three reasons for this preference are given:

(1) The total costs of administration, transactions, marketing, information, and compliance would be lower under a rights system than under a tax system that achieves the same present value.[46]

(2) Rights to take specific quantities of fish largely eliminate individual fishermen's incentives to protect and increase their shares of the catch by defensively and competitively increasing their fishing power.[47]

(3) A property rights system permits full flexibility with respect to the division of resource rents between government and the participating fishermen.[48]

2.3 The Concepts of Property Rights, Ownership and Natural Resource Use

The property rights concept is both broad and diverse, containing distinct characteristics and dependent upon the prior existence of incontrovertible necessary conditions.[49] The extensive nature of the concept necessitates any discussion of property rights revolving upon the complex interfaces of law and several social sciences, especially economics, political science and sociology.[50]

Property rights have been defined as "the set of rules within society which regulates the relationships among individuals towards the use of scarce resources."[51] It follows then that "property" cannot be thought of in terms of objects that can be owned or possessed, but rather of man's rights with respect to material objects. Materials or objects are not property, but constitute its foundation and the idea of property springs out of the connection, or control, or interest which may be acquired in or over them.[52] "Property rights do not refer to relations between men and things, but rather to the sanctioned behavioural relations among men that arise from the existence of things and pertain to their use. Property rights assignments specify the norms of behaviour with respect to things that each and every person must observe or bear the cost of non-observance."[53]

This interest in objects or materials which governs relations among men with respect to specific material (property rights) acquired relevance when combined with the right of ownership. Ownership in property, whether

by private party or state, is "understood to consist of the right to use, to change form and substance, and to transfer all rights in property (through sale) or some rights (through rental, lease)."[54] The rights of ownership are implicitly dependent upon the right of exclusion.[55] Ownership of property rights allows the holders of the rights to use property in the ways conferred in the concept of ownership to the exclusion of all other persons. The concept of property in combination with the right of ownership and its dependence upon the exclusion principle are the factors which give rise to values being placed upon materials and resources within a society.

Although the right of onwership must be exclusive by definition, it is not absolute. An exclusive right may be limited by restrictions explicitly stated in law[56] and is always subject to "the controls and limitations vested in a sovereign power."[57]

With respect to natural resources, the chosen property rights institution "governs how natural resource property is created and defined, determines the rates of resource use and establishes the procedure for transfer of resource ownership. The chosen institutional framework serves as the ultimate criterion for the distribution of wealth in natural resources and for the allocation of natural resources in various alternative employments."[58] In addition to being a primary social institution, property rights as applied to natural resources provide the basis for several important secondary institutions including taxation, credit, and tenancy.[59]

To summarize, the important characteristics of property and the property rights concept are as follows:[60]

(1) Property and property rights are attributes of human beings, not chattels;

(2) They are different from free goods in the sense that, involved, are appropriable objects of value over which man can and does exert possession.

(3) Rights of ownership are exclusive though not absolute.

(4) Property rights are always subject to the controls and limitations vested in the sovereign power.

(5) Property rights presupposes the existence of:

a. an owner together with other persons who can be excluded from the exercise of ownership rights.

b. property objects that can be held as either private or public possessions.

c. a sovereign power that will sanction and if necessary protect the property rights vested in individuals or groups.

2.3.1 *Property Rights, Externalities and Optimal Resource Allocation*

There exists a large body of literature advocating the introduction of the property rights concept within the context of the neoclassical market model to resolve resource allocation problems once thought to be "extra-market" or "non-economic". Proponents of this approach emphasize certain basic ideas dependent upon the "interconnectedness of ownership rights, incentives and economic behaviour,"[61] thus resulting in systematic relations between property rights and economic choices. "Consequently, a change in the general system of property rights must affect the way people behave, and, through this effect on behaviour property rights assignments affect the allocation of resources, composition of output, distribution of income, etc."[62]

The idea of a relationship between property rights and human economic behaviour has generated solutions to externalities problems based on alternative assignments of property rights.[63] "Externalities are said to exist whenever the utility of one or more individuals or firms is dependent upon, among other things, one or more activities which are under control of

someone else."[64] Most simply, the standard policy prescription of property rights advocates is to internalize externalities by changing property rights assignments and thus the scope of individual decision-making.[65]

The seminal article which gave rise to the property rights approach is considered to be that of Ronald Coase,[66] which presented a decentralized decision framework for externality problems. A summary of the Coasian argument is as follows:

> If property rights with respect to liability for damage are clearly specified, transferable, and rigidly enforced upon appeal, under any given liability rule, one or the other party will have an incentive to attempt to modify the externality by offering inducement to the other party to behave differently. Negotiations for the exchange of property rights in the externality will continue until all gains from trade have been exhausted. Given perfect competition an efficient solution will be achieved.[67]

The argument continues that if there were:

(a) no wealth effects on demand,

(b) no transactions costs,

(c) rights to create or control externalities; the allocative solution would be invariant and optimal regardless of the initial assignment of rights.[68] The price as well as the quantity of externality would be established entirely by market forces.[69]

Two key components in the Coasian argument are the concepts of transactions costs and the allocative neutrality of liability rules. Coase assumed zero transactions costs in the trade of externalities. However, subsequent property rights advocates modified this assumption by requiring the costs of a transaction in the rights between the parties (internalization) not to exceed the gains from internalization."[78] Advocates conceded transactions costs can be large relative to gains because of legal reasons.[71] Where only legal constraints make transactions costs infinitely large, property rights advocates cited the legal prohibition toward establishing

an exchangeable ownership title as the factor responsible for precluding the internalization of external costs and benefits.[72]

The allocative neutrality of liability rules stated when gains from trade had been maximized optimal resource allocation would occur regardless of whether the creator of the diseconomy was bribed by the recipient to modify behaviour or whether the recipient was compensated by the creator for the effects of the diseconomy. Furubotn and Pejovich provide a succinct description of the liability concept:[73]

> In principle, an individual A seeking to modify the behaviour of another individual B, (who is generating an externality) can engage in trade with the latter B and both can move to preferred positions. The benefits obtained by A are purchased from B at a price. Not only must B's behaviour be modified so as to insure that he will take the costs externally imposed on A into a count, but A's behaviour must be modified so as to insure that he will take the costs imposed internally on B into account. The justification for compensation to B rests on the idea that, at any given time, individuals can have "rights" to create certain types of diseconomies. Thus an individual B who is undertaking a lawful activity in good faith must be compensated if there is to be a change in the law that will redefine property rights and reduce his welfare position.
>
> The composition of output will be independent of whether or not the individual creating diseconomies bears the liability for the damages caused to others. A cost is incurred by B when he pays an indemnity to A in order to produce another unit of output or when B foregoes a bribe by A designed to induce B to limit production.

To summarize, the property rights approach focuses on the impacts of changes in the structure of property rights on the choices individuals make. The approach is predicated on the assumption of market logic being applicable to individual decision-making. The association between externalities and the costs of defining, exchanging or enforcing property rights is emphasized. Divergence between private and social benefits and costs caused by externalities tend to arise because of high transactions costs or

because of the existence of legal restraints on the use and exchange of resources.[74]

2.3.2 *Objections to the Property Rights Approach*

As can be expected the property rights approach to the externalities problem is not without critics. The allocative neutrality of liability rules has been the theoretical element of Coase's argument most subject to attack. Critics argue Coase failed to distinguish between property rights and liability rules.[75] The key point being property rights are exclusive, whereas "liability rules are general impersonal rules of law which apply to any producer or recipient of externalities."[76]

Frech[77] demonstrated this theoretical flaw by maintaining Coase's assumptions and assigning liability to the creator (firm) of the externality. Those individuals (firms) receiving payments would be in receipt of excess profits (i.e. profits exceeding the zero profit equilibrium required by the neoclassical model of perfect competition), thus indicating entrants into the externality affected occupation in order to reach the required zero profit equilibrium. Because liability rules are not exclusive, new and potential entrants are entitled to compensation. The introduction of additional entrants leads to higher than optimal damage payments which must be paid by the creators of the externality. Firms in this occupation would be induced to leave. After entry and exit, products of the externality-affected activity are overproduced and products of the externality creating activity are underproduced. Where the creator of the externality is not liable, unlimited numbers of individuals (firms) may threaten to engage in the activity simply to be paid for not creating the externality. The long-run situation is now reversed with the products of the externality creating

activity being overproduced, while products of the affected activity are underproduced. Coase overlooked the non-exclusive nature of liability rules and assumed liability rules equivalent to the assignment of property rights.

Other attacks of the property rights concept have been based upon the concept's inability to serve as a policy formula. Critics argue "Coase's assumptions are so far removed from the real world that his analysis is irrelevant for prescriptive policy purposes."[78] By ignoring distributional questions and transactions costs, Coase ignored many of the complexities inherent in public policy formulation and prescription. Considerations and complexities which arise when the property rights approach is used as a basis for policy formulation are as follows:

(1) The distribution of income is clearly influenced by the assignment of property rights and liability for damages.[79] Alternative distributions of rights directly imply alternative distributions of income and wealth. Different rights assignments place the responsibility for payment, in the event of trade, on different parties. Thus, the possibility of trade under different rights assignments is strictly limited by different sets of budget constraints.[80]

(2) Market solutions are only relevant to externality problems when there exists potential gains from trade between acting parties. The application of the market solution is not relevant when externalities offend nobody, and externalities which offend one party, who for reasons of utility function or budget constraints, is unable to make an offer large enough to induce trade.[81]

(3) The analysis avoids the coercion of the social welfare function, but replaces it with the coercion of the status quo distribution of income, wealth, and power.[82]

(4) Exchange involves costs which may be substantial. Each party must gather information and decide bargaining position. The bargaining process requires time and money. Decisions made must be enforced, also at a cost. Transactions costs may impede exchange, thus leading to less efficiency.[83]

Because of the above complications, the pure market-solution has been described as at best only applicable to "two party externality situations in which both parties are rather equal in economic power, each in possession of full information concerning his own and his adversary's position, and resource allocation elsewhere is optimal."[84]

In summation, the property rights approach has been criticized on two levels; one being theoretical, which proved Coase's allocative neutrality of liability rules incorrect, and the other at the level of policy formulation which emphasizes considerations relevant to public policy, but ignored by the Coasian analysis.

2.3.3 *Property Rights and Fisheries Management*

The market solutions proposed by property rights advocates seldom are observed in practice.[85] Therefore, it is not surprising that the volume of empirical, theoretical and management oriented fisheries literature in this area is not overwhelming. The most obvious complication being the fugitive nature of the fisheries resource and the fact fish do not respect man's boundaries.[86] The creation of markets for externalities rights is relevant to the fisheries problem insofar as the taking of fish by one fisherman inflicts an externality upon others. However, the problem differs in that the parties involved are in the same industry and not unique pairs of victims and producers of the external effect.[87] Fishermen are simultaneously victims and producers of the externality.

As mentioned previously, a system of property rights would take the form of marketable and transferable rights to harvest specific quantities of fish. "The biological complications of age, stock, species, place, and time might be dealt with by special individual quotas for fish of each

characteristic and in part by general laws about the conditions under which all rights were valid."[88]

Maloney and Pearse[89] best describe the adjustment that may occur should a system of property rights be introduced to a specific fishery.

> "Individual fishermen would face the problem of maximizing profits subject to the constraint that total production must not exceed the total number of rights held. Costs are of two kinds; the usual costs of production and the cost of harvesting rights. With the ability to adjust both, an individual can be expected to do so in light of the marginal revenues and costs associated with each, in search of a harvesting unit of the most efficient size and technology. Market forces can be expected to generate an equilibrium price for fish harvesting rights which reflect the full difference between minimum achievable catching costs and the price of the product. The aggregate value of rights held by the fleet should thereby measure the full economic rent attributable to the resource, and their unit price the resource's average and marginal social value. A system of quantitative rights would generate economic incentives for optimal organization of the fishery in the sense of cost minimization or rent maximization. All rents would be capitalized in the value of rights."

The initial distribution of rights is often questioned when property rights are discussed as a means of fisheries rationalization. A solution commonly proposed "would be to give every active fisherman a quota certificate; however, the size of the catch going with each may be very small; and fishermen will be given an incentive to buy and sell quotas to assemble rights sufficient to catch a profitable amount."[90] The small size and large numbers of quota certificates would contribute to an active market in rights and hence flexibility in adjustments to the size of individual fishing enterprises.[91] An active market in rights would ensure allocation to those who can derive from them the greatest value.[92] Quota certificates could also be used for positive redistributive purposes, such as guaranteeing a livelihood to isolated communities or to protected groups.[93]

The advantages envisaged by Pearse and Maloney in the quantitative rights system are summarized as follows:[94]

(1) Relatively easy to introduce and thereafter to sustain without involuntary dislocation among established fishermen.

(2) Permits flexible redistribution of rights through private market transactions.

(3) Permits adjustments in total catch, through intervention in the market for rights by the regulatory authority without inflicting financial uncertainty on the participants.

(4) Allows for the management authority to designate rights to specific stocks in specific seasons and areas.

(5) Eliminates incentives for individuals to expand and protect their share of the catch by increasing fishing power.

(6) Permits full flexibility with respect to the division of resource rents between government and participating fishermen.

2.3.4 *Empirical Studies of Applied Property Rights in the Fishery*

The United States East coast oyster fishery has provided a comparitive basis for empirical study of property rights structures and common property arrangements.

Natural productivity varies among oyster beds. Productivity can be increased by improving the bed substrate. This difference in oyster bed productivity is referred to as the grounds quality externality.[95]

A study of the American East coast oyster fishery by Angello and Donnelley found that "where the grounds quality externality is of some significance, the establishment of exclusive user rights through private leasing of sub-aqueous lands, would generate substantial increases in productivity. The negative impact on unemployment in the harvesting sector

was minimal."[97] The same study also found property rights to be a significant factor in the average product of labour when the grounds quality externality was most pervasive. This positive impact on labour productivity was attributed to: (1) increased incentive for cultch (material laid down on oyster beds to furnish points of attachment for the spat) replacement), (2) encouragement for optimal seasonal and secular harvesting patterns, (3) increased incentives for culling catch, (4) decrease in harvest congestion, and (5) the use of more efficient capital techniques. A complementary study by the same authors found property rights influencing price levels and harvesting patterns in the short-run.[98] Common property arrangements were associated with lower price levels and lower incomes than private property rights. The higher price levels associated with private rights were attributed to more optimal temporal harvesting patterns than would occur with a common property system.

The studies by Angello and Donnelley, which were concerned with a sedentary benthic fishery resource seemed to indicate that in the case of non-migratory fish species, property rights appear practical.

2.4 The Application of the Literature to the Study

The review of the literature is relevant to the study in two ways: (1) it enhances the analytical power of the case interpretations and, (2) it reveals the theoretical foundations of the current system of Lake Winnipeg commercial fishery resource allocation.

The use of a case study approach requires the theoretical basis of case interpretations be made explicit.[99] The foregoing literature review provides the general theoretical propositions about the workings of a commercial fishery and how the industry, and those within, will react to

certain measures. The analysis of the particular cases will proceed from these general theoretical precepts. The assumption is that the consequences of open-access resource use, the concept, characteristics and application of property rights, and the micro-economic explanation of individual behaviour apply universally to all commercial fisheries. The particular cases are assumed subsets of the larger class of commercial fisheries.

The review also displays the theoretical underpinnings of the current system of resource allocation on Lake Winnipeg. The introduction of restrictive licensing and individual quotas removed the incentives to exploit the resource to the point of "bionomic equilibrium". The degree to which excessive investment in superior conditions may occur is now limited. The individual quotas on Lake Winnipeg do represent a right in property, as it has been defined in the literature. However, the relevance of these property rights with respect to resource allocation is limited because the property rights are not combined with the rights of ownership. The rights of ownership, which affect resource allocation are held by the Province. The current allocation system makes limited use of only one of the literature's two basic economic prescriptions (that of property rights) and it can only be assumed that other social policies favouring employment and/or income distribution were incorporated into the scheme.

LITERATURE CITED

1. Pigou, A. C., 1918. The Economics of Welfare. The MacMillan Co., London. p. 194.

2. Ibid., p. 195.

3. Ibid., p. 194.

4. Ibid., p. 195.

5. Knight, F. H. 1924. "Some Fallacies in the Interpretation of Social Cost", Quarterly Journal of Economics. 38:582-606.

6. Ibid.,

7. Gordon, H. S., 1954. "The Economic Theory of a Common Property Resource: The Fishery," Journal of Political Economy. SX11(2): 129-142.

8. Ibid., p. 134.

9. Ibid., p. 135.

10. Ibid., p. 137.

11. Ibid., p. 141.

12. Scott, A. D., 1955. "The Fishery: Objectives of Sole Ownership," Journal of Political Economy, 63:116-124.

13. Ibid., p. 121.

14. Scott, A. D., 1962. "The Economics of Regulating Fisheries," p. 25-61 in R. Hamlisch (ed.). Economic Effects of Fishery Regulation. F.A.O. Rome, 1962.

15. Gould, J. R., 1972. "Extinction of a Fishery by Commercial Exploitation: A Note," Journal of Political Economy LXXX, 5, 1972, 1031-1038.

16. Ibid., p. 1033.

17. Ibid., p. 1034.

18. Crutchfield, J. and A. Zellner, 1963. "Economic Aspects of the Pacific Halibut Fishery," United States Department of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, Fishery Industrial Research. p. 10-20. Washington, 1963.

19. Pearse, P. H., 1971. National Regulation of Fisheries, Department of Economics, University of British Columbia, (unpublished) 1971. p. 1-39.

20. Crutchfield, J. and A. Zellner, 1963. Op. cit., p. 16.

21. Turvey, R., 1964. "Optimization and Sub-optimization in Fishery Regulation". American Economic Review. March 1964. p. 64-76.

22. Crutchfield, J. and A. Zellner, 1963. Op. cit. p. 17.

23. Pearse, 1971. Op. cit. p. 20.

24. Crutchfield, J. and A. Zellner. 1963. Op. cit. p. 18.

25. Scott, A. 1962. Op. cit. p. 53.

26. Turvey, R. 1964. Op. cit. p. 73.

27. Ibid., p. 73.

28. Scott, A. 1962. Op. cit. p. 57.

29. Ibid., p. 58.

30. Bultin, J. 1975. "Optimal Depletion of a Replenishable Resource: An Evaluation of Recent Contributions to Fisheries Economics in P. W. Pearce (ed.) Economics of Natural Resource Depletion. MacMillan, London, 1975. p. 85-114.

31. Scott, A. 1962. Op. cit. p. 55.

32. Bultin, J. 1975. Op. cit. p. 90.

33. Quirk, J. P. and J. J. Smith. 1969. "Dynamic Economic Models of Fishing", in Scott, A. D. (ed.). Economics of Fisheries Management: A Symposium, H. R. MacMillan Lectures in Fisheries, University of British Columbia, March 1969.

Plourde, G. C. 1970. "A Simple Model of Replenishable Natural Resource Exploitation". American Economic Review. XL3, 1970.

Thompson, R. G., M. D. George, R. J. Callen, and L. C. Wolken. 1973. "A Stochastic Investment Model for a Survival Conscious Firm Applied to Shrimp Fishing". Applied Economics, V,2, 1973.

34. Smith, V. L. 1969. "On Models of Commercial Fishing". Journal of Political Economy. 6, 1969. p. 181-198.

35. Bultin, J. 1975. Op. cit. p. 111.

36. Ibid., p. 111.

37. Clarke, C. W. 1973. "Profit Maximization and Extinction of Animal Species". Journal of Political Economy. 81. p. 950-961.
1976 Mathematical Bioeconomics: The Optimal Management of Renewable Resources. Wiley, New York, New York, 1976.

Clark, C. W., F. H. Clark, and R. D. Munro. 1976. "The Optimal Exploitation of Renewable Resource Stocks: Problems of Irreversible Investment". PNRE Paper 8, University of British Columbia, 1976.

Nehr, P. 1974. "Notes on the Volterra-Quadratic Fishery". Journal of Economic Theory, 8. p. 39-49.

Lewis, T. R. and Schalmensee. 1977. "Nonconvixity and Optimal Exhaustion of Renewable Resources". International Economic Review. 18. p. 535-552.

Bell, F. W. 1972. "Technological Externalities and Common Property Resources: An Empirical Study of the U. S. Northern Lobster Fishery". Journal of Political Economy, 80. p. 148-158.

38. Scott, A. 1979. "Development of Economic Theory on Fisheries Regulation". Journal of the Fisheries Research Board of Canada, 36. p. 725-741.

39. Austin, B. C. 1977. "Incorporating Economic Considerations into Practical Fisheries Policies", in Anderson (ed.). Economic Impacts of Extended Fisheries Jurisdiction. Ann Arbor Science Publishers, Inc., 1977. p. 195-207.

40. Howe, C. W. 1979. Natural Resource Economics Issues, Analysis and Policy. John Wiley and Sons, Inc. 1979. p. 256-274.

41. Ibid. p. 265.

42. Scott, A. 1979. Op. cit. p. 733.

43. Austin, B. C. 1977. Op. cit. p. 200.

44. Scott, A. 1979. Op. cit. p. 735.

45. Ibid., p. 738.

46. Moloney, D. G. and P. H. Pearse. 1979. "Quantitative Rights as an Instrument for Regulating Commercial Fisheries". Journal of the Fisheries Research Board of Canada, 36. p. 859-866.

47. Scott, A. 1979. Op. cit., p. 738.

48. Moloney, D. G. and P. H. Pearse. 1979. Op. cit. p. 860.

49. Barlow, R. 1978. Land Resource Economics. Englewood Cliffs, N. J. Prentice-Hall, p. 394.

50. Dales, J. H. 1968. Pollution Property and Prices. University of Toronto Press. p. 58.

51. Hutter, M. 1975. "The Property Rights Paradigm: A Comment". Jahr Nationalokon Statist. Feb. 188(6). p. 552.

52. Barlow, R. 1978. Op. cit. p. 395.

53. Furubotn, E. G., S. Pejoivich. 1972. "Property Rights and Economic Theory: A Survey of Recent Literature". Journal of Economic Literature. p. 1139.

54. Ibid., p. 1140.

55. Barlow, R. 1978. Op. cit. p. 396.

56. Furubotn, E. G., S. Pejovich. 1972. Op. cit. p. 1140.

57. Barlow, R. 1978. Op. cit. p. 396.

58. Seitz, W. D., J. D. Headley. 1975. "Changing Natural Resource Property Rights: An Overview". Natural Resources Journal, (15). p. 643.

59. Ciriacey - Wantrup, S. U., R. C. Bishop. 1975. "Common Property as a Concept in Natural Resources Policy". Natural Resources Journal (15). p. 714.

60. Barlow, R. 1978. Op. cit. p. 396.

61. Furubotn,E. G., S. Pejovich. 1972. Op. cit. p. 1137.

62. Ibid., p. 1139.

63. Bromley, D. W. 1978. "Property Rules, Liability Rules, and Environmental Economics". Journal of Economic Issues, 12(1). p. 44.

64. Frech, H. E. 1979. "The Extended Coase Theorm and Long-Run Equilibrium: The Non-Equivalence of Liability Rules and Property Rights". Economic Inquiry, 17(2). p. 175.

65. Bromley, D. W. 1978. Op. cit. p. 44.

66. Coase, R. 1960. "The Problem of Social Cost". The Journal of Law and Economics. p. 142-171.

67. Ibid., p. 147.

68. Ibid., p. 149.

69. Ibid., p. 144-49.

70. Demsetz, H. 1967. "Toward a Theory of Property Rights". American Economic Review, 57. p. 348.

71. Ibid., p. 348.

72. Ibid., p. 349.

73. Furubotn, E. G., S. Pejovich. 1972. Op. cit. p. 1142-43.

74. Ibid., p. 1143.

75. Frech, H. E. 1979. Op. cit. p. 234.

Randall, A. 1974. "Coasian Externality Theory in a Policy Context". Natural Resources Journal (14). p. 42-46.

76. Frech, H. E. 1979. Op. cit. p. 255.

77. Ibid., p. 259-61.

78. Randall, A. 1972. "Market Solutions to Externality Problems: Theory and Practice". American Journal of Agricultural Economics (54). p. 177.

79. Randall, A. 1974. "Coasian Externality Theory in a Policy Context". Natural Resources Journal (14). p. 38.

80. Randall, A. 1978. "Property Institutions and Economic Behaviour". Journal of Economic Issues. 12(1). p. 10.

81. Randall, A. Op. cit., p. 38.

82. Randall, A. 1978. Op. cit. p. 12.

83. Randall, A. 1974. Op. cit., p. 38.

84. Bromley, D. W. 1978. Op. cit., p. 44.

85. Randall, A. 1972. Op. cit., p. 180.

86. Christy, F. T., Jr. 1975. "Property Rights in the World Ocean". Natural Resources Journal. 15(4). p. 695-6.

87. Moloney, D. W., P. H. Pearse. 1979. "Quantitative Rights as an Instrument for Regulating Commercial Fisheries". Journal of the Fisheries Research Board of Canada. 36(7). p. 861.

88. Scott, A. 1979. "Development of Economic Theory on Fisheries Regulation". Journal of the Fisheries Research Board of Canada. 36(7). p. 735.

89. Moloney. D. G., P. H. Pearse. 1979. Op. cit. p. 863.

90. Scott, A. 1979. Op. cit., p. 735.

91. Moloney, D. G., P. H. Pearse. 1979. Op. cit., p. 861.

92. Ibid., p. 861.

93. Scott, A. 1979. Op. cit., p. 735.

94. Moloney, D. G., P. H. Pearse. 1979. Op. cit., p. 865.

95. Angello, R. J. L. P. Donnelley. 1976. "Externalities and Property Rights in the Fisheries". Land Economics. 52(4). p. 521.

96. Ibid., p. 521-25.

97. Ibid., p. 528.

98. Angello, R. J., L. P. Donnelly. 1975. "Prices and Property Rights in the Fisheries". Southern Economic Journal. 42(4). p. 251.

99. Eckstein, H. 1975. Op. cit. p. 99.

CHAPTER THREE

DISCUSSION OF FINDINGS

3.0 INTRODUCTION

In addition to a theoretical basis for analysis, a factual basis is required. This chapter will establish the factual basis for case interpretations.

Addressed will be the objective of determining the structure of the commercial fishing industry as it has evolved under the current system of resource allocation in the areas of Gimli and Berens River with respect to; (1) the number of skiff operations, (2) production, (3) the relative size of the operations, (4) the distribution of fishing rights and production among operators and, (5) the economic viability of skiff operations.

3.1 Participation

A discussion of industrial structure must begin with the number of firms or participants in the industry. Once levels of participation have been established, relationships between participants may be examined. Participation is also the initial variable from which a review and evaluation of the current resource allocation system may begin. The current licensing scheme has the potential to move the industry toward either maximum or minimum participation limits. An examination of participation during the 1972-1979 period will illustrate in which direction the industry is moving in terms of minimum or maximum limits and the degree of variability in annual participation levels.

3.1.1 *Lakewide Participation*

Based on existing licensing information (August 1980) the number of licensed fishermen on Lake Winnipeg has varied from a low of 651 in 1975 to a high of 700 in 1978 (Table 3). There is no distinguished trend with respect to the number of licensees increasing or decreasing during this period. The number of annual participants appears to fluctuate randomly and is dependent upon the number of licenses vacated each year and the distribution of points held by those competing for vacated licenses. For instance, if potential entrants (those who have worked in the fishery and accumulated points but do not hold a license) hold a greater amount of points relative to existing licensees, (a licensed fisherman who does not hold a license for the vacated season for which he is competing, but has accumulated points toward the vacated license), the number of licensed fishermen on the Lake will increase. If the reverse is true, the number will decrease.

Prior to the issuing of licenses for the summer 1980 season there were 1,216 licenses within the summer, fall, and winter categories. In addition, 44 licenses are issued for the summer whitefish season in the north-end of the Lake. Within the present system of license allocation, there is the potential for the number of licensed fishermen to increase to a point equal to the number of licenses (1,260 = 1,216 + 44). Conversely, the minimum number of fishermen the present system of license allocation could allow is 420 (providing no new licenses are issued or existing licenses permanently revoked). The minimum number (420) would result in all whitefish licensees holding the maximum allowable two additional licenses (fall, winter) and the remaining participants

TABLE 3

NUMBER OF LICENSED FISHERMEN
Lake Winnipeg and Selected Communities

Year	Lakewide	Area Location Gimli	Berens River
1972	671	67	56
1973	694	66	60
1974	689	65	60
1975	651	64	59
1976	695	66	61
1977	697	66	60
1978	700	66	62
1979	690	66	60

Source: Department of Natural Resources
Fisheries Branch, Licensing Records.

holding the maximum number of 3 licenses (fall, summer, winter).

3.1.2 *Study Area Participation*

The number of participants in the study areas is similar to lake-wide participation with respect to the absence of any distinguishable increasing or decreasing trends over time. In the Gimli area, participation varied between 64 (1975) and 67 (1972) individuals and in Berens River participation ranged from 56 (1972) to 62 (1978) individuals (Table 3). The present licensing allocation system could allow a maximum of 104 and a minimum of 35 participants in Berens River. In Gimli, the respective maximum and minimum participation levels that could be reached are 150 and 55 individuals.

3.2 Quota Entitlements and Production Categories

The system of individual quota entitlements on Lake Winnipeg has allowed for the disaggregation of skiff operations into distinct production categories. An individual's legally allowable maximum production limit (production category) is determined by the number of licenses held and the quota entitlement associated with each license.

Berens River area individual quota entitlements by season are as follows:

License	Quota
Summer	1972-1977 -- 7,700 lbs.(1978-79 - 9,000 lbs.)
Fall	1972-1979 -- 8,400 lbs.
Winter_{cf}	1972-1979 -- 4,000 lbs.
Winter_{co}	1972-1979 -- 9,000 lbs.

Gimli area individual quota entitlements by season are as follows:

License	Quota
Summer	1972-1977 -- 4,200 lbs.(1978-1979 - 5,000 lbs)
Fall	1972-1979 -- 8,400 lbs.
$Winter_{cf}$	1972-1979 -- 4,000 lbs.
$Winter_{co}$	1972-1979 -- 9,000 lbs.

There are three production categories (one license, two licenses and three licenses). The industry structure will be developed within the framework of these categories. Any combination of quota entitlements (licenses) may be held providing the total does not exceed three and not more than one license per season is held.

The numbers of fishermen within each production category through 1972-1979 and corresponding production (lbs.) and gross revenue figures for a fishing year are provided in Appendix B, Tables 1-6.

3.3 Production

Production values are the aggregate of sales of both quota and non-quota species contracted by fishermen with the Freshwater Fish Marketing Corporation. Complete production values ($, lbs.) for the harvest obtained during the winter months (November-March) of the 1978 and 1979 fishing years were not available. Total production for these years will therefore be greater than the amounts shown.(Tables 4, 7).

3.3.1 *Berens River--Production*

The amount of production varied from a low of 582,805 lbs. in 1973 to a high of 715,753 in 1978 (Table 4). Environmental (weather, biological) conditions will influence harvest levels and the measurement of production is subject to the form in which fish are delivered (headless, headless and dressed, round). Amounts in Table 4 are those for actual

Table 4

Total Production 1973-1979 Berens River

Production Category:		1973	1974	1975	1976	1977	1978 *	1979 *
Summer	$	17,821	20,531	25,951	35,572	33687	39,670	43,045
	Lbs.	41,759	52,085	61,545	51,105	50,240	70,227	65,671
1 Lic. Fall	$	23,040	19,092	21,823	48,178	45,345	39,248	50,069
	Lbs.	51,801	50,818	70,301	60,196	69,987	64,461	66,364
Winter (CO)	$		924	5,194	7,156	3,621	3,832	
	Lbs.		2,519	9,000	9,000	7,784	7,407	
Sub-Total	$	40,861	40,547	62,968	90,906	82,653	82,750	93,114
	Lbs.	93,560	105,422	140,846	120,301	128,011	142,095	132,035
2 Lic. Summer, Fall	$	108,685	106,586	166,195	229,365	219,973	251,947	286,769
	Lbs.	258,176	283,214	375,197	291,429	355,256	416,474	383,667
Sub-Total	$	108,685	106,586	166,195	229,365	219,973	251,947	286,769
	Lbs.	258,176	283,214	375,197	291,429	355,256	416,474	383,667
Summer, Fall, Winter(CO)	$	48,526	52,840	56,794	88,087	80,374	57,993	64,006
3 Lic.	Lbs.	137,793	181,818	129,802	129,792	131,991	94,286	83,510
Summer, Fall, Winter(CF)	$	15,820	17,382	21,950	40,709	39,411	36,363	65,278
	Lbs.	39,276	50,549	50,556	61,395	62,584	62,861	82,278
Sub-Total	$	64,346	70,222	78,744	128,796	119,785	94,356	129,284
	Lbs.	177,069	232,367	180,358	191,187	194,575	157,184	165,788
Total	$	213,892	217,355	307,907	449,067	422,411	429,053	511,711
	Lbs.	582,805	621,003	696,401	602,917	677,842	715,753	681,490

Source: Department of Natural Resources Fisheries Branch Licensing Records.
Freshwater Fish Marketing Corporation Production Records.

* 1978-1979 values do not include value of winter harvest.

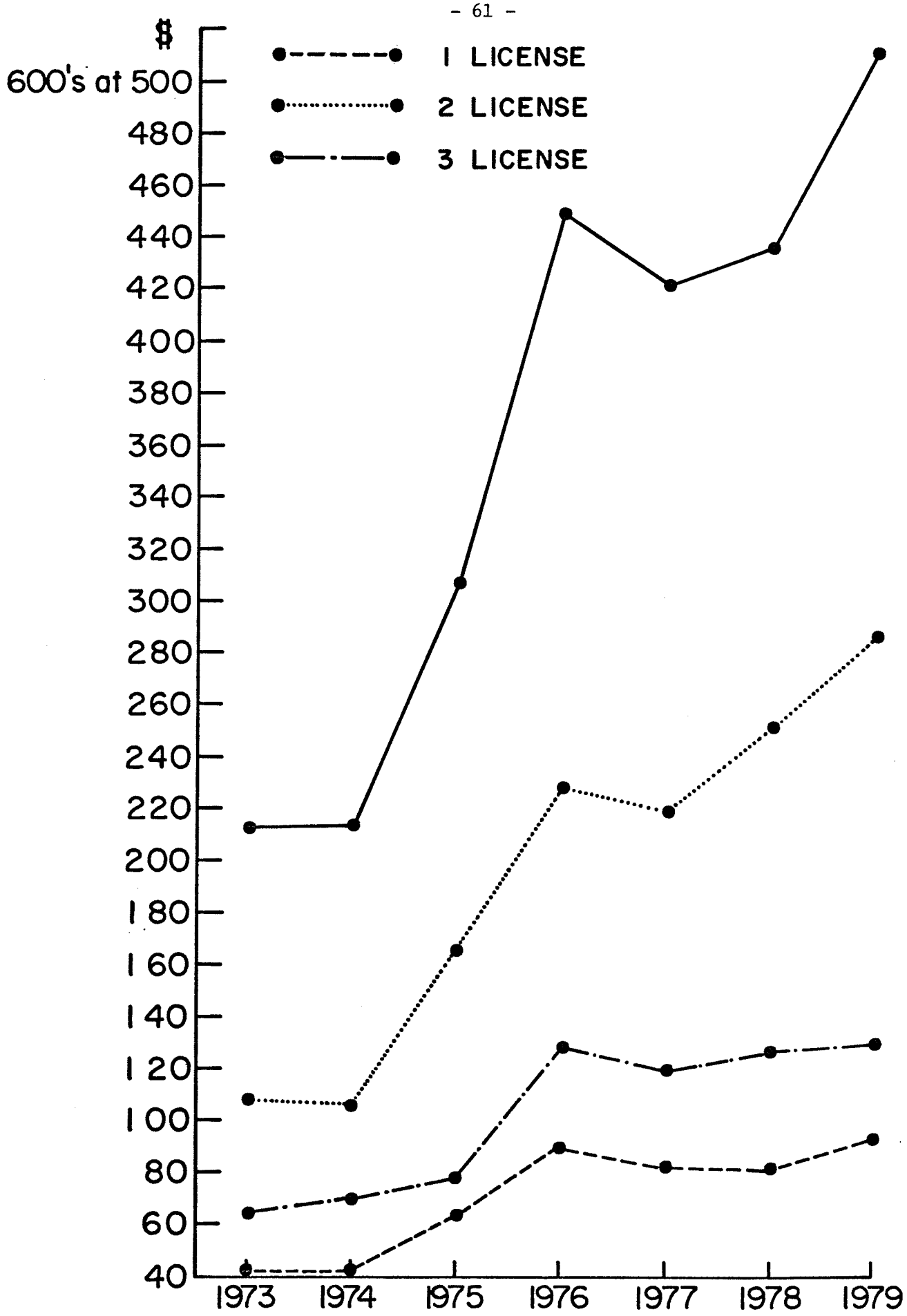

FIG. 5 TOTAL PRODUCTION ($) BY PRODUCTION CATEGORY - BERENS RIVER

delivered pounds and the form in which fish are delivered can vary annually. The value and amount of non-quota species (northern pike, mullet, and perch) harvested will also influence annual production levels as these amounts vary between fishermen in a given year and on an aggregate basis between years (Appendix C).

The value of production has increased from $213,892 (1973) to $511,711 (1979) (Table 4, Fig. 5). Annual gross revenues are subject to the previously mentioned factors influencing production, but price increases are the most important factor affecting gross revenues.

The majority of production occurs during the open-water seasons (June 1 - July 10 and Labour Day - October 30) (Table 5). The two license production category, which includes the greatest proportion of fishermen (Appendix B, Tables 1-3) accounts for the highest proportion of total production (Table 4, Fig. 5).

Mean gross revenues by production category for open-water harvests during the 1973-1979 period are provided in Appendix C, Tables 1-3. The most significant observation arising from comparison of these values (Table 6) is that, with the exception of 1975, mean open-water gross revenues in the three license production category exceeded those observed in the two license category. The majority of individuals holding these licenses chose to exercise their "roll-over" option and harvest all or a portion of winter quota entitlements during the open-water seasons.

3.3.2 *Gimli--Production*

Total production in the Gimli area, as recorded in sales contracted with the FFMC, peaked in 1977 and subsequently declined in 1978 and 1979

TABLE 5

Value of Open-Water Production
Berens River - 1973-79

Year		1 License	2 License	3 License	Total Open Water	% of Total
1973	$	40,861	108,685	35,919	185,465	86.70
	lbs.	93,560	258,176	85,038	436,774	82.60
1974	$	39,623	106,586	40,775	186,984	86.03
	lbs.	102,903	283,214	118,289	504,406	81.22
1975	$	62,068	116,195	52,513	230,776	74.95
	lbs.	131,896	375,197	123,168	630,261	90.50
1976	$	81,854	229,365	112,204	423,423	94.30
	lbs.	107,770	291,429	142,442	541,641	89.84
1977	$	82,653	219,973	106,343	408,969	96.82
	lbs.	128,011	355,256	166,915	650,182	95.02
1978	$	82,750	251,947	94,356	429,053	N/A
	lbs.	142,095	416,474	157,184	715,753	N/A
1979	$	93,114	286,769	129,284	511,717	N/A
	lbs.	132,035	383,667	165,788	681,490	N/A

Source: Department of Natural Resources, Fisheries Branch Licensing Records.

TABLE 6

Comparison of Open-Water Production Values Between Two and Three License Production Categories: Berens River

YEAR		Production Category	
		2 LICENSE	3 LICENSE
1973	$	4180.92	4489.87
	lbs.	9929.85	10629.75
1974	$	3947.63	4530.55
	lbs.	10489.41	13143.22
1975	$	5935.54	5834.78
	lbs.	13399.89	13143.22
1976	$	8718.58	12467.11
	lbs.	11037.12	15826.89
1977	$	7856.18	10634.30
	lbs.	12587.71	16691.50
1978	$	8687.83	10502.89
	lbs.	14361.17	17464.88
1979	$	10910.88	12928.40
	lbs.	14615.58	16578.30

Source: Department of Natural Resources, Fisheries Branch Licensing Records. Freshwater Fish Marketing Corporation Production Records.

to levels below or near those observed in 1973 and 1974 (Table 7, Fig.6). Although production levels are influenced by the same factors affecting those in Berens River, the data indicate fewer individuals contracted smaller volumes of sales with the Corporation in 1978 and 1979 than occurred in previous years (Appendix B, Tables 4-6). In the one license production category, 54% (1978) and 58% (1979) of the total number of licensed fishermen engaged in sales with the Corporation. During the peak period of production (1977) 88% of the total number of licensed fishermen in this category (one license) appeared in FFMC production data. The proportion of fishermen contracting sales through the Corporation in the two license production category declined from 93% (1977) to 75% (1978) and 62% (1979). In the three license production category, this proportion declined from 84% (1977) to 66% (1978) and 27% (1979). [Percentage figures were obtained by expressing the N values for each year, in each category, as a proportion of the total number of licensed fishermen per year in each category (Appendix B, Tables 4-6)].

The reason for such a decline may be due to two factors. A large proportion of fishermen in the area may have decided to harvest a significant proportion of their entire quota entitlements during the winter season and therefore would not have appeared in the 1978 and 1979 production data which included only open-water (fall, summer) values. Secondly, those individuals not appearing on FFMC production records in 1978 and 1979 may have decided to market their catch directly to consumers, thus by-passing the FFMC.

Table 7

Total Production 1973-1979 Gimli Area

Production Category:			1973	1974	1975	1976	1977	* 1978	* 1979
1 Lic.	Summer	$					2,325	2,986	
		Lbs.					3,926	6,639	
	Fall	$	44,857	30,218	24,063	32,604	12,161	16,125	33,948
		Lbs.	91,521	66,097	50,956	51,452	72,078	23,849	40,670
	Winter (CF)	$				2,701	3,590		
		Lbs.				3,465	5,050		
	Sub-Total	$	44,857	30,218	24,063	35,305	45,751	19,111	33,948
		Lbs.	91,152	66,097	50,956	54,917	77,128	30,488	40,670
2 Lic.	Summer, Fall	$	39,108	25,745	23,862	25,752	29,946	34,273	51,328
		Lbs.	90,697	64,824	56,711	46,385	51,991	57,590	72,840
	Fall, Winter(CO)	$	14,875	6,827	12,957	24,513	21,384	11,620	13,823
		Lbs.	25,653	13,034	27,474	35,112	35,907	15,600	16,377
	Fall, Winter(CF)	$	7,978	8,673	19,152	45,446	35,309	17,780	22,979
		Lbs.	17,025	20,582	43,263	70,206	60,913	31,398	27,445
	Summer, Winter	$						5,644	5,958
		Lbs.						7,762	6,802
	Sub-Total	$	61,961	71,463	55,971	95,711	86,639	82,935	94,088
		Lbs.	133,375	164,537	127,448	151,703	148,811	112,350	123,464
3 Lic.	Summer, Fall,Winter(CO)	$	25,989	21,779	33,842	39,181	35,731	21,096	19,150
		Lbs.	65,927	61,392	93,969	65,417	61,117	37,523	23,771
	Summer, Fall,Winter(CF)	$	47,818	30,722	52,516	119,380	144,148	53,078	26,135
		Lbs.	96,287	69,543	118,758	183,429	233,321	82,828	36,639
	Sub-Total	$	73,807	52,501	86,358	158,561	179,879	74,174	45,285
		Lbs.	162,214	130,935	212,727	248,846	294,439	120,351	60,410
	Total	$	180,625	154,182	166,392	289,577	312,269	176,220	173,321
		Lbs.	386,741	361,569	391,131	455,466	520,378	263,189	224,544

Source: Department of Natural Resources Fisheries Branch Licensing Records.
Freshwater Fish Marketing Corporation Production Records.

* 1978-1979 values do not include value of winter harvest.

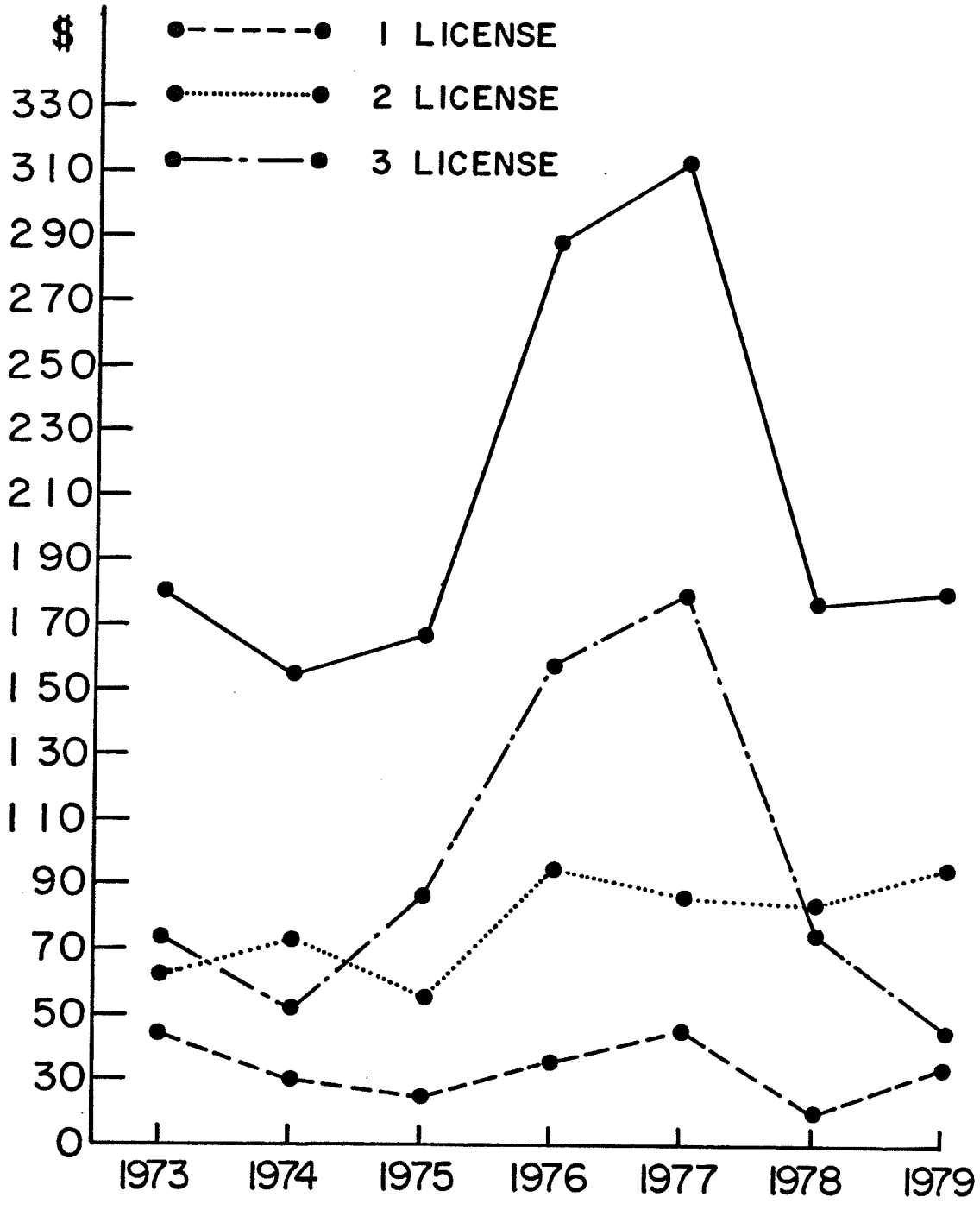

FIG. 6 TOTAL PRODUCTION ($) BY PRODUCTION CATEGORY - GIMLI REGION

No production category consistently contributed toward a major proportion of total production. (Table 7, Fig. 6). From 1975-1977, the three license category formed the major portion of total production. However, in 1978 and 1979, the two license category contributed more toward total production than the three license category. The decline in the three license production category's share of total production may be explained by the decreasing number of fishermen in this category contracting sales with the FFMC during the open water seasons of 1978 and 1979. (Appendix B, Tables 4-6).

The significance of the winter fishery toward total production was greater in the Gimli area than in Berens River (Table 8). The reasons may be due to the greater relative proportion of winter licenses in the Gimli area, the possibility of alternate sources of employment during the open water seasons in Gimli or cultural factors.

Mean gross revenues by production category for open-water harvests during the 1973-1979 period are provided in Appendix C, Tables 4-6. As was the case in Berens River, mean open-water gross revenues in the three license production category consistently exceeded those observed in the two license production category (Appendix C, Tables 4-6) and (Table 9). It appears the majority of individuals holding three licenses in the Gimli area also chose to exercise their "roll-over" option and harvest all or a portion of winter quota entitlements during the open-water seasons.

TABLE 8

Value of Open-Water Production
Gimli - 1973-79

Year		1 License	2 License	3 License	Total Open Water	% of Total
1973	$	44,857	50,614	52,024	147,495	81.66
	lbs.	91,521	110,126	109,041	310,688	80.33
1974	$	30,218	32,401	33,053	95,672	62.05
	lbs.	66,097	80,095	80,820	227,012	62.78
1975	$	24,063	42,918	58,429	125,410	75.37
	lbs.	50,956	99,408	134,586	284,950	72.85
1976	$	32,604	62,620	100,030	195,254	67.43
	lbs.	51,452	105,250	160,609	317,306	69.67
1977	$	42,161	69,534	107,039	218,734	70.05
	lbs.	72,078	118,965	163,575	355,248	68.27
1978	$	16,125	68,509	65,636	150,270	N/A
	lbs.	23,849	110,648	109,351	243,848	N/A
1979	$	33,948	94,088	45,285	173,321	N/A
	lbs.	40,670	123,458	60,400	224,528	N/A

Source: Department of Natural Resources, Fisheries Branch Licensing Records. Freshwater Fish Marketing Corporation Production Records.

TABLE 9

Comparison of Open-Water Production Values Between Two and Three License Production Categories: Gimli

YEAR		Production Category	
		2 LICENSE	3 LICENSE
1973	$	3615.28	5202.40
	lbs.	7866.14	10904.10
1974	$	2945.54	4131.62
	lbs.	7281.36	10102.50
1975	$	3576.50	5311.73
	lbs.	8284.00	12235.09
1976	$	4472.86	7145.00
	lbs.	7517.86	11471.71
1977	$	4966.71	7645.64
	lbs.	8497.50	11683.93
1978	$	4893.50	5966.91
	lbs.	7903.43	9941.00
1979	$	7728.00	9057.00
	lbs.	10056.25	12080.00

Source: Department of Natural Resources, Fisheries Branch Licensing Records. Freshwater Fish Marketing Corporation Production Records.

3.4 Distribution of Fishermen, Licenses and Gross Revenues by Production Category

3.4.1 *License Distribution--Lakewide*

The present system of license allocation has resulted in very little change with respect to the number of fishermen within each production category during the 1972-1979 period (Table 10). Those individuals holding one license, have declined from 47.2% (1972) to 42.5% (1979) of total fishermen. Those holding two licenses have increased from 34.4% (1972) to 38.5% (1979) of the total fishermen, while those holding three licenses have increased from 18.4% (1972) to 19.0% (1979) with a peak of 20.3% in 1977. Such small changes in license distribution would seem to indicate that as an individual retires from the fishery, the licenses he held are redistributed in such a way among new entrants and existing licensees, as to maintain a relatively constant distribution of licenses among fishermen during the 1972-1979 period.

3.4.2 *Distribution of Fishermen, Licenses and Gross Revenues by Production Category--Berens River*

Within the present allocative system, distribution of fishermen, licenses and revenues has remained relatively constant from 1973-1979, (Tables 11 and 12). The majority of fishermen (43.4%) fall into the two license category and account for 50% and 56% of licenses and revenues respectively. The fewest fishermen (16.7%) are found within the three license category and hold 28.9% of the licenses, thus producing 25.3% of the gross revenues. Thirty-six percent of the total fishermen hold one license and hold 21.2% of the total licenses, while producing 18.2% of total gross revenues. The structure of the commercial fishing industry in Berens River with respect to the distribution of fishing rights

TABLE 10

Distribution of Licenses Among Licensed Fishermen
1972-79
(Excluding North-End Whitefish Licenses)

Year	Total Licensed Fishermen	Production Category % of Total Licensees			Total Licenses
		1	2	3	
1972	668	47.2	34.4	18.4	1144
1973	693	46.6	35.3	18.0	1188
1974	689	47.3	34.1	18.6	1180
1975	651	44.4	34.6	19.4	1178
1976	695	45.3	35.2	19.4	1208
1977	696	44.1	35.6	20.3	1226
1978	699	42.6	38.0	19.3	1234
1979*	689	42.5	38.5	19.0	1216

Source: Department of Natural Resources Fisheries Branch, Licensing Records.

* 1979 Values are those recorded prior to the issuing of summer 1980 licenses.

TABLE 11

Distribution of Licenses Among
Berens River Fishermen
1972-79

Year	Total Licensees	Production Category % of Total Licensees			Total Licenses
		1	2	3	
1972	56	42.9	39.3	17.9	98
1973	60	40.0	45.0	15.0	105
1974	60	40.0	45.0	15.0	105
1975	59	39.0	45.8	15.2	104
1976	61	39.3	44.3	16.4	108
1977	60	36.6	46.7	16.7	108
1978	62	38.7	45.2	16.1	110
1979	60	36.7	43.3	16.7	104

Source: Department of Natural Resources Fisheries Branch, Licensing Records.

Table 12 Distribution of Fishermen, Licenses, and Gross Revenues by Production Category

Berens River: 1973-1979

Production Category		1973	1974	1975	1976	1977	1978	1979
1 License	% Fishermen	40.0	40.0	39.0	39.3	36.6	38.7	36.7
	% Licenses	22.8	22.8	22.1	22.2	20.3	21.8	21.2
	% Gross Revenues	19.1	18.6	20.4	20.2	19.6	19.0	18.2
2 Licenses	% Fishermen	45.0	45.0	45.8	44.3	46.7	45.2	43.3
	% Licenses	51.4	51.4	52.0	50.0	51.9	50.9	50.0
	% Gross Revenues	50.8	49.0	54.0	51.1	52.1	57.8	56.0
3 Licenses	% Fishermen	15.0	15.0	15.2	16.4	16.7	16.1	16.7
	% Licenses	25.7	25.7	25.9	27.8	27.8	27.2	28.9
	% Gross Revenues	30.1	32.3	25.6	28.7	28.3	23.2	25.3

and gross revenues among fishermen has changed little since the present system of license allocation was introduced in 1972.

3.4.3 *Distribution of Fishermen, Licenses and Gross Revenues by Production Category: - Gimli*

Unlike Berens River, there has been considerable change in the distribution of fishermen, licenses and gross revenues by production category (Tables 13 and 14). The proportion of individuals holding one license has decreased from 31.3% (1972) to 18.2% (1979). Those holding two licenses have increased from 25.4% (1972) to 31.8% (1979), while the proportion of individuals in the three license category has increased from 20.9% (1972) to 27.3% (1979).

The share of licenses held by fishermen in the one license production category has declined from 15.8% (1973) to 8% (1979), while the share of licenses held by those in the two license category has fluctuated between 20.5% (1977) and 28.0% (1979) with an average share of 25.1%. The greatest change in the proportion of licenses held occurred in the three license category with an increase from 26.1% (1973) to 36.0% (1979). The share of licenses held by this category reached a maximum of 39.0% in 1977.

Changes in gross revenues contributed by each production category do not reflect changes in the percentages of licenses held by each category as one might expect. As previously mentioned, this unusual relationship may be due to the decisions of producers within each category to market their catch directly to consumers rather than through the Freshwater Fish Marketing Corporation.

TABLE 13

Distribution of Licenses Among
Gimli Fishermen
1972-79

Year	Total Licensees	Production Categories % of Total Licensees			Whitefish %	Total Licenses
		1	2	3		
1972	67	31.3	25.4	20.9	22.4	137
1973	66	31.8	27.3	18.2	22.7	133
1974	65	32.3	26.2	18.5	23.1	131
1975	64	26.5	26.5	23.4	23.4	137
1976	66	24.2	24.2	28.8	22.7	147
1977	66	25.8	22.7	28.8	22.7	146
1978	66	19.7	30.3	27.3	22.7	150
1979	66	18.2	31.8	27.3	22.7	150

Source: Province of Manitoba, Department of Natural Resource, Fisheries Branch - Lake Winnipeg Licensing Records.

Table 14 Distribution of Fishermen, Licenses, and Gross Revenues by Production Category

Gimli: 1973-1979

Production Category		1973	1974	1975	1976	1977	1978	1979
1 License	% Fishermen	31.8	32.3	26.5	24.2	25.8	19.7	18.2
	% Licenses	15.8	15.8	12.4	10.9	11.6	8.7	8.0
	% Gross Revenue	24.8	19.6	14.5	12.2	14.6	10.8	19.6
2 Licenses	% Fishermen	27.3	26.2	26.5	24.2	22.7	30.3	31.8
	% Licenses	27.1	27.0	24.8	21.8	20.5	26.8	28.0
	% Gross Revenue	34.3	46.3	33.6	33.0	27.7	47.1	54.3
3 Licenses	% Fishermen	18.2	18.5	23.4	28.8	28.8	27.3	27.3
	% Licenses	26.1	27.0	32.8	38.8	39.0	36.2	36.0
	% Gross Revenue	40.9	34.0	51.9	54.7	57.6	42.1	26.1
Whitefish	% Fishermen	22.4	29.9	23.4	22.7	22.7	22.7	22.7
	% Licenses	30.1	30.1	29.9	28.5	28.7	28.2	28.0
	% Gross Revenue	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

The number of fishermen holding summer whitefish licenses in the Gimli area has remained at 15 or approximately 23% of the total licensed fishermen from 1972-1979. All whitefish operators hold at least one additional quota entitlement with the majority holding the maximum of two additional quotas (Table 15). Gross revenue figures for these individuals were not gathered, although the total whitefish entitlement (1979) for these producers equals 515,000 lbs. (round weight) which is greater than the peak level of production from both the skiff and winter fisheries in 1977 (Table 7). The distribution of revenues would be altered significantly if these individuals were included. It is not unreasonable to assume that upwards of 40% of the gross dollar value of production in the Gimli area is accounted for by these 15 individuals.

3.5 Economic Viability

Economic viability requires an enterprise to generate sufficient funds from its operation to allow reinvestment in capital equipment. The economic viability of a business may be measured in a number of ways. One common measure of operating performance is the accounting measure of net revenue. In this study, net revenue is the difference between gross revenues earned from fish sales and the sum of variable, fixed and interest expenses. The exact procedure by which net revenues were calculated is provided in Appendix D. Positive net revenues are an indication of a relatively secure financial position, while negative net revenues are preliminary indicators of financial instability.

TABLE 15

Additional Quota Entitlement Held by Whitefish Licencees for Gimli Area 1972-79

YEAR	Seasons	QUOTA ENTITLEMENT lbs. (Round Wt.)	NUMBER OF FISHERMEN
72	WS	24,000	
	WS,F	32,400	5
	WS,W,F	$36{,}400_{co}$ $41{,}400_{cf}$	7_{co} 3_{cf}
73	WS	24,000	
	WS,F	32,400	5
	WS,W,F	$36{,}400_{co}$ $41{,}400_{cf}$	7_{co} 3_{cf}
74	WS	24,000	
	WS,F	32,400	5
	WS,W,F	$36{,}400_{co}$ $41{,}400_{cf}$	7_{co} 3_{cf}
75	WS	24,000	
	WS,F	32,400	4
	WS,W,F	$36{,}400_{co}$ $41{,}400_{cf}$	7_{co} 4_{cf}
76	WS	30,200	
	WS,F	38,600	
	WS,W,F	$42{,}600_{co}$ $47{,}600_{cf}$	8_{co} 4_{cf}
77	WS	30,200	
	WS,F	38,600	3
	WS,W,F	$42{,}600_{co}$ $47{,}600_{cf}$	8_{co} 4_{cf}
78	WS	35,000	
	WS,F	43,400	3
	WS,W,F	$47{,}400_{co}$ $52{,}400_{cf}$	8_{co} 4_{cf}
79	WS	35,000	
	WS,F	43,400	3
	WS,W,F	$47{,}400_{co}$ $52{,}400_{cf}$	8_{co} 4_{cf}

LEGEND: WS = Whitefish (Summer Season)
F = Fall
W = Winter
co = Commercial Operator (Winter)
cf = Commercial Fisherman (Winter)

Source: Dept. of Natural Resources, Fisheries Branch Licensing Records.

All enterprises within all production categories experienced positive net revenues in all years (Tables 16 and 17). The absolute value of these revenues is not overly impressive. In the Gimli area, in all production categories, the income earned by an operator is less than that which could have been earned in full-time employment with renumeration at the rate of the Provincial minimum wage (1979). For example, the total estimated income earned by an individual in the three license production category in 1979 was $ 5,344.13 (Appendix D - Table D-6, net revenue plus labour which the operator would retain in a one-man operation). Comparatively, an individual working full-time earning the Provincial minimum wage (3.55/hour - 1979) would receive a gross income of $6,360.00. Seasonal income from fishing may be supplemented by income from other employment or transfer payments. The fact fishing income is seasonal must be emphasized when considering revenues earned. It may be the seasonal characteristic which allows an individual to maximize total employment opportunities (and therefore income) throughout a year. Commitment to a one-industry full-time occupation may not provide such an opportunity.

In Berens River, net revenues in the two and three license production categories exceeded those for Gimli (Tables 15 and 16). Larger quota entitlements associated with these categories in Berens River (Appendix B - Tables 2-6) probably accounts for the differences. Operators within these categories were earning incomes in excess of that which could be earned from full-time employment paying the Provincial minimum wage.

TABLE 16

NET REVENUES (OPEN-WATER) BY PRODUCTION CATEGORY:
GIMLI AREA 1973 - 1979

Year	Production Category		
	1 License	2 License	3 License
1973	$ 731.35	$ 1,152.57	$ 2,353.93
1974	1,026.35	1,486.89	2,649.16
1975	1,280.17	1,761.94	2,886.82
1976	1,557.21	2,066.99	3,120.65
1977	1,881.12	2,446.29	3,479.43
1978	2,163.33	2,781.48	3,795.80
1979	2,343.98	2,993.42	3,972.85

TABLE 17

NET REVENUES (OPEN-WATER) BY PRODUCTION CATEGORY:
BERENS RIVER 1973 - 1979

Year	Production Category		
	1 License	2 License	3 License
1973	$ 677.17	$ 1,795.91	$ 2,131.04
1974	948.58	2,469.82	3,109.76
1975	1,175.61	3,078.52	4,012.67
1976	1,424.44	3,721.03	4,949.90
1977	1,720.74	4,469.48	5,985.48
1978	1,976.52	5,177.46	6,973.59
1979	2,124.97	5,736.77	7,805.75

Positive net revenues for all categories in all years suggests that the "typical firm" is receiving at least the minimum acceptable returns to labour and although the operator's capital requirements are artificially low due to public sector subsidization, the returns to an operator's capital from the fishing enterprise must at least be equal to the operator's opportunity cost of capital. If this were not so, one would expect participation to be decreasing. As has been illustrated (Table 3) this is not the case. Skiff operations in the study area are economically viable to the extent that they are at least capable of generating funds sufficient to meet owner equity requirements (equity requirements range downward from 10% - Appendix D) for reinvestment in capital equipment.

The degree of economic viability is obviously influenced by the production category within which a particular enterprise falls. Because capital investment requirements are similar for all firms regardless of production category, the economic viability of skiff operations increases as the quota entitlement (production category) increases.

3.6 Conclusions

Although the current system of resource allocation has defined minimum and maximum participation levels, there has been no distinguishable trend toward these levels either on a lakewide or community (Gimli and Berens River) basis. The number of participants has fluctuated randomly and to a small degree. The absence of directional trends makes a predic-

tion as to whether future participation levels will increase, decrease, or continue to fluctuate randomly, difficult.

Production data indicate the Berens River fishery as being primarily an open-water fishery, while in the Gimli area the winter fishery is of greater importance. Declining Gimli area open-water production levels in 1978 and 1979 in conjunction with the decreasing number of fishermen contracting sales with the FFMC for the open-water season suggests that either more fishermen are harvesting their entire quota entitlement during the winter season or have chosen to by-pass the FFMC and market their catch directly to consumers. Observation of open-water production data have also revealed the majority of fishermen (the majority of those appearing in FFMC production data) in both communities in the three license production category chose to harvest all or a portion of winter quota entitlements during the open-water season.

The structure of the skiff fishery in the Gimli area has been changed by the resource allocation system in that there has been a trend toward larger sized operations as more fishermen moved into the two and three license production categories while those in the one license category declined. In Berens River, the resource allocation system has maintained the distribution of participants at a relatively constant level during the 1972-1979 period.

These changing and constant patterns of industrial structure acquire relevance when examined in conjunction with the economic viability analysis. The analysis demonstrated that the economic viability of the skiff enterprises increased as the size of the production category increased. Therefore, in addition to changing costs and revenue

conditions the economic position of the fishery is affected by the dynamics of the resource allocation system. As the number of operators in the two and three license production categories in the Gimli area increased the economic viability of the skiff fishery as a whole was improving, while the economic viability of the skiff fishery in Berens River, as it was influenced by the system of resource allocation, remained constant.

On the basis of these conclusions, an evaluation and analysis of the current system of resource allocation relative to the marketable property rights alternative may proceed.

CHAPTER FOUR

ANALYSIS

4.0 INTRODUCTION

Variables relating to the decision to maintain the present system of resource allocation or adopt a system of property rights allocated by the market institution will be analyzed within a three level hierarchy of conceptualized decision systems.[1]

On the first level decision-making relates to the determination of inputs, outputs, and a host of similar decisions made by the operating sectors of the economy; individuals, firms, industries, and public operating agencies. This level is designated the operating level. The decision systems on the next level comprise the institutional regulation of decision-making on the first level. This level will be called the institutional level and specifically refers to the Fisheries Branch of the Department of Natural Resources. On the third level, changes within institutions on the second level are the subject of decision-making. This level of decision systems will be referred to as the policy level.

The use of levels of decision systems as an analytical framework is not intended to portray a predeterministic model of public policy and program formulation. Each "level" is merely a component of a larger interactive informational system. The entire system is dependent upon a continuous flow of information between components and no level is considered less important than another to the overall process.

Decisions on each level can be analyzed with respect to procedure (structure, functioning), and performance. The following analysis will focus more directly upon the procedural aspects of the policy and institutional

levels, while performance will be more heavily emphasized within the operating level.

4.1 The Policy Level

Historically, initial decisions made regarding fisheries policy at this level are a consequence of ideas rather than interests and institutions. The concept of paradigms in public policy is applicable to fisheries policy not only in Manitoba, but in Canada as well. "A policy paradigm constitutes a series of principles which express the current assumptions from which specific policy-making can proceed ... limit the appropriate set of policy instruments, and ... summarize the world view of the policy-making community."[2] Specific paradigms may become dominant, and subsequently subject to the challenge of contending schools of thought due to increases in analytical capability or the inadequacy of the dominant paradigms' prescriptions. Eventually, original paradigms may be overthrown by the contending school of thought. The point at which an established paradigm is overthrown by a contending school of thought constitutes an intellectual revolution.[3]

The policy level of fisheries management fits neatly into the above concept. Initially, policy decisions were dominated by biological and ecological paradigms. Policy instruments took the form of biological controls to protect and enhance stocks. The works of Scott-Gordon and A. Scott (1955) constituted an intellectual revolution and introduced new ideas into the sphere of fisheries policy decision-making. The biological paradigms were never overthrown, but were no longer dominant in that policy-making and policy instruments were no longer derived solely from biological and ecological assumptions. Gradually, the economic theories and ideologies became prominent, first in the literature, and recently in policy objectives.

The extent to which economic paradigms have been incorporated successfully into actual management programs is extremely limited. The failure of policy decisions to be fully incorporated at the administrative level is best explained by what is referred to in the political science literature as public choice theory,[4] and in the economic literature as the theory of regulation.[5] Paradigms provide the stimuli resulting in primary decisions being made at the policy level. The will to act is derived from the paradigms. However, the ability to act is determined by arrangements structuring the authority of the state to act in coercive manners. "The content of what is done is determined both by ideas - the paradigms that give shape to public policies and those governmental activities - and by institutions - the arrangements which structure the authority to exercise the coercive functions of the state." The latter encompasses the incentive systems and rules of behaviour through which interests (economic self-interests and social values) obtain their political representation".[6] In a democratic political institution attempts to shape the actions and behaviour of individuals and organizations will incur political as well as economic costs and benefits.

Producers, processors, consumers and governments all have a vested interest in the fishing industry and each will resist relinquishing privileges that are preserved by the status quo. Proposed policy decisions may not be feasible at the administrative or political levels. The divergence between the will to enact specific policies and the ability to enact them, is more clearly understood by examining the role of regulations (coercion) in the political process.

The product or effect of almost any type of regulation is a redistribution or transfer of wealth.[7] In the case of regulations derived from

theoretical economic prescriptions (ie. marketable property rights) designed to rationalize the fishing industry, wealth would be redistributed in two ways: (1) redundant inputs of labour and capital would be transferred to other industries, (2) the rent generated by such regulations would be redistributed through government to society or to fishermen in the absence of taxation. Consequently, fishery regulations that are not explicitly efficiency based (ie. the allocation of quotas on the basis of experience and dependency criteria) will involve a redistribution of wealth away from society to those directly involved in the industry. The general public incurs a tax by sacrificing the natural wealth that could be created. The role of regulation now becomes "that of a fulcrum upon which contending interests seek to exercise leverage in pursuit of wealth."[8]

The output of regulation (the transfer of wealth) is the essential commodity transacted in the political market where "the market will distribute more of the good to those whose effective demand is highest."[9] The "output" of Lake Winnipeg licensing criteria and the one license per season regulation is a transfer of potential wealth away from the general public and those fishermen wishing to expand their operations toward fishermen favouring more secure and equitable forms of access to the resource. This situation may be considered indicative of the dominance of a small group with a large per capita stake at the expense of large or less concentrated groups with more diffused interests.

The tendency of small groups to dominate the regulatory process is due primarily to two factors:[10]

(1) With respect to any particular issue the individual must inform himself about the general implications for his wealth. The acquisition of information involves costs which must be offset by prospective gains. A large group will experience a small per capita gain, hence information costs usually outweigh perceived gains.

(2) As the size of the group increases the costs of organizing and mounting a concerted effort for (against) the desired (undesired) regulation increases faster than group size.

When examined from the perspective of the regulator each regulation affecting a wealth transfer will involve a political return and a political cost. Theoretical abstraction would demand the regulator to proceed to the extent where marginal political returns from a wealth transfer equals marginal political costs of the transfer; where costs and returns may both be expressed as votes.[11] When applying this concept to the fishery, it seems unlikely the general public would ever demand of the regulator rent maximization or allocative efficiency in the use of the commercial fishery resource. The average citizen is unaware of the revenues society forgoes as a result of the stable equilibrium situation characteristic of mature fisheries. On the other hand, fishermen constitute a vocal and visible group capable of organizing and exerting political pressure. Paradigms which prescribe a reduction of resources employed may be associated with large political costs to the decision-maker at the policy level.

To summarize, the concept of paradigms and public policy explains initial decisions made at the policy level of fisheries management. However, the coercive nature of prescriptive norms derived from economic paradigms will be limited by the political arrangements structuring the authority of the state. The result is a modification of decisions made at the policy level to accommodate political costs and benefits. Such revisions are best explained by the theories of public choice and regulation.

4.1.1 *The Manitoba Situation at the Policy Level: An Overview*

Within the last 12 years a number of major policy decisions affecting the Manitoba and Lake Winnipeg commercial fisheries have been made. The

first decision to affect significantly Manitoba's fishing industry was that which created the Freshwater Fish Marketing Corporation (1969). The decision was precipitated by economic analysis prescribing the need to eliminate redundancy in the processing and marketing sectors in order to increase primary producer incomes. The creation of the Corporation was subject to much controversy and elected representatives undoubtedly weighed political costs and benefits before effecting the change. The aforementioned theories of public choice and regulation appear to provide a suitable theoretical framework within which further formal analysis of this decision could proceed.

The closure of Lake Winnipeg to commercial fishing in 1970 is a policy decision requiring little formal analysis. The decision was not a question of choice, but of necessity (mercury pollution). The closure did provide an opportunity to assess past policy and administrative procedure. The limitation of entry to commercial fishing upon reopening of Lake Winnipeg in 1972 was a partial incorporation of economic policy prescriptions. The limited entry program, which promised increased incomes to fishermen, was a transitional change as prior to 1972 licensing limits existed, but numbers were set above the number of fishermen requesting licenses (Appendix A). The goal of the individual quota system imposed at this time was to equalize potential income for fishermen.[12] In addition, the individual quotas marked the introduction of a formal system of quantitative rights into the fishery.

Past policy decisions when examined chronologically rather than in isolation from each other appear to represent a general trend toward industry rationalization. This rationalization trend is more likely accidental rather than part of a comprehensive policy for the industry. Policy

decisions have been made by different levels of government and in response to unforeseen circumstances (mercury pollution). However, the denominator common to all of these decisions is that they have been made in response to poor economic conditions and intended to increase primary producer incomes. Even the closure of Lake Winnipeg was seized as an opportunity to evaluate past administrative procedures and develop programs to improve income levels.

Within this brief historical perspective a decision to adopt a system of marketable property rights would seem another transitional step toward the rationalization of the industry; specifically the Lake Winnipeg fishery. Property rights and the market institution are not radically different concepts (radical in the sense they would represent changes significantly different from the norm). The individual quota constitutes a right in property and has been accepted by most fishermen on the Lake. The market institution although never applied formally in this specific case, is a familiar one and its use in allocating rights to the fishery could not be considered so radical a departure from past decision to be considered irrelevant.

4.2 The Institutional Level

The Fisheries Branch functions in both regulatory and managerial capacities. The Branch is an administrative entity performing a range and mix of regulatory adjudicative, consultative, advisory, and research functions. Primary clientele are commercial fishermen while secondary clientele include The Federal Government and The Freshwater Fish Marketing Corporation. The relationship between these clientele and The Fisheries Branch is complementary and interdependent. The Branch is administratively dependent

upon a continuing flow of information between itself and the clients, as are the clients dependent upon the reverse flow. The fairly wide degree of multi-functionality [(conservation (enforcement, enhancement)], allocation, and research), the presence of a Crown Corporation as part of the client group and the administrative interdependence with other Federal and Provincial Departments suggests the Branch may be more accurately viewed as being intended to perform more of a managerial function than a regulatory one.[13]

The Branch regulates mainly in the areas of conservation (enforcement) and allocation. With respect to allocation the Branch functions as an intermediary adjudicator in the redistribution of fishing rights among competing individuals. The adoption of the property rights policy instrument would reduce the regulatory functions of the Branch and increase the managerial roles. The Branch would no longer actively redistribute licenses, but merely record the direction of redistribution.

4.2.1 *Evaluation of Alternatives*

Alternatives will be limited to: (1) maintaining the present system of license allocation, (2) applying the concept of property and property rights to commercial fishing rights and using the market institution to allocate such rights. The alternatives will be evaluated according to the following criteria:

(1) Effectiveness in Achieving Management Goals and Dealing with Current Issues.

(2) Ease of Organization and Administration.

(3) Effects of the Distribution of Associated Benefits and Costs.

(4) Legality.

4.2.1.1 Effectiveness in Achieving Management Goals and Dealing with Current Issues

The Provincial fisheries management goal of "establishing and maintaining a viable commercial fishing industry wherein participants can earn a reasonable return on investment and time, and with limited social disruption" is related intimately to the issues of allocation criteria and methods. As fishing industry costs and revenues are generally beyond direct Provincial government control the allocation procedure is the only direct method through which Fisheries Branch may influence commercial fisheries' economic performance.

4.2.1.1(a) The Current System of Resource Allocation

The goal of the individual quota system on Lake Winnipeg was to equalize potential income for fishermen. Experience in the fishery has been the major criterion for allocating quotas. The result has not been an equalization of potential income among Lake Winnipeg fishermen, but rather an industry stratified into distinct production categories. Potential incomes are only equalized among similar individuals in similar locations within the same production category. Equalization of potential income would require the present system to allocate quotas so as to result in all fishermen holding equal entitlements. With the experience criterion being dominant such an occurence would only be accidental and not a direct consequence of the allocation method. The ability of the current allocation system to achieve present economic goals is unclear simply because the terms viable and reasonable returns are subject to interpretation and perspective. The preceeding chapter's economic analysis indicated all skiff operations in all production categories in both communities appeared capable of generating minimum owner's equity requirements. Therefore, from the accounting

stance of the fisherman, the operation could be considered viable. Whether these conditions would persist with the removal of government (MACC) financing (and therefore the artificially low equity requirements) is unknown. However, viability would still occur in varying degrees in that an operator in the three license production category would be more viable than one in the two license production category who would be more viable than one in the one license category.

The level and duration of government financing is an important variable when assessing economic performance relative to an allocation system. If we assume present skiff operations in the one and two license production categories economically unviable in the absence of government support, the present allocation system could only rectify this situation if fish prices rose at a rate sufficiently greater than factor input prices to improve viability or if the future allocation of licenses resulted in more fishermen entering the three license production category. The first solution is independent of any actions that may be taken within Fisheries Branch. To predict the future distribution of entitlements among production categories under the present system is possible, but would require extremely detailed knowledge of the points distribution among license competitors and the intentions of existing licensees with respect to retirement. Also, once an individual enters the three license production category he is removed from any further license competition. Any state resulting in all producers moving into this category (and therefore becoming economically viable in the absence of government support) would be extremely unstable and only persist until additional licenses became vacant.

The determination of what constitutes reasonable returns is dependent upon alternative opportunities. Within a regional economy employment alternatives may be limited to the extent that employment in the fishery is the only alternative available. An operator in this situation would not consider investing his capital in any other alternative because employment in the fishery is dependent upon the decision to commit capital to that industry. Actual returns to owners' equity are incidental to the decision-making process. The primary economic return is the opportunity to be employed. Income maximization rather than maximizing investment return is the objective of the operator.

It should also be noted that regardless of the allocation method used enterprises may be viable, independent of government support, and earning a "reasonable" return on investment, but the annual income received from the fishery by the operator incapable of sustaining him for an entire year because of the seasonal nature of the industry. In the absence of complementary seasonal employment alternatives, income earned from the fishery could be unacceptable even though all economic goals for the fishery had been met.

The need to accommodate opportunities for business development has been identified as an issue which must be dealt with if economic management goals are to be achieved. The current system's ability to deal with this issue is limited because the absolute size of an operation is restricted by the one license per season regulation. In addition, the time investment required to expand operations through the points system acts as a deterrent to business development.

4.2.1.1 (b) The Marketable Property Rights Alternative

A regime of marketable property rights would only be effective in achieving management goals if it resulted in a greater concentration of production (fewer vessels with larger production), thus allowing operators to take advantage of production economies which appear to exist (Tables 19,20).

Any allocation system based on property rights and the market would have to be organized in such a way so as to prevent a dilution of production. Dilution could be a consequence of such a system in the presence of current low equity requirements to enter the fishery due to public sector grant and lending programs. The anticipation of even relatively small positive net revenues will induce individuals to enter the market for fishing rights if the opportunities to earn income elsewhere are severely limited. The end result could be an increase in the number of enterprises, which from the accounting stance of the operators are "viable" in light of the alternatives, but from an industry perspective economic viability would decrease and the dependence on government support increase. Therefore, a concentration of production will be dependent upon the quantity and quality of the entitlement being transferred and the structure of the market within which transfers occur.

Structural variables which will affect directly achievement of economic management goals are: (1) the initial allocation of rights; (2) divisibility of rights; and (3) the minimum amount of entitlement which may be held.

Initial allocation may occur via an open auction. However, this may lead to an involuntary dislocation of existing fishermen and more importantly, could result in production being less concentrated among operators

than is currently the case. It may be more prudent to allow the existing distribution of quota entitlements to stand as is and allow negotiations for sale to begin from the existing allocation.

If the market institution is to organize an industry efficiently the market must be competitive. Effective competition is dependent upon large numbers of buyers and sellers. To enhance the competitive nature of the market and therefore the movement of the industry toward greater efficiency (and subsequent increased economic viability) the good being negotiated for (fishing rights) must be divisible. It should be noted absolute divisibility is impossible and this characteristic will be subject to practical and administrative constraints.

If fishing rights being transferred were of the same quantities as existing quota entitlements (5,000, 8,400, 9,000 lbs.) the divisibility characteristics would be restricted. A market based on current large quota blocks would exclude many potential buyers and sellers from the market. Potential buyers would be unable or unwilling to enter sufficiently high bids for large quota blocks, although the bid per unit of entitlement could conceivably be greater if quota blocks were smaller. These individuals could be eliminated from the market because the amount of entitlement for which they must bid is larger than what is needed. Conversely, large quota blocks would infringe upon the freedom of sellers as well as reducing the number of potential sellers in the market. A fisherman's flexibility in adjusting the size of his operation would be restricted. As well, the selling price per pound could conceivably be less with larger quota entitlements.

The specification of a minimum allowable entitlement is dependent upon an absolute definition of acceptable levels of economic viability and reasonable returns and whether such levels are to be calculated with or

without the presence of government lending programs. The concept of a minimum entitlement could possibly complement government lending programs if such an entitlement was an eligibility criterion for financial assistance. Minimum entitlements would also have to be reviewed and evaluated periodically to assure (their relevance) accuracy with respect to changing fish prices and costs. Initially, minimum entitlements could be set at a level high enough to prevent the number of fishermen on the lake or in any community from increasing significantly or at the level required to make a skiff operation self-sustaining in the absence of government financing.

Property rights in the fishery would obviously provide an attractive vehicle for business development. However, the acquisition of additional harvest rights would represent an increased capital investment on the part of the fisherman. Business development will be dependent upon the quality of business skills which are required to evaluate accurately an asset (fishing rights) providing continuous, but uncertain, future income streams. Both the amount and degree of risk associated with investing in a fishing enterprise will increase. Marketable property rights represent as much an "opportunity" for business failure as for business development.

To summarize, the initial allocation of marketable fishing rights among fishermen should not differ greatly from the current allocation of quota entitlements. To ensure competitive and effective market the quantity of rights which could be traded would have to be much smaller than current quota blocks. A level of minimum allowable rights would have to be determined to prevent an increase in fishermen and having the fishery divided into private lots too small for efficient fishing. A system of property rights organized within this framework should aid in the achievement of economic management goals.

4.2.1.2 Ease of Organization and Administration

Factors which must be considered within the criterion of organization and administration include: (a) the spatial aspect of the property rights, (b) specification of the bundle of rights which are to be held by the fishermen, (c) enforcement, and (d) information and communication costs.

(a) *The Spatial Aspect*

The spatial aspect of the property right to be held in the fishery would involve both biological and geographical components. Biologically, quotas are associated with specific areas of Lake Winnipeg.[14] The right to harvest a specific quantity of fish must be attached to the biological component of space if stocks are to be conserved and maintained, when purchased. Harvest rights associated with a specific biological area of the lake could not be transferred to another biological area without compromising the conservation goal.

Geographically, individual quota entitlements are tied to community licensing areas. Individuals harvesting from within the same biological areas, but residing in different communities could conceivably trade in fishing rights, although transactions costs will increase with distances between communities. Evaluation problems may also arise when fishing rights are transferred between individuals from different communities. These problems would stem from the fact species quality, mix and accessibility differ among geographic areas. An accurate evaluation of harvest rights requires incorporation of these variables. An individual purchasing harvest rights from outside their community area would have to acquire this information, thus compounding transactions costs.

Administratively, intra-community transactions may be less complex,

although if trade is restricted to biological areas the complexity of inter-community trade may not be prohibitive. To the extent communities lie within the same biological regions of the lake a system of property rights could be organized and administered on either an intra- or inter-community basis.

(b) *The Bundle of Rights to be Held*

"Property involves several distinct interests or rights which can be held separately and which when taken together represent a bundle of separable property rights." A private owner has the right to possess and use, to sell, to devise, to lease, to mortgage and to sub-divide. The state reserves the rights to tax, to take for public use, to control the use of and to escheat.[15]

The rights to possess and use, and sell are necessary if the market is to allocate fishing rights. The right to sub-divide would be restricted in accordance with the quantity (size of quota block) of entitlement designated transferable. The decision to include the rights to lease, mortgage and devise in the bundle of rights attached to the fishery would require closer study and be subject to the broader economic and social aspects of resource use policy.

If the right to lease were granted it may provide a mechanism for individuals who do not possess sufficient resources to enter the fishery to acquire simultaneously the capital equipment for harvesting and harvesting rights. Leasehold arrangements could be a viable alternative for young fishermen to acquire necessary fishing assets on an incremental basis. Disadvantages of granting the right to lease would include the introduction of a rather complex legal property arrangement in communities where few similar arrangements may exist. The terms and conditions of the lease

would also affect the ability of a property rights system to achieve management goals of increased incomes, viability (economic) and reasonable returns. The evaluation, measurement and bargaining process involved in negotiating leasehold arrangements would add to the transactions costs of a property rights system. Regulatory problems would also arise with respect to assigning liability to the lessee or lessor for infractions of existing harvesting regulations.

Should the right to mortgage be included in the bundle associated with fishing rights the latitude afforded fishermen in investment decision-making could increase. If rights to the fishery developed into a legitimately mortgagable asset, the need for government lending programs may be reduced. However, the right, if granted, would be insignificant if conventional lending institutions refuse or hesitate to accept fishing rights as mortgagable property. Property rights applied to the fishery are a unique concept and may be difficult for financiers to accept. The acceptance of fishing rights as a mortgagable asset will be dependent upon the creation of an active market for the rights. Administratively, the problem associated with mortgaging would be few as the burdens of organization and administration would not fall upon The Fisheries Branch. Fulfillment of economic viability and reasonable returns objectives may also be enhanced as the defining of those variables would not be a responsibility of the Branch, or other government agencies.

Long term rights would be simpler administratively than rights which require allocation annually. Perpetual rights would eliminate the issuing task of the Branch except in cases where unused or abused rights which have reverted to the Province are re-issued. Long-term rights also afford the fishermen a higher degree of financial security in investment planning.

The ability to acquire rights for a term as long or longer than the planned life of the physical capital would add considerably to the fisherman's security. The disadvantages of extremely long-term or perpetual rights are due to the greater uncertainties involved in evaluating returns far into the future and the increased funds required by fishermen which could discourage an active market.

(d) *Enforcement*

Enforcement problems that may occur under a system of marketable property rights would differ little from those presently experienced. Namely, under any system of quantitative rights there exists incentives to bootleg fish in excess of one's quota. The strength of the incentive will be dependent upon the gains in relation to penalties imposed for bootlegging. Currently penalties include fines or the suspension of rights for a period of time. A system where rights have been acquired via the market could reduce the incentive to exceed quotas, thus enhancing the biological management of the resource. Currently the right to fish is acquired without pecuniary cost. The suspension of a purchased right would penalize the offender through the loss of potential income, and the amount which was paid for the right to gain income from the fishery receives no return during the period of suspension. There will also be an increased incentive for fishermen to police each other and report gross offenders. The motivation to report or persuade offenders to stay within their quota will arise because those who exceed quotas will be diminishing the value of their fellow fishermen's investment in the fishery, which required a monetary outlay.

Market conditions, especially those prevailing in the retail domestic sector will affect the incentive to bootleg. Marketable property rights

conceivably could allow a fishing enterprise to acquire sufficient rights to permit the enterprise to enter the retail domestic market on a fairly large scale. Fish would no longer be channelled through FFMC agents, thus greatly reducing the ability to monitor catch levels. On the other hand, should transactions in fishing rights result in a greater concentration of production there will be fewer individuals to police and enforcement costs could decrease.

Although the amount of rights issued will be consistent with an "optimal" sustainable level of catch, biological fluctuations may necessitate cyclical and even shorter term adjustments in total catch. Within the current regime of rights allocation the ability of the management authority to decrease quota entitlements is fairly clear should stocks be unable to sustain projected catch. However, should the quantitative rights held by fishermen change from a non-marketable status right to a marketable property right, the ability of the management agency to revoke rights without compensation is less clear. The Province may have to enter the market for rights when aggregate catch levels require adjustment. If the market in fishing rights is active the measurement of "just" compensation would not be difficult. If markets are relatively inactive, the measurement enforcement and administration of compensation schemes would be costly and difficult. In addition, should stocks be capable of sustaining increased harvests subsequent to compensation programs rights will have to be re-allocated. Re-allocation mechanisms could take the form of an open auction or simply be resold to those who were originally compensated in amounts equal to that each individual was originally required to relinquish. Those originally compensated may be unwilling to repurchase fishing rights at a rate similar to that paid in compensation; while at the same time being opposed to competing for rights on an auction basis.

Any major enforcement problems encountered when applying the property rights policy instrument to the Lake Winnipeg commercial fishery will be dependent upon the bundle of rights issued and the severity of biological fluctuations which may require the Province to enforce and adminster the relinquishing of fishing rights.

(d) *Information and Communication*

Initially, the information and communication costs associated with introducing the market institution to allocate property rights could be costly and time-consuming. The Lake Winnipeg fishery would incur smaller amounts of such costs because a system of quantitative rights is already in place. The concepts of property and exclusive use as applied to the fishery have been put successfully into practise on Lake Winnipeg.

Information programs would have to be developed in two areas. If fishermen are to be required to purchase additional rights they will undoubtedly be most curious to know the terms and conditions under which they may use their property. The extent of such terms will be dependent upon the bundle of rights issued. In addition, the use of the rights will most likely be subject to all existing regulations under which commercial fishing must take place. It is important the bundle of rights to be issued be carefully analyzed and structured precisely by the Province before presentation to fishermen. Any appearance of confusion or uncertainty on the part of those introducing the property rights policy instrument would only serve to complicate and lengthen the information and communication process. Also, the facts that absolute ownership of all material resource assets (land, timber, fur, minerals, fish, etc.) is held by the Province and the creation of private property in the assets is dependent upon the continued existence and functioning of Government authority, should be stressed during

any presentations to fishermen.

The second major area requiring an information program would involve methods of evaluating the price of fishing rights. The program would most likely take the form of introducing the principles of investment decision-making and capital budgeting to fishermen. The practise of discounting future returns would prevent the incorporation of "unreasonable" expectations into fishermens' evaluations of fishing rights. The Fisheries Branch could also assist fishermen in developing acceptable risk premiums which could be assigned to fishing rights.

4.2.1.2.1(a) A Comparitive Overview of Organization and Administration

The current system of quota allocation requires both intensive and extensive securing, organization and analysis of data. Fishermen, fishermen's helpers, conservation officers, and Fisheries Branch personnel (Winnipeg) are all responsible for recording and collecting relevant information. The selection procedure used to fill vacated licenses requires a ten year review of each applicant's fishing history.[16] An estimate of one man-year as the time required to administer this allocation mechanism would not be unreasonable. In addition, other than casual observation by local Conservation Officers, the Fisheries Branch has no way of knowing whether points acquired as fishermen's helpers have been done so legitimately. There is no limit on the number of helpers permits that may be issued and there is no stipulation requiring helpers to be involved directly in the industry. Even if such stipulations did exist, they would be unenforceable. The current system of resource allocation is also incapable of discriminating between applicants holding equal amounts of points. Current practise, in the event of a tie between two applicants, is to award both a quota. The

next vacancy which occurs is then not offered for redistribution. If ties are infrequent and only involve two applicants this system is workable. However, as the frequency of ties and the number of tied applicants increases such procedure will be unacceptable as the resource base is incapable of supplying all equally entitled applicants with additional quotas.

To summarize, initial costs associated with the development and information and communication requirements of marketable fishing rights could be high. Enforcement problems will be dependent upon the bundle and structure of the rights which can be marketed, although there appears few reasons why these problems need be any greater than those currently encountered. The clerical costs associated with monitoring a marketable rights regime would be significantly less than those presently incurred. Information derived from market transactions would be an improvement over that currently available for evaluating the fishery resource.

4.2.1.3 Effects of the Distribution of Associated Benefits and Costs

Initial considerations of benefits and costs involves identifying those who would appear to gain or lose directly from the introduction of a marketable property rights scheme (Table 18). Other considerations arising under this criterion would involve the distribution of any resource rents which may arise, the impacts of introducing a less than perfect market where none previously existed, and the benefits and costs associated with the present system of Lake Winnipeg fishery resource allocation.

At this preliminary stage of analysis, absolute identification of gainers and losers and the quantification of benefits and costs is not possible. However, it is possible to estimate the perceived direction of benefits and costs among various groups and individuals (Table 18). In

TABLE 18

PERCEIVED DIRECTION OF BENEFITS & COSTS

	GAINER	LOSER	UNDETERMINED
Sellers of Rights	X		
Buyers of Rights	X		
High Income and Equity Fishermen	X		
Low Income and Equity Fishermen		X	
Low Point Holders	X		
Higher Point Holders		X	
Local Labour			X
Local Manufacturing Industries			X
Local Service Industries			X
FFMC	X		

the absence of any sort of resource rent taxation, those individuals selling all or a portion of their fishing rights would benefit by the value of the sale. Conversely, those purchasing additional rights would benefit by the value of increased income obtained from the fishery. Increased incomes would be dependent upon individuals not grossly overestimating the value of additional fishing rights. Persons, whether fishermen or not, who are in a high income, high equity position would benefit from the property rights scheme in that their ability to gain income from the fishery will be greater than that which exists under the current regime. The ability of individuals in low income, low equity positions to compete for fishing rights would be reduced under a system of marketable rights. Fishermen who have accumulated a large number of points and are on the verge of acquiring additional rights, would incur losses as points became valueless. Fishermen credited with small amounts of points would benefit from a property rights approach providing their abilities to compete for fishing rights in the market is somewhat greater than their abilities to compete on the basis of experience. The impacts on local labour and local service and manufacturing industries is, at this point, a matter of conjecture. The extent to which the prospect of increased incomes in the fishing industry will stimulate local service and manufacturing industries is unknown. A concentration of production in the fishing industry would involve a decrease in labour employed, although the indirect impacts of capital generation in the fishery may increase local employment. Should the property rights scheme serve to decrease the number of fishermen on Lake Winnipeg, the FFMC would benefit as the aggregate costs of transacting sales with fishermen would decrease.

The distribution of rents question is no different from any other equity question in that the answer is primarily a social value judgment manifested in the processes of political decision-making. Rent distribution

and the value judgments with regards to the status quo distribution of income, wealth, and power implicit in any policy instrument sanctioning the use of the market institution are concerns which are usually addressed at the policy rather than the institutional level of decision-making. Therefore, such concerns will be considered briefly in this discussion.

Essentially, two significant groups may lay claim to resource rents; (1) individuals working in the fishery, (2) the general public, represented by the government as owners of the fish stocks that constitute a public resource. General social policy would dictate a public resource be managed so as to not only offer exemplary incomes to those engaged in the exploitation of the resource, but also so as to produce a good return to the public purse for the use of the resource. Whether the Lake Winnipeg fishery resource is capable of yielding both exemplary incomes and returns to the public purse is unknown. Also, income earned from fishing is seasonal and although incomes may be considered exemplary on a seasonal basis, they may be only adequate on an annual basis in the absence of complimentary seasonal employment opportunities. The ability of the property rights mechanism to achieve the goal of securing increased incomes for fishermen is the main reason for considering the tool as a management alternative. The capture of all or a significant portion of any rents that consequentially emerged would defeat the purpose of utilizing the policy instrument initially.

The argument which condemns the choice of property rights systems on the basis of their implicitly condoning the status quo income distribution is legitimate. However, the pervasiveness of the argument can be limited by the structure (organization and administration) of the particular property rights mechanism. For example, the limiting of market competition for fishing rights to those within the same communities on the Lake would alleviate

the impacts which income disparities between communities may have. If distributional effects are heavily weighted, the property rights mechanism would permit the placing of an upper limit on the amount of rights which could be held.

The current system of allocating fishing rights benefits those who have spent the most time associated with the fishery. The extent to which any individual may benefit from the fishery is limited by the one license per season stipulation. The costs of the system are borne most heavily by young fishermen wanting to enter the fishery as operators rather than hired men. The period of apprenticeship required to obtain fishing rights is lengthy and may not be attractive relative to alternative employment opportunities. Between the fall of 1976 and the winter of 1980/81 twenty quota entitlements became vacant in the Gimli region.[17] Only nine of these vacancies were filled by individuals who had not previously held a license. In Berens River, only five vacancies occurred and one was filled by an individual who had not previously held a license.

Fishermen's children are in a privileged position as they may acquire fishing rights from their fathers. This transference from father to child produces a paradoxical situation. The experience criterion is used to measure an individual's competence as a fisherman.[18] The parent to child transfer is permitted to "protect the investment a fisherman has built up in the family business and the heritage of fishermen."[19] Experienced (presumably more competent) fishermen are eliminated from competing for rights which are transferred from parent to child in favour of less experienced (less competent) fishermen. The investment and heritage of experienced childless fishermen is discounted to protect the investment and heritage of fishermen with children.

It is difficult to imagine the current system of resource allocation resulting in anything but an industry where the average age of the participants is steadily increasing. Even with a simultaneous mass retirement of existing fishermen and a large influx of "younger" fishermen, the current system would freeze the younger labour force and eventually the average age of fishermen would again begin to increase.

4.2.1.4 Legality

The Province's proprietary rights in the fishery provide the jurisdiction necessary to initiate any changes in the allocation of fishing rights. The authority is derived from the terms of the Natural Resources Transfer Agreement and British common law. The terms and conditions of a property rights mechanism utilizing a market institution would constitute amendments to the Manitoba Fisheries Regulations under Section 34 of The Fisheries Act. The procedure by which amendments recommended by the Province are initiated is in place and operable.

4.3 The Operating Level

Decision-making at the institutional level will affect the operational level from two perspectives. First decisions made regarding resource allocation mechanisms will influence directly the behaviour of fishermen. Secondly, the behaviour of fishermen will affect the communities in which they live.

The primary criterion used to evaluate the allocation alternatives from the perspective of the individual skiff operator will be that if the ability of each alternative to increase potential net incomes from fishing. If by expanding production (acquiring additional entitlements) an operator's average cost per unit of production declines, the operator is said to be

taking advantage of production economies, or becoming more efficient. Most simply, efficiency may be defined as maximum consumption of goods and services given the available amount of resources, or what is logically equivalent, the use of a minimum amount of resources to produce or make available for consumption a given amount of goods and services."[20] In the case of a skiff operator, the logical equivalent is more applicable. The operator will strive to harvest his quota entitlement at the least possible cost.

The net revenue calculations (Appendix D) allow analysis of each production category within a set of typical average and marginal cost curves. By definition average cost X output equals total cost. The ratio of total costs to gross revenues may be used as a proxy for average costs per dollar of gross revenues acquired (Table 19 and 20). As an operator acquires additional quota entitlements and moves from smaller to larger production categories the average cost per dollar of gross revenues acquired is declining (Tables 19 and 20). This situation occurred in both Berens River and Gimli regions. The fact that production levels ($, lbs.) of fishermen in the three license category (both in Berens River and Gimli), were consistently greater than those in the two license category during the open water seasons indicates fishermen must also perceive these economies. Fishermen holding three licenses have chosen to exercise their "roll-over" option because it appears profitable to do so. These findings are also consistent with those which found Lake Winnipeg fishermen in the one license production category, who had ceased fishing due to quota restrictions "although the value of fish from an additional lift was still greater than the cost of an additional lift."[21]

TABLE 19

RATIO OF TOTAL COSTS/GROSS REVENUES 1973-79 - GIMLI

YEAR	PRODUCTION CATEGORY		
	1 License	2 License	3 License
1973	.630	.559	.473
1974	.599	.552	.470
1975	.593	.555	.499
1976	.583	.551	.509
1977	.564	.533	.501
1978	.558	.527	.501
1979	.572	.541	.517

TABLE 20

RATIO OF TOTAL COSTS/GROSS REVENUES 1973-79 - BERENS RIVER

YEAR	PRODUCTION CATEGORY		
	1 License	2 License	3 License
1973	.652	.526	.500
1974	.621	.498	.461
1975	.616	.491	.448
1976	.606	.481	.435
1977	.587	.462	.417
1978	.582	.451	.408
1979	.598	.457	.412

The situation of declining average costs with increasing production categories is presented graphically in Fig. 7. An operator in the one license production category would receive revenues of $OPR_1 1$ and incur total costs of $ON_1 C_1 1$, thus making a pure profit of $N_1 PR_1 C_1$. Operators in the two license category would experience a lower average cost per unit output (C_2) and be subjected to total costs of $ON_2 C_2 2$. Total revenues would equal $OPR_2 2$, thus resulting in a pure profit of $N_2 PR_2 C_2$. In the three license production category total costs would equal $ON_3 C_3 3$, with total revenues of $OPR_3 3$ and a pure profit of $N_3 PR_3 C_3$.

As is suggested in Fig. 7 there may be production economies and therefore potential increases in net incomes beyond the three license production category. A system of marketable property rights would allow operators to acquire entitlements beyond this level, thus increasing potential incomes for fishermen and improving the "efficiency" of the fishery as a whole. In addition, a mechanism which would allow operators to expand production beyond current maximum limits would provide incentives for producers to experiment with the capital-labour mix of their enterprise and perhaps introduce technological innovations to the fishery possibly shifting costs downward to the right (Fig. 7).

At the operational level of decision-making income may be a major constraint confronting a system of marketable property rights. In the absence of outside financing the accumulation of a cash surplus after accounting for living expenses is necessary if an operator is going to purchase additional fishing rights. Accumulation of the financial resources required may be dependent upon income earned outside the fishery. Where alternative employment opportunities are limited, as is the case in Berens River, (Appendix E) the potential to acquire the cash outlay required for

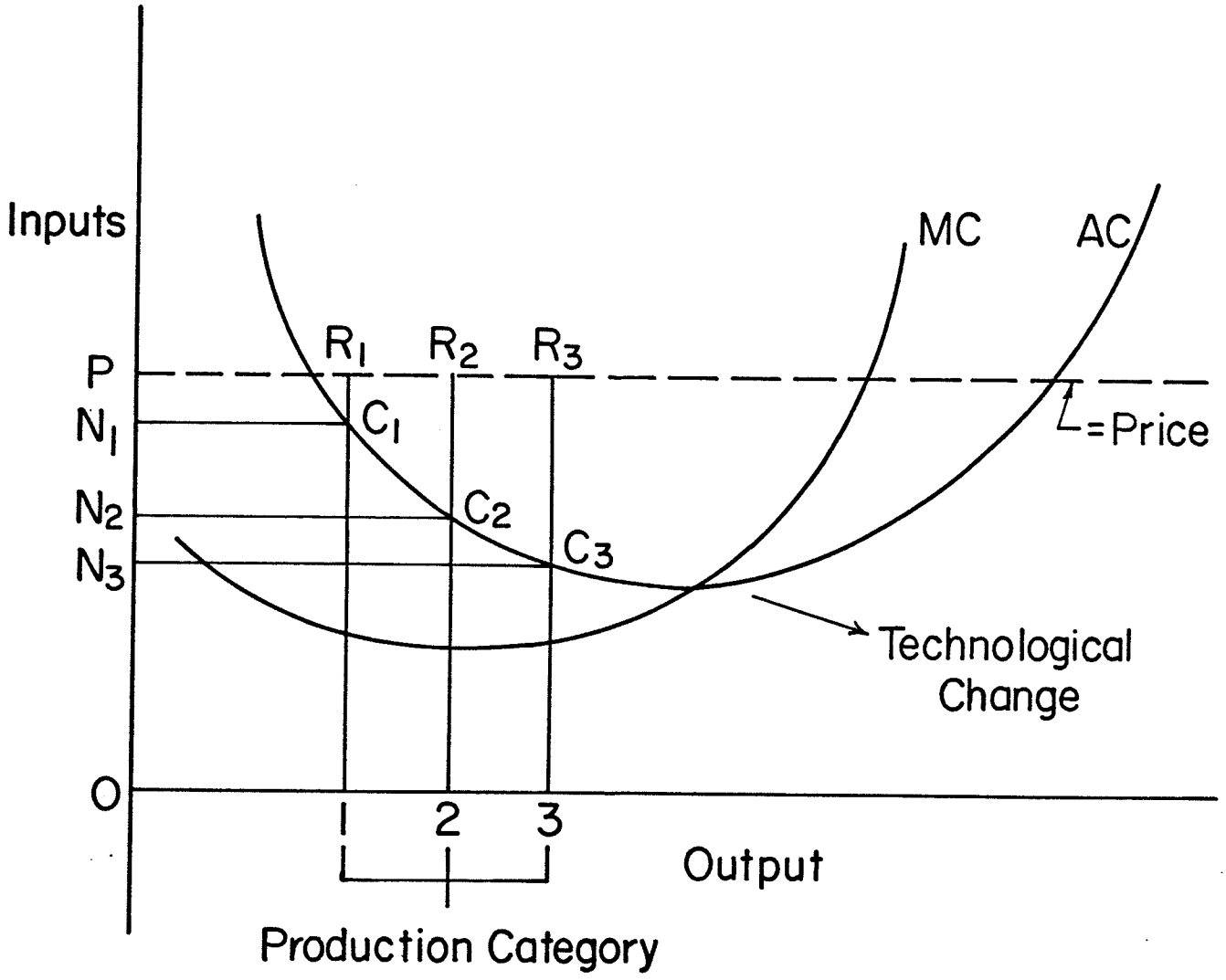

FIG. 7 AVERAGE (AC) AND MARGINAL (MC) COSTS BY PRODUCTION CATEGORY

additional fishing rights would be hampered. For example, a Berens River fisherman in the three license production category would receive a return of $7,331.80 (1977 levels: net revenues and labour) from open-water fishing. In addition, the reception of average transfer payments totalling $1,443.00 (Appendix E) (1977) will be assumed. The operator would also receive income from winter fishing, although the data necessary to calculate such incomes were unavailable. Total income, in the absence of complementary employment would be $8,779.00. If the fisherman is the primary income earner in a typical 6.98 person Berens River household, the likelihood of there being a surplus of income after living expenses is small.

The situation in the Gimli Region is somewhat different as there exists a fair diversity of employment and income opportunities (Appendix E). Income earned from either seasonal or permanent employment in other industries could be invested in fishing rights. A system of marketable property rights may provide the incentive for individuals who currently are discouraged from entering the fishery due to lengthy experience requirements. The time required to secure necessary financial resources may be less than that required to satisfy the established experience criterion.

From the community perspective the situation is one of two contrasting cases. Low incomes and a lack of employment opportunities are the major problems facing Berens River. The current system of allocating the fishery resource offers little potential for alleviating these problems. Participation rates in the industry have changed little since the system was introduced and only due to factors beyond the control of both the Fisheries Branch and the community will there be an increase in employment in the fishing industry. Also, any increases in incomes will be a result of factors independent of local or administrative influence.

Existing evidence suggests a system of marketable fishing rights would allow for increases in individual fishing incomes as well as the total income generated from fishing. Should employment be an overriding concern of the community a system of marketable property rights could be flexible enough to address this matter. The local Community or Band Council in Berens River could enter the market for fishing rights. Once rights had been acquired the allocative decision would be made at the discretion of local government officials. The community (through its elected representatives) would have the opportunity to decide whether to maximize income or employment from the fishery.

In terms of regional or community economic development Berens River has been judged large enough to support a more diversified and expanded service sector.[22] Problems recognized as preventing such expansion are the lack of capital and management resources.[23] It is believed a locally controlled service sector "could result in lower prices through lower shipping costs and the use of local labour would also result in greater employment".[24] Should a market in fishing rights result in the resource producing economic rents, the fishery could present a potential source of capital to the community. In addition, participation in a market system and exposure to even the most basic principles of investment decision-making, which would be required in evaluating quota entitlements, would enhance the development of management skills.

In relation to Berens River, income and employment problems are much less severe in the Gimli region. The fishery could not be considered a major source of income or employment to the community. The fishery provides seasonal employment for 66 licensees in contrast to an industrial sector employing nearly 400 individuals (Appendix E). In addition, the

region supports a fairly large business and professional sector. Should marketable fishing rights be introduced to the community those who choose to divest themselves of their interest in the fishery would most likely be fishermen considering retirement or alternative employment. A consolidation of production could result in the fishing industry contributing more toward community income as well as possibly providing an attractive career alternative to young people in the community.

4.3.1 *Corporate Fishery Potential*

The introduction of a market for fishing rights would enhance the ability of the fishery to acquire corporate characteristics. The degree to which corporate fleets may operate is dependent upon the nature of ownership applied to harvest rights.

A corporate fleet would require a minimum size harvest right to be viable. Distributional concerns in certain communities may force the system to prescribe maximum allowable entitlements below that required for viable corporate development.

Development of corporate fleets would require a legal definition of the relationship between quota entitlements and fishing licenses under a marketable property rights system. Currently, quota entitlements are tied to licenses and licensees must personally participate in all fishing authorized by the license. A corporate property owner would need to hire fishermen, either on a wage, share of catch, or leasehold basis. The Province would have to determine whether property owners or fishermen or both require fishing licenses and whether the owner of the harvest rights or fishermen are liable for infractions of regulations. The same "problem" would arise with individuals acquiring rights in excess of personal harvest potential

and therefore requiring additional equipment and labour to harvest their entire entitlement.

The relationship between a corporation and its employees will affect the ability of the marketable property rights alternative to permit "participants to earn a reasonable return on investment and time and with limited social disruption." The entire industry may become more viable through corporate development, but it does not necessarily follow that the earnings of fishermen will increase. For example, a corporate operation in Berens River where the fishery is a major employer and alternative employment limited, would be able to exert tremendous bargaining power over fishermen with respect to income levels. In Gimli, where there is less dependence upon fishing employment there would be a more even distribution of bargaining power between company and employee.

A system of marketable property rights is a vehicle through which a corporate fishery may develop. However, the degree of corporate development will be dependent upon the structure of ownership rights issued. The introduction of corporate participants to the fishery obscures the ability of a marketable property rights system to increase fishermen's incomes.

LITERATURE CITED

1. Ciriacy - Wantrup and Bishop. 1975. "Common Property as a Concept in Natural Resources Policy". Natural Resources Journal . (15), p. 716.

2. Doern, B. and P. Aucoin. 1979. Public Policy in Canada: Organization Process and Management. The Macmillan Company of Canada. p. 15.

3. Ibid., p.15.

4. Ibid., p. 7.

5. Peltzman, S. 1976. "Toward a More General Theory of Regulation". Journal of Law and Economics. (19), p. 211-248.

6. Doern, B. and P. Aucoin. 1979. Op. cit., p. 17.

7. Peltzman, S. 1976. Op. cit., p. 214.

8. Ibid., p. 220.

9. Ibid., p. 224.

10. Ibid., p. 229.

11. Ibid., p. 230.

12. Government of Manitoba, Department of Mines, Resources and Environmental Management. 1973. Annual Report. p. 77.

13. Doern, B. and P. Aucoin. 1979. Op. cit., p. 183.

14. Government of Manitoba, Department of Renewable Resources and Transporation Services. 1978. "Administrative Procedure Guidelines for Lake Winnipeg Commercial Fishery". p. LWPG-2.

15. Barlowe, R. 1978. Land Resource - Economics. Englewood Cliffs, N. J. Prentice-Hall. p. 398.

16. "Administrative Procedure Guidelines for Lake Winnipeg Commercial Fishery". 1978. Op. cit. p. LWPG-4.

17. Government of Manitoba, Department of Natural Resources, Lake Winnipeg License Applications 1976-1980/81 and Licensing Records 1972-79.

18. "Administrative Procedure Guidelines for Lake Winnipeg Commerce Fishery." 1978. Op. cit., LWPG-4.

19. Ibid., p. LWPG-8.

20. Seneca, J. and M. Taussig. 1979. Environmental Economics. Prentice-Hall Inc. p. 6.

21. Gislason, G. S., J. A. MacMillan, and J. Craven. 1976. "Economic Analysis of the Manitoba Commercial Freshwater Fishery". University of Manitoba, Department of Agricultural Economics, unpublished draft. p. 525.

22. Government of Manitoba, Department of Northern Affairs. 1975. "Community Profiles LW-3: Berens River Manitoba". p. D-5.

23. Ibid., p. D-5.

24. Ibid., p. D-5.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.0 CONCLUSIONS

General conclusions reached regarding the concepts of property rights, externalities, the market institution and fisheries rationalization are as follows:

(1) Much of the literature devoted to the property rights approach attempts to apply the concept to consumer-producer cases where it is often difficult to delineate distinct groups of those affected and those creating the effects. In such cases, transactions costs are usually high, difficulties arise when measuring the extent of externalities among individuals and the assignment of liability cause much debate. Consequently, it may be wrongly assumed the same problems will be encountered when the concept is applied to the fishery. In fact, the fishery is an industry closely resembling the theoretical Coasian example. The only major difference is that different fishermen are simultaneously inflicted and being subjected to the same externalities. The externality is quantifiable and transferable. Both parties possess similar information and there is no reason for transactions costs to be excessive.

(2) Maximization of income and efficiency need not be the only goal of the marketable property rights instrument and a program based on this concept could be flexible enough to meet the equity and employment demands of society and regional economies while still improving the performance of the industry.

(3) The most attractive aspect of using the marketable property rights alternative as a rationalization tool is that there is no involuntary dislocation of individuals from the fishery.

(4) The "success" of any policy instrument based on the market institution is dependent upon allowing the market to function. Enterprises (fishermen) must be allowed to fail if the system is to operate effectively. Bankruptcy and business failures will be necessary in the harvesting sector if the use of marketable property rights is to achieve management goals.

(5) The political feasibility of public policy and programs designed to influence the behaviour of relatively small groups with specific interests (fishermen) is dependent upon support from these specific interest groups, although such programs may have diffuse benefits for society in general.

(6) Property rights regimes will have to be monitored or "regulated" so as to prevent the system from enhancing monopoly or oligopoly over time thereby producing inefficiency (if allocative efficiency is to remain a goal of fisheries management).

Specific conclusions reached regarding the review, analysis, and evaluation of alternatives are as follows:

(1) The current system of allocating commercial fishery harvesting rights based on experience and dependency criteria is extremely limited in its ability to achieve economic management goals. A system of marketable property rights would be more flexible, less costly, and offers more potential for achieving current goals.

(2) An influx of outside capital may be necessary if an active market in fishing rights is to develop in Berens River.

(3) The further removed from the community the actual "owner" of fishing rights is the greater the transactions, administration, and enforcement costs will be. Also, should an "absentee landlord" situation develop the ability of a marketable property rights system to increase incomes to fishermen becomes less clear. Therefore, from the viewpoint of organization and administration and maximizing producer income it would be more desirable to structure a property rights system so as to enhance the growth of owner-operator enterprises.

(4) Elimination of the fishing ahead option will prevent those in the three license production category from taking advantage of production economies which appear to exist in the open-water fishery.

5.1 Recommendations

(1) The marketable property rights alternative should be be adopted on Lake Winnipeg to achieve the management objectives of income maximization, economic viability, and reasonable returns. The tentative structure of such a system could be as follows:

(a) The initial allocation of fishing rights (quotas) among producers would remain as is.

(b) The transferable amount would be 500 lbs. (round weight) to provide for sufficient divisibility required to promote an active market. This would require that the 8,400 lbs. fall entitlement be raised to 8,500 lbs. or lowered to 8,000 lbs. so that no individual would hold fractions of a transferable (500 lb.) unit.

(c) Initially, trade should be restricted to an intra-community basis so as to prevent an increase in existing regional disparities and to facilitate administration, enforcement and conservation.

(d) The period during which transactions take place and be formally recognized by the Province would be limited to that between fishing seasons.

(e) The duration of the right would be perpetual, but subject to annual renewal providing the holder has complied with existing fishery regulations.

(f) The minimum amount of rights which may be held would be set at what is currently the lowest seasonal quota in each community area.

(g) The "owner of the rights" would be required to harvest the resource.

(2) An information and communication program regarding the alternative system should be developed prior to implementation so that input from all three levels of decision-making (policy, institutional and operating) be included in formulating the actual structure and terms of the harvesting rights.

(3) Further study should be undertaken to test the open-water production economies hypothesis and quantify, should they exist, the extent of such economies subject to existing technologies.

BIBLIOGRAPHY

Abgrall, J. F. 1978. "Fishery Industry: In Support of the Single Manager". Canadian Journal of Agricultural Economics, July 26 (2) 35-42.

Ackerman, S. R. 1977. "Market Models for Water Pollution Control". Public Policy. 25:pp. 383-406.

Agnello, R. J. and L. P. Donnelley. 1975. "Prices and Property Rights in the Fisheries". Southern Economics Journal. Oct. 42(4). pp. 253-62.

_____. 1975. "Property Rights and Efficiency in the Oyster Industry". Journal of Law and Economics. Oct. 18(2). pp. 521-33.

_____. 1976. "Externalities and Property Rights in the Fisheries". Land Economics. Nov. 52(4). pp. 518-29.

_____. 1977. "Externalities and Property Rights in the Fisheries: Reply". Land Economics. Nov. 1977. 53(4). pp. 492-95.

Anderson, L. G. 1977. Economic Impacts of Extended Fisheries Jurisdiction. Ann Arbor Science Publishers Inc.

Anderson, L. G. 1976. "The Relationship Between Firm and Fishery in Common Property Fisheries". Land Economics. May 52(2). pp. 179-91.

_____ . 1978. "The Relationship Between Firm and Fishery in Common Property Fisheries: Reply". Land Economics. Feb. 54(1). pp. 104-05.

Andersson, F. R., A. V. Kneese, P. D. Reed, S. Taylor and R. B. Stevenson. 1977. Environmental Improvement through Economic Incentives. John Hopkins University Press, Baltimore, MD. 195 pp.

Austin, B. C. 1977. "Incorporating Economic Considerations into Practical Fisheries Policies", in Anderson (ed.) Economic Impacts of Extended Fisheries Jurisdiction. Ann Arbor Science Publishers, Inc.

Barlowe, R. 1978. Land Resource Economics. Englewood Cliffs, N. J. Prentice-Hall.

Bell, F. W. 1972. "Technological Externalities and Common Property Resources: An Empirical Study of the U.S. Northern Lobster Fishery". Journal of Political Economy. 80: pp. 148-158.

Bishop, R. C. 1973. "Limitation of Entry in the United States Fishing Industry: An Economic Appraisal of a Proposed Policy". Land Economics. 49(4), pp. 381-390.

Bishop, R. C. 1975. "Limitation on Entry in the United States Fishing Industry: A Reply". Land Economics. 51(2), May. pp. 182-185.

Boles, K. 1977. "A Reconciliation of Theoretical and Practical Aspects of Fisheries Management". Intermountain Economic Review. Fall 8(2). pp. 40-46.

Bromley, D. W. 1978. "Property Rules, Liability Rules and Environmental Economics". Journal of Economic Issues, Symposium Part II. March, 1978. 12(1). pp. 43-60.

Brown, G. M. 1974. "An Optional Program for Managing Common-Property Resources with Congestion Externalities". Journal of Political Economy. 87: pp. 163-173.

Buchanan, J. M. 1956. "Private Ownership and Common Usage: The Road Case Re-examined". Southern Economic Journal. 22: pp. 305-316.

Bultin, J. 1975. "Optimal Depletion of a Replenishable Resource: An Evaluation of Recent Contributions to Fisheries Economics". Chapter 6 in D. W. Pearce (ed.). Economics of Natural Resource Depletion. MacMillan, London.

Campbell, E. 1975. "Water Management in Ontario - An Economic Evaluation of Public Policy". Osgoode Hall Law Journal. 12: pp. 475-526.

Carruthers, B. 1976. "A History of Commercial Fishing in Manitoba". Conservation Comment. Manitoba Department of Renewable Resources and Transportation Services.

Cassidy, P. A. 1973. "Commonality, Fishery Resources, Potential and Policy: Comment". American Journal of Agricultural Economics. Aug. 55(3) pp. 526 - 29.

Castle, E. N. 1978. "Property Rights and the Political Economy of Resource Scarcity". American Journal of Agricultural Economics. Feb. 60(1). pp. 1-9.

_____. 1979. "Property Rights and the Political Economy of Resource Scarcity: Reply". American Journal of Agricultural Economics. 61(1). pp. 119.

Cheung, S. 1970. "The Structure of a Contract and the Theory of a Non-Exclusive Resource". Journal of Law and Economics. 13(1). pp. 49-70.

Christy, F. T., Jr. 1973. "Fisherman's Quotas: A Tentative Suggestion for Domestic Management". University Rhode Island, Law of the Sea Institute, Occasional Paper. 19:7.

_____. 1975. "Property Rights in the World Ocean". Natural Resources Journal. Oct., 15(4). pp. 695-712.

Ciriacy-Wantrup, S. V. and R. C. Bishop. 1975. "Common-Property as a Concept in Natural Resources Policy". Natural Resources Journal. 15:pp. 713-727.

Clark, C. W. 1973. "Profit Maximization and the Extinction of Animal Species". Journal of Political Economy. 81:pp. 950-961.

Clark, C. W. 1976. Mathematical Bioeconomics: The Optimal Management of Renewable Resources. Wiley, New York, N.Y.

Clark, C. W., F. H. Clarke, and G. Munro. 1977. "The Optimal Exploitation of Renewable Resource Stocks: Problems of Irreversible Investment". PNRE Paper 8. University of British Columbia.

Clark, C. W. and G. R. Munro. 1976. "The Economics of Fishing and Modern Capital Theory: A Simplified Approach". Journal of Environmental Economic Management. 2: pp. 92-106.

Coase, R. H. 1960. "The Problem of Social Cost". Journal of Law and Economics. 3:pp. 1-44.

Comitini, S. and P. S. Huang. 1971. "Licensing and Efficiency: An Empirical Study of the Japanese Tuna Fishing Industry". Malayan Economic Review. April 16(1). pp. 76-83.

Copes, P. 1979. "Rational Resource Management and Institutional Constraints: The Case of the Fishery". School of Business Administration and Economics, Discussion Paper Series Simon Fraser University. pp. 1-33.

Copes, P. 1979. "The Evolution of Marine Fisheries Policy in Canada". School of Business Administration and Economics, Discussion Paper Series. Simon Fraser University. pp. 1-44.

Crocker, T. D. 1971. "Externalities, Property Rights and Transactions Costs: An Empirical Study". Journal of Law and Economics. Oct. 14(2). pp. 451-64.

Crommelin, M. 1978. "Management of Oil and Gas Resources in Alberta: An Economic Evaluation of Public Policy". Natural Resources Journal. 18:pp. 337-89.

Crutchfield, J. 1961. "An Economic Evaluation of Alternative Methods of Fishery Regulation". Journal of Law and Economics. Oct. (4). pp. 131-143.

Crutchfield, J. and A. Zellner. 1963. "Economic Aspects of the Pacific Halibut Fishery". United States Department of the Interior, Fish and Wildlife Service. Bureau of Commercial Fisheries. Fishery Industrial Research. Washington.

Crutchfield, J. A. 1972. "Economic and Political Objectives in Fishery Management", in World Fisheries Policy Multidisciplinary Views. Rothschild, B. J. ed. University of Washington Press, Seattle.

_____. 1979. "Economic and Social Implications of the Main Policy Alternatives for Controlling Fishing Effort". Journal of the Fisheries Research Board of Canada. 36(7). 742-752.

Dales, J. H. 1968. Pollution, Property and Prices. University of Toronto Press.

Dawson, R. 1970. The Government of Canada. Toronto, University of Toronto Press.

Demsetz, Harold. 1967. "Toward a Theory of Property Rights". American Economic Review. May (57) pp. 347-59.

Doern, B. and P. Aucoin. 1979. Public Policy in Canada: Organization Process and Management. The MacMillan Company of Canada.

Flagg, V. G. 1977. "Optimal Output and Economic Rent of the Eastern Tropical Pacific Tuna Fishery: An Empirical Analysis". American Journal of Economic Society. Jan. 36(11) pp. 19-31.

Frech, H. E., III. 1973. "Pricing Pollution the Coase Theorm in the Long-Run". Bell Journal, Spring 4(11). pp. 316-19.

_____. 1979. "The Extended Coase Theorm and Long-Run Equilibrium: The Non-Equivalence of Liability Rules and Property Rights". Economic Enquiry. April 17(2). pp. 254-68.

Furubotn, E. G. and S. Pejovich. 1972. "Property Rights and Economic Theory: A Survey of Recent Literature". Journal of Economic Literature. pp. 1137-1157.

Gerhardsen, G. M. 1952. "Production Economics in Fisheries". Revista de Economia. 5:pp. 1-12.

Gislason, G. S., J. A. MacMillan, and J. Craven. 1976. "Economic Analysis of the Manitoba Commercial Freshwater Fishery". University of Manitoba, Department of Agricultural Economics. Unpublished draft.

Gordon, H. S. 1953. "Optimum Utilization of Fisheries Resources". Journal of the Fisheries Research Board of Canada. 100:pp. 442-457.

Gordon, H. S. 1954. "The Economic Theory of Common-Property Resource: The Fishery". Journal of Political Economy. L411(2):pp. 124-142.

Gould, J. R. 1972. "Extinction of a Fishery by Commercial Exploitation: A Note". Journal of Political Economy LXXX, 5. pp. 1031-1038.

Government of Canada. Canadian Transport Commission. 1977. "Isolated Communities Digest of Transportation Social and Economic Data".

Government of Manitoba. Department of Mines, Resources and Environmental Management, 1973 Annual Report.

_____. Department of Natural Resources 1979-80 Annual Report.

_____. Department of Natural Resources. 1981. "Toward a Provincial Strategy for Manitoba Fisheries". (Internal Document).

_____. Department of Northern Affairs. 1975. "Community Profiles LW-3: Berens River, Manitoba."

_____. Department of Renewable Resources and Transportation Services. 1978. "Administrative Procedure Guidelines for Lake Winnipeg Commercial Fishery".

_____. 1973 Guidelines for the Seventies. Queen's Printer, Winnipeg.

_____. Manitoba Bureau of Statistics 1980. "Spatial Indicies for Gasoline for Selected Communities". Manitoba Statistical Review.

_____. Operational Policy Branch. 1975. "Statement of Operating Expenses for Fishermen Around Manitoba".

Griffin, W. L., R. D. Lacewell, and J. P. Nichols. 1976. "Optimal Effort and Rent Distribution in the Gulf of Mexico Shrimp Fishery". American Journal of Agricultural Economics Part 1. Nov. 58(4), pp. 644-52.

Gulland,J. A. and M. A. Robinson. 1973. "Economics of Fishery Management". Journal of Fisheries Research Board of Canada. 30, pp. 2042-2050.

Hannesson, R. 1974. "Fishery Dynamics: A North Atlantic Cod Fishery". Canadian Journal of Economics. 8:pp. 151-173.

Harris, C. C., Jr. and U. J. Norton. 1978. "The Role of Economic Models in Evaluating Commercial Fishery Resources". American Journal of Agricultural Economics. Dec. 60(5):pp. 1013-19.

Henderson, J. J. and M. Tugwell. 1979. "Exploitation of the Lobster Fishery: Some Empirical Results". Journal of Environmental Economic Management. Dec. 6(4), pp. 287-96.

Howe, C. W. 1979. Natural Resource Economics: Issues Analysis and Policy. John Wiley and Sons Inc.

Huang, O. S. and C. W. Lee. 1976. "Toward a General Model of Fishing Production". Southern Economic Journal. July 43(1) pp. 846-54.

Hutter, M. 1975. "The Property Rights Paradigm: A Comment". Jahr Nationalokon Statist. Feb. 188(6) pp. 552-56.

Knight, F. H. 1924. "Some Fallacies in the Interpretation of Social Cost". Quarterly Journal of Economics. 38:pp. 582-606.

Lawler, G. H. 1950. "The Use of Nylon Netting in the Gill Net Fishery of Lake Erie Whitefish". The Canadian Fish Culturist. 7:pp. 22-24.

Levelton, C. R. 1979. Toward an Atlantic Coast Commercial Fisheries Licensing System. A report prepared for the Department of Fisheries and Oceans, Government of Canada. pp. 1-83.

Lewis, T. R. and R. Schmalensee. 1977. "Non-convexity and Optimal Exhaustion of Renewable Resources". International Economic Review. 18:pp. 535-552.

Loose, V. W. and G. C. Robinson. 1977. "Externalities and Property Rights in the Fisheries: Comment". Land Economics. Nov. 53 (4) pp. 488-91.

McIvor, G. H. 1965. "Report of Commission of Inquiry into Freshwater Fish Marketing". Queen's Printer, Ottawa.

Moloney, D. G. and P. H. Pearse. 1979. "Quantitative Rights as an Instrument for Regulating Commercial Fisheries". Journal of the Fisheries Research Board of Canada. 36: pp. 859-866.

Montgomery, W. P. 1972. "Markets in Licenses and Efficient Pollution Control Programs". Journal of Economic Theory. 5:pp. 395-418.

O'Rourke, A. D. 1973. "Commonality, Fishery Resources, Potential and Policy: Reply". American Journal of Agricultural Economics. Aug. 55(3) pp. 530-31.

Owers, J. 1975. "Limitation of Entry in the United States Fishing Industry: A Comment". Land Economics. 51(2) May 1975. pp. 177-78.

Pearse, P. H. 1971. National Regulation of Fisheries. Department of Economics, University of British Columbia. Unpublished.

Pearse, P. A. 1978. Approaches to Economic Regulation of Fisheries CIDA/FOA/CECAF Workshop on Fishery Development and Planning. Feb. 6017. Lime, Togo.

Peltzman, S. 1976. "Toward a More General Theory of Regulation". Journal of Law and Economics. 19:pp. 211-248.

Peterson, F. M. and A. C. Fisher. 1977. "The Exploitation of Extractive Resources: A Survey." Economic Journal. 8:pp. 681-721.

Pigou, A. C. 1918. The Economics of Welfare. The MacMillan Co., London.

Plourde, G. C. 1970. "A Simple Model of Replenishable Natural Resource Exploitation". American Economic Review. XL,3.

_____. 1971. "Exploitation of Common-Property Replenishable Natural Resources". Western Economic Journal. Sept. 9, pp. 256-266.

Pontecorvo, G. 1966. "Optimization and Taxation: The Case of an Open Access Resource, the Fishery", in M. Gaffney (ed.). Conservation, Taxation, and the Public Interest in Extractive Resources. Madison, University of Wisconsin Press.

Quirk, J. P. and J. J. Smith. 1969. "Dynamic Economic Models of Fishing", in Scott, A. D. (ed.). Economics of Fisheries Management: A Symposium. C. R. MacMillan, Lectures in Fisheries, University of British Columbia.

Randall, A. 1972. "Market Solutions to Externality Problems: Theory and Practice". American Journal of Agricultural Economics. 54 May. pp. 175-83.

_____. 1974. "Coasian Externality Theory in a Policy Context". Natural Resources Journal 14 January:pp. 35-54.

_____. 1975. "Property Rights and Social Microeconomics". Natural Resources Journal. 15:pp. 729-747.

_____. 1978. "Property Institutions and Economic Behaviour". Journal of Economic Issues. March 12(1), pp. 1-21.

Sander, W. 1979. "Property Rights and the Political Economy of Resource Scarcity: Comment". American Journal of Agricultural Economics. 61(1) pp. 116-118.

Scott, A. B. 1955. "The Fishery: Objectives of Sole Ownership". Journal of Political Economy. 64:pp. 116-124.

_____. 1962. "The Economics of Regulatory Fisheries". In R. Hamlisch (ed.). Economic Effects of Fishery Regulation (F. A. O. Rome, pp. 25-61.

Scott, A. 1972. Natural Resources, the Economics of Conservation. 2nd ed. McClelland and Steward, Toronto, Ontario.

_____. 1979. "Development of Economic Theory on Fisheries Regulation". Journal of the Fisheries Research Board of Canada. 36:pp. 725-741.

Scott, A. and C. Southey. 1969. "The Problem of Achieving Efficient Regulations of a Fishery". In Economics of Fisheries Management a Symposium. pp. 1-149.

Seitz, W. P. and J. C. Headley. 1975. "Changing Natural Resources Property Rights: An Overview". Natural Resources Journal. 15:pp. 639-42.

Seneca, J. and M. Taussig. 1979. Environmental Economics. Prentice-Hall Inc.

Smith, J. L. 1968. "Economics of Production from Natural Resources". American Economic Review. 58:pp. 409-431.

_____. 1969. "On Models of Commercial Fishing". Journal of Political Economy. 77:pp. 181-198.

_____. 1974. "Optimal Costly Firm Entry in General Equilibrium". Journal of Economic Theory. 9:pp. 397-417.

Southey, C. "Policy Prescriptions in Economic Models: The Case of the Fishery". Journal of Political Economy. 80(4):pp. 769-775.

Statistics Canada: Consumer Price and Price Indices (62-010) Main Components, Sub-Groups and Selected Items.

_____. Canadian Statistical Review, (11-003) General Wholesale Price Index.

_____. Canadian Statistical Review (11-003) Consumer Price Index for Services.

Stephens, J. K. 1972. "A Theoretical Note on the Capacity of a Market System to Abate Pollution: A Reply". Land Economics. Aug. 48(3):pp. 304-05.

Stroup, R. and J. Baden. 1973. "Externality Property Rights and the Management of our National Forests". Journal of Law and Economics. Oct. 16(2):pp. 303-12.

Teeguarden, O. E. 1969. "Allocating Public Timber by Transferable Purchasing Quotas: A Policy Analysis". Natural Resources Journal. Oct. 9(4):pp. 576-89.

Thompson, A. R. and H. R. Eddy. 1973. "Jurisdictional Problems in Natural Resource Management in Canada" in Essays on Aspects of Resource Policy. Ottawa, Information Canada.

Thompson, Peter C. 1974. "Institutional Constraints in Fisheries Management". Journal of the Fisheries Research Board of Canada. 31:pp. 1965-1981.

_____. 1978. "The Economic Viability of the Commercial Skiff Fishery in Western Canada". Freshwater Institute, Unpublished draft, Winnipeg.

Thompson, R. G., M. D. George, R. J. Callen and L. C. Wolken. 1973. "A Stoichastic Investment Model for a Survival Conscious Firm Applied to Shrimp Fishing". Applied Economics. 9(2): pp. 753-82.

Tietenburg, T. 1974. "The Design of Property Rights for Air Pollution". Public Policy. 22:pp. 275-292.

Turvey, R. 1964. "Optimization and Sub-optimization in Fishery Regulation". American Economic Review. March, pp. 64-76.

Visgilio, G. R. 1978. "The Relationship Between Firm and Fishery in Common Property Fisheries: Comment". Land Economics. Feb. 54(1):pp. 100-103.

Waugh, G. and P. Calvo. 1974. "Economics of Exhaustible Resources: The Fishery". Economic Rec. Sept. 74. 50(131):pp. 423-29.

Weitzman, M. "Free Access vs. Private Ownership Alternative Means of Managing Common Property". Journal of Economic Theory. 8: pp. 225-239. 1974.

Wilson, J. and F. Olson. 1975. "Limitation on Entry in the United States Fishing Industry: A Second Comment". Land Economics. 51(2)May: pp. 179-181.

LIST OF APPENDICIES

APPENDIX A

ADMINISTRATIVE AND PROCEDURAL GUIDELINES

FOR LAKE WINNIPEG COMMERCIAL FISHERY

Source: Department of Renewable Resources and Transportation Services, Fisheries Management Branch, 1978.

Quotas:

Each of the several regulatory areas on Lake Winnipeg is assigned a combined commercial production quota for pickerel *(Stizostedion vitreum vitreum)*, sauger *(Stizustedion canadense)* and whitefish *(Coregonus culpea formis)*. These area quotas are fished competitively or divided equally as individual quotas, as the fishermen prefer. Only three areas, Grand Rapids, Gull Bay, Poplar River--Black River are fished competitively (summer season only). Annual quotas are apportioned among summer, fall and winter seasons.

Production quotas serve two purposes; (1) conservation of fish stocks, and (2) more immediate benefits to the fishermen resulting from greater year to year stability in catches. Quotas provide for the protection of fish stocks in the biological sense by preventing over-fishing. Quotas are also intended to eliminate the effects of severe peaks and troughs in catches by spreading the harvest of larger year classes over a period of several years.

The average annual pickerel and sauger catch in the 1965-1969 period and the average annual whitefish catch in 1964-1968 period in each area were used as the basis for present quotas. The aggregate quotas are slightly higher than the average for these five year periods because allowances were made for the increase of stocks during 1970 and 1971 when the lake was closed to commercial fishing and for incidental catch of whitefish in pickerel sauger areas and of pickerel in whitefish areas.

Quotas are reviewed annually and are changed from time to time as information from stock assessment programs indicates that changes are necessary.

Fishermen will be allowed a margin of 50 pounds round weight on their annual individual quota. Fishermen surpassing this margin will be charged under the Manitoba Fisheries Regulations. Those individuals classified as underproducers for two consecutive years may have their licenses cancelled. Any individual whose catch is less than one-half of his individual quota as adjusted by the proportion of the aggregate quota that is actually caught (% Area Quota Caught) (Individual Quota) (.5) is considered to be an underproducer.

Regulatory Seasons and Boundaries:

The Lake Winnipeg fishing grounds are divided into 9 different regulatory areas in the summer season, 3 in the fall season and 3 in the winter season as described on plans of record number 18306 (Fig. 1), 11307 (Fig. 2), 18308 (Fig. 3), respectively. Various net mesh and quota regulations have been applied to the different regulatory areas. (Schedule XVI)

The regulatory areas reflect the traditional fishing grounds of various groups of Lake Winnipeg fishermen. The boundaries, in more or less their present positions, were in effect long before the temporary closure of the lake in 1970. They were not introduced as part of a new management scheme which took shape during and after 1972. As early as 1911 there was recognition of the need for different regulations, particularly regarding net mesh, between whitefish grounds and pickerel grounds. The same is true between grounds that are dominated by sauger and those dominated by pickerel. Not all areas of the lake produce the same species or amounts of fish. Neither are all areas of the lake fished

SCHEDULE XVI
COMMERCIAL SEASONS, LIMITS AND CONDITIONS
Part I — Lake Winnipeg

Item	Column I Waters of Manitoba	Column II Species	Column III Open Season	Column IV Type of Gear	Column V Maximum Gear Allowable per Licence (In Meters)	Column VI Mesh Size, Extension Measure in Millimeters	Column VII Round Weight Quota (Kilograms in the Aggregate)	Column VIII Maximum Number of Licences or Persons
1.(1)	That portion of Lake Winnipeg shown as Area B on plan of record filed in the office of the Director of Surveys as Plan Number 18306	Pickerel, Sauger and Whitefish	(1) June 1st to July 27th	(1) Gill Nets	(1) 1400	(1) 128 to 140	(1) 106 600 kg	(1) 39
(2)	That portion of Lake Winnipeg shown as Area C on plan of record filed in the office of the Director of Surveys as Plan Number 18306	Pickerel, Sauger and Whitefish	(2) June 1st to July 27th	(2) Gill Nets	(2) 1400	(2) 108 to 140	(2) 36,300 kg	(2) 20
2.	That portion of Lake Winnipeg shown as Area D on plan of record filed in the office of the Director of Surveys as Plan Number 18306.	Pickerel, Sauger and Whitefish	June 1st to July 10th	Gill Nets	1400	108 to 140	50,900 kg	25
3.	That portion of Lake Winnipeg shown as Area E on plan of record filed in the office of the Director of Surveys as Plan Number 18306	Pickerel, Sauger and Whitefish	June 1st to July 10th	Gill Nets	1400	96 to 140	196,320 kg of which not more than 168,000 kg may be of Pickerel and Sauger	48
4 (1)	That portion of Lake Winnipeg shown as Area F on plan of record filed in the office of the Director of Surveys as Plan Number 18306.	Pickerel, Sauger and Whitefish	(1) June 1st to July 10th	(1) Gill Nets	(1) 1400	(1) 108 to 140	(1) 61,290 kg of which not more than 53,460 kg may be Pickerel and Sauger	(1) 27
(2)	That portion of Lake Winnipeg shown as Area B on plan of record filed in the office of the Director of Surveys as Plan Number 18308.	Pickerel, Sauger and Whitefish	(2) 1st day after November 1st that ice makes to March 31st	(2) Gill Nets	(2) 3700	(2) 108 to 140	(2) 93,900 kg	(2) 23
5	That portion of Lake Winnipeg shown as Area G on plan of record filed in the office of the Director of Surveys as Plan Number 18306.	Pickerel, Sauger and Whitefish	June 1st to August 8th	Gill Nets	7400	128 to 140	698,720 kg	44
6. (1)	That portion of Lake Winnipeg shown as Area H on plan of record filed in the office of the Director of Surveys as Plan Number 18306.	Pickerel, Sauger and Whitefish	(1) June 1st to July 10th	(1) Gill Nets	(1) 1400	(1) 77 to 140	(1) 348,480 kg of which not more than 288,000 kg may be Pickerel and Sauger.	(1) 96
(2)	That portion of Lake Winnipeg shown as Area I on plan of record filed in the office of the Director of Surveys as Plan Number 18306.	Pickerel, Sauger and Whitefish	(2) June 1st to July 10th	(2) Gill Nets	(2) 1400	(2) 96 to 140	(2) Quota included in Item 6 (1)	(2) Included in Item 6 (1)
7.	That portion of Lake Winnipeg show as Area J on plan of record filed in the office of the Director of Surveys as Plan Number 18306	Pickerel, Sauger and Whitefish	June 1st to July 10th	Gill Nets	1400	77 to 140	308,720 kg	136
8.	That portion of Lake Winnipeg shown as Area B on plan of record filed in the office of the Director of Surveys as Plan Number 18307	Pickerel, Sauger and Whitefish	From the day following the Labor Day statutory holiday to October 30	Gill Nets	1400	96 to 140	518,160 kg	136
9. (1)	That portion of Lake Winnipeg shown as Area C on plan of record filed in the office of the Director of Surveys as Plan Number 18307	Pickerel, Sauger and Whitefish	(1) From the day following the Labor Day statutory holiday to October 30	(1) Gill Nets	(1) 1400	(1) 77 to 140	(1) 895,350 kg	(1) 235
(2)	That portion of Lake Winnipeg shown as Area D on plan of record filed in the office of the Director of Surveys as Plan Number 18307	Pickerel, Sauger and Whitefish	(2) From the day following the Labor Day statutory holiday to October 30	(2) Gill Nets	(2) 1400	(2) 77 to 140	(2) 670,560 kg	(2) 176
0.	That portion of Lake Winnipeg shown as Area C on plan of record filed in the office of the Director of Surveys as Plan Number 18308	Pickerel, Sauger and Whitefish	1st day after November 1st that ice makes to March 31st	Gill Nets	7400	128 to 140	312,310 kg	47
1	That portion of Lake Winnipeg shown as Area D on plan of record filed in the office of the Director of Surveys as Plan Number 18308	Pickerel, Sauger and Whitefish	1st day after November 1st that ice makes to March 31	Gill Nets	3700	77 to 140	715,750 kg	175
2	Lake Winnipeg	Sturgeon	From June 1st to August 8th	Gill Nets	1400	305	Unlimited	Unlimited
3.	That portion of Lake Winnipeg shown as Area A on plans of record filed in the office of the Director of Surveys as Plan Number 18306, 18307 and 18308	All species	No open season	None	None	None	No Quota	0

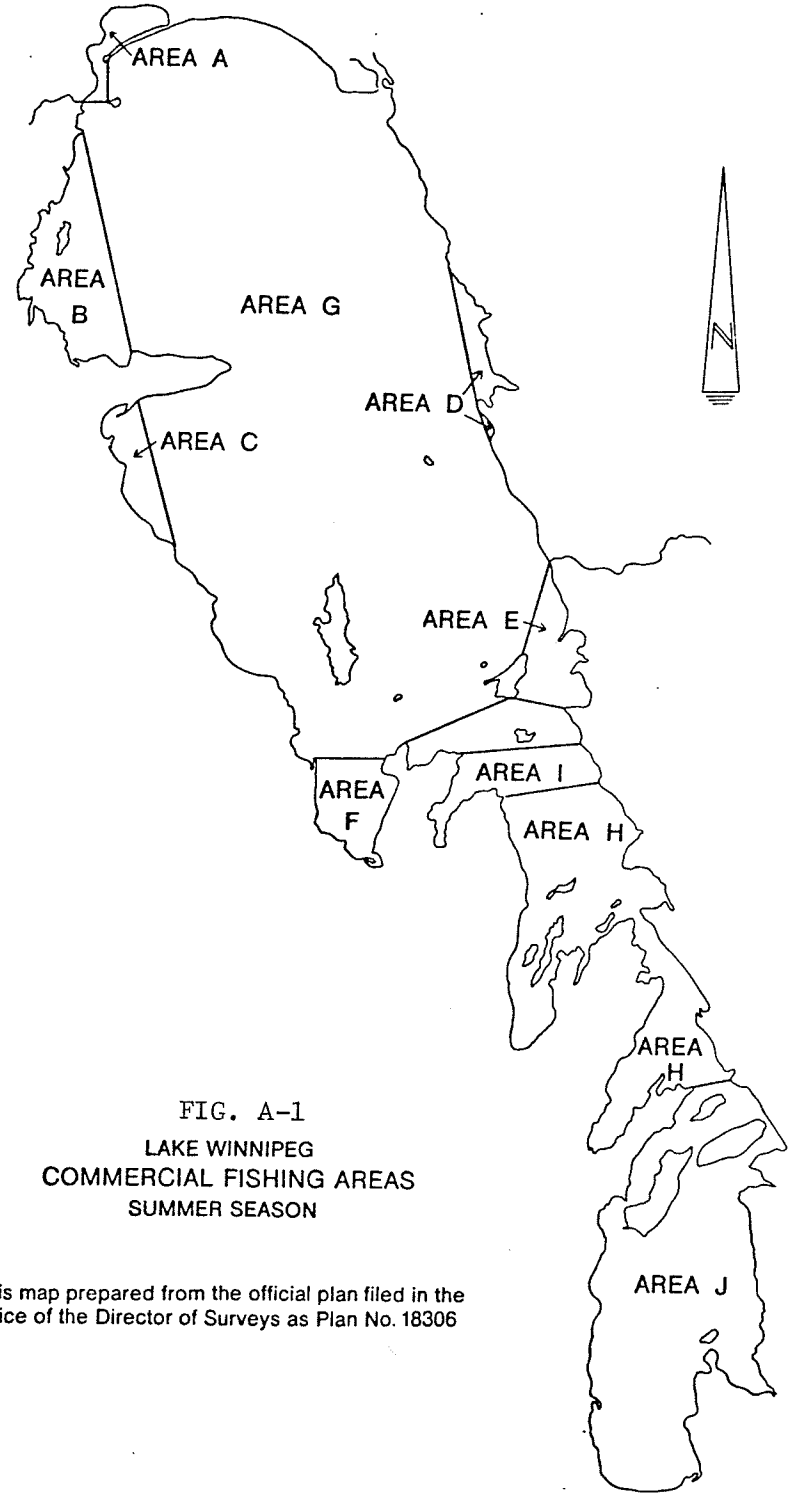

FIG. A-1

LAKE WINNIPEG

COMMERCIAL FISHING AREAS

SUMMER SEASON

This map prepared from the official plan filed in the office of the Director of Surveys as Plan No. 18306

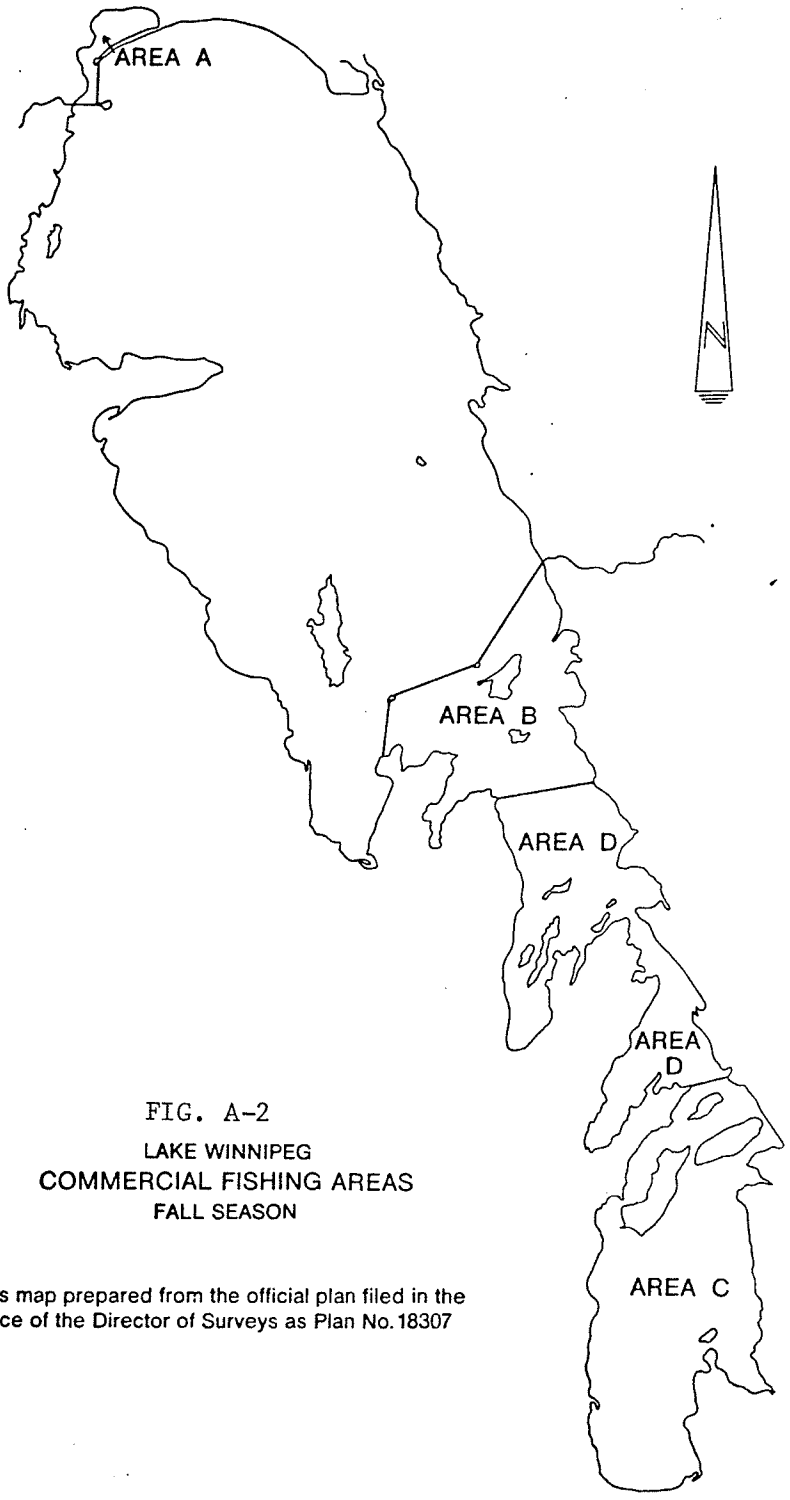

FIG. A-2

LAKE WINNIPEG
COMMERCIAL FISHING AREAS
FALL SEASON

This map prepared from the official plan filed in the office of the Director of Surveys as Plan No. 18307

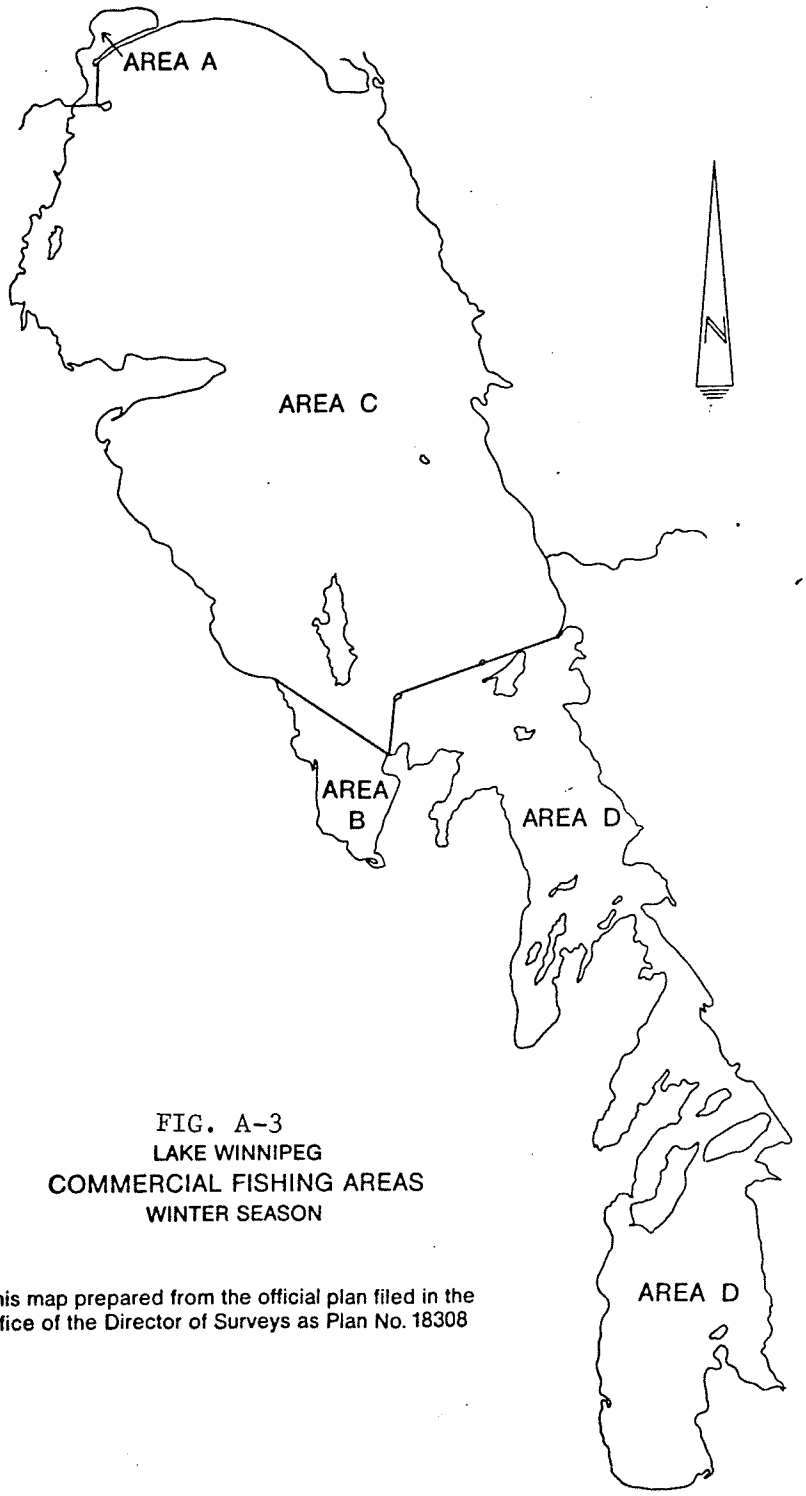

FIG. A-3
LAKE WINNIPEG
COMMERCIAL FISHING AREAS
WINTER SEASON

This map prepared from the official plan filed in the office of the Director of Surveys as Plan No. 18308

with the same intensity. Therefore, different production quotas in different areas are needed to ensure the conservation of different stocks that occur within the Lake Winnipeg fishery.

Natural divisions in fishing seasons occur during the conversion from open water to ice cover and vice versa. Open commercial seasons are from June 1 to July 10, from the day after Labour Day to October 30, and from first ice after November 1 to March 31. A special summer whitefish season runs from June 1 to August 8. The season is closed during August because high water temperatures at that time of year result in quality and spoilage problems.

Licensing:

Prior to 1970 restricting the number of licenses issued was not used as a management practice. When limits were set, their number were set above the number of fishermen requesting licenses. The lake was closed to fishing due to mercury contamination in 1970. Upon re-opening in 1972, a restrictive licensing system was implemented. Citing a recommendation of the Fisheries Adjustment Study (1971), that there was no need to reduce current participation levels and the fact that participation levels in the Lake Winnipeg fishery had declined by 30 percent between 1961 and 1969, the Policy and Planning Committee endorsed a policy to limit licenses at previous (1969) levels.

Only fishermen who had fished in either 1968 or 1969 and had fished six of the last seven years previous to 1960 were allowed re-entry. The number of licenses allowed has remained approximately the same since 1972 (1,232 licenses, 696 fishermen, all areas, all seasons). License

limitation is maintained by licensing new fishermen only to fill vacancies created by those who withdraw from the fishery.

Vacancies created by death, retirement or voluntary withdrawal and by cancellation of licenses are filled by selecting the applicant with the greatest amount of experience in the season in which the opening occurs, the most formal training, and the greatest dependency on the fishery. The applicant must fulfill three basic el gibility criteria before applications are considered:

1. He must reside within twenty miles of the lakeshore unless already licensed in at least one season.

2. He must not have a full-time job at the time of application.

3. He must be 16 years of age or older.

Points for experience are considered in the ten-year period preceeding the current application. Points are awarded for each year the applicant has fished either as a licensee or as a hired man in the season for which he has applied. More recent experience counts more heavily. The applicant receives 4 points for each of the first four years, 5 points for each of the next three years, 6 points for each of the next two years and 7 points for the last (most recent) year, up to a maximum of 50 points.

Points for dependency are awarded on the basis of one point for each season fished as a licensee or helper in the previous 10 years (maximum 30 points).

Whenever a vacancy occurs, the applicant with the highest point total for the appropriate season receives the license.

Anyone who has held a license in the previous year is eligible for another license in the same season without having to compete with new applicants.

The number of licenses allotted to each of the twelve recognized community areas is based on 1975 levels. Only individuals from within the community are allowed to compete for the vacant licenses within that community. Community area licensing is reviewed bi-annually to consider possible redistribution of license privileges.

An individual may transfer a commercial license only in the case where it is transferred from a parent to his/her child, providing that the recipient of the license meets basic eligibility criteria.

A license may be cancelled if the operator is found to be in violation of commercial fishing regulations or if production is usually low. All appeals regarding cancellations are subject to review by a Lake Winnipeg license review board.

Fishermen who are 55 years of age or over and desire to continue fishing, but not at their former quota level can voluntarily give up their licenses without being forced to stop fishing entirely. Such a person may obtain a retirement license that allows continued commercial fishing, but at a reduced level.

The north-end summer whitefish season is limited to 44 licenses. Vacancies are filled through the established criteria, but not on a community area basis. Competition for entry is on a lake-wide basis.

APPENDIX B

NUMBER OF FISHERMEN AND PRODUCTION ($, lbs.) BY PRODUCTION CATEGORY

TABLE B-1
QUOTA ENTITLEMENT WITH CORRESPONDING PRODUCTION (lbs.) AND REVENUE ($) FOR BERENS RIVER FISHERMEN HOLDING 1 LICENSE (1972-79)

YEAR		QUOTA ENTITLEMENT Season	lbs.	NUMBER OF FISHERMEN	MEAN GROSS PRODUCTION (lbs.)	MEAN GROSS REVENUE ($)
72		Summer	7,700	13	N/A	N/A
		Fall	8,400	10	N/A	N/A
		$Winter_{co}$	9,000	1	N/A	N/A
		$Winter_{cf}$	4,000			
73	N=9	Summer	7,700	12	4,639.89	1,980.11
	N=10	Fall	8,400	10	5,180.10	2,349.00
	N=1	$Winter_{co}$	9,000	1	8,325.00	2,689.00
		$Winter_{cf}$	4,000			
74	N=9	Summer	7,700	12	5,787.22	2,281.22
	N=11	Fall	8,400	11	4,619.82	1,735.69
	N=1	$Winter_{co}$	9,000	1	2,519.00	924.00
		$Winter_{cf}$	4,000			
75	N=10	Summer	7,700	11	6,154.50	2,595.50
	N=10	Fall	8,400	11	7,030.10	3,182.30
	N=1	$Winter_{co}$	9,000	1	9,000.00	5,194.00
		$Winter_{cf}$	4,000			
76	N=10	Summer	7,700	11	5,110.50	3,557.20
	N=10	Fall	8,400	12	6,019.60	4,817.80
	N=1	$Winter_{co}$	9,000	1	9,000.00	7,156.00
		$Winter_{cf}$	4,000			
77	N=9	Summer	7,700	10	5,582.22	3,743.00
	N=10	Fall	8,400	11	6,998.70	4,534.50
	N=1	$Winter_{co}$	9,000	1	7,784.00	3,621.00
		$Winter_{cf}$	4,000			
78*	N=10	Summer	9,000	11	7,022.70	3,967.00
	N=9	Fall	8,400	11	7,162.33	4,360.89
	N=1	$Winter_{co}$	9,000	1	7,407.00	3,832.00
		$Winter_{cf}$	4,000	1	N/A	N/A
79*	N=9	Summer	9,000	10	7,305.67	4,782.78
	N=9	Fall	8,400	11	7,091.11	5,845.89
	N=1	$Winter_{co}$	9,000	1	N/A	N/A
		$Winter_{cf}$	4,000			

LEGEND: co - Commercial Operator cf - Commercial Fisherman

*1978-79 Production and Revenue Figures only include values for open-water harvest (Summer, Fall). Winter season values were not available.

SOURCE: Department of Natural Resources, Fisheries Branch Licensing Records. Freshwater Fish Marketing Corporation Production Records.

TABLE B-2
QUOTA ENTITLEMENTS WITH CORRESPONDING PRODUCTION (lbs.) AND REVENUE ($) FOR BERENS RIVER FISHERMEN HOLDING 2 LICENSES (1972-79)

YEAR		QUOTA ENTITLEMENT Season(s)	lbs.	NUMBER OF FISHERMEN	MEAN GROSS PRODUCTION (lbs.)	MEAN GROSS REVENUE ($)
72		SF	16,100	22	N/A	N/A
		SW	$16,700_{co}$			
			$11,700_{cf}$			
		FW	$17,400_{co}$			
			$12,400_{cf}$			
73	N=26	SF	16,100	26	9,929.85	4,180.92
		SW	$16,700_{co}$			
			$11,700_{cf}$			
		FW	$17,400_{co}$			
			$12,400_{cf}$	1_{cf}	8,009.00	3,337.00
74	N=27	SF	16,100	27	10,489.41	3,394.63
		SW	$16,700_{co}$			
			$11,700_{cf}$			
		FW	$17,400_{co}$			
			$12,400_{cf}$			
75	N=28	SF	16,100	28	13,399.89	5,935.59
		SW	$16,700_{co}$			
			$11,700_{cf}$			
		FW	$17,400_{co}$			
			$12,400_{cf}$			
76	N=27	SF	16,100	27	11,703.00	8,718.58
		SW	$16,700_{co}$			
			$11,700_{cf}$			
		FW	$17,400_{co}$			
			$12,400_{cf}$			
77	N=28	SF	16,100	28	12,687.71	7,856.18
		SW	$16,700_{co}$			
			$11,700_{cf}$			
		FW	$17,400_{co}$			
			$12,400_{cf}$			
78*	N=29	SF	17,400	29	14,316.17	8,687.83
		SW	$18,000_{co}$			
			$13,000_{cf}$			
79*	N=28	SF	17,400	28	14,615.58	10,910.88
		SW	$18,000_{co}$			
			$13,000_{cf}$			
		FW	$17,400_{co}$			
			$12,400_{cf}$			

LEGEND: S = Summer; F = Fall; W = Winter; co = Commercial Operator (Winter); cf = Commercial Fisherman (Winter)

* 1978-79 Production and Revenue Figures only include values for open-water harvest (Summer, Fall). Winter season values were not available.

SOURCE: Department of Natural Resources, Fisheries Branch Licensing Records. Freshwater Fish Marketing Corporation Production Records.

TABLE B-3

QUOTA ENTITLEMENTS WITH CORRESPONDING PRODUCTION (lbs.) AND REVENUE ($) FOR BERENS RIVER FISHERMEN HOLDING 3 LICENSES (1972-79)

YEAR		QUOTA ENTITLEMENTS Season	lbs.	NUMBER OF FISHERMEN	MEAN GROSS PRODUCTION (lbs.)	MEAN GROSS REVENUE ($)
72		SFW_{co}	25,100	6	N/A	N/A
		SFW_{cf}	20,100	4	N/A	N/A
73	N=6	SFW_{co}	25,100	6	22,965.50	8,087.67
	N=3	SFW_{cf}	20,100	3	13,092.00	5,273.33
74	N=6	SFW_{co}	25,100	6	30,303.00	8,806.67
	N=3	SFW_{cf}	20,100	3	16,849.67	5,794.00
75	N=6	SFW_{co}	25,100	6	21,633.67	9,465.67
	N=3	SFW_{cf}	20,100	3	16,825.00	7,316.67
76	N=6	SFW_{co}	25,100	6	21,632.00	14,801.17
	N=4	SFW_{cf}	20,100	4	15,348.75	10,177.25
77	N=6	SFW_{co}	25,100	6	21,998.50	13,395.67
	N=4	SFW_{cf}	20,100	4	15,646.00	9,852.75
78*	N=5	SFW_{co}	26,400	6	18,572.00	11,598.60
	N=4	SFW_{cf}	21,400	4	15,715.25	9,090.75
79*	N=5	SFW_{co}	26,400	5	16,702.00	12,801.20
	N=5	SFW_{cf}	21,400	5	16,455.60	13,055.60

LEGEND: S = Summer; F= Fall; W = Winter; co = Commercial Operator (Winter)
cf = Commercial Fisherman (Winter)

*1978-79 Production and Revenue Figures only include values for open-water harvest (Summer, Fall). Winter season values were not available.

SOURCE: Department of Natural Resources, Fisheries Branch Licensing Records. Freshwater Fish Marketing Corporation Production Records.

TABLE B-4

QUOTA ENTITLEMENTS WITH CORRESPONDING GROSS PRODUCTION (lbs.) AND REVENUE ($) FOR GIMLI FISHERMEN HOLDING 1 LICENSE (1972-79)

YEAR		QUOTA ENTITLEMENT Season	lbs.	NUMBER OF FISHERMEN	MEAN GROSS PRODUCTION (lbs.)	MEAN GROSS REVENUE ($)
72		Season	4,200	1	N/A	N/A
		Fall	8,400	19	N/A	N/A
		$Winter_{co}$	9,000			
		$Winter_{cf}$	4,000	1	N/A	N/A
73		Summer	4,200	2	N/A	N/A
	N=15	Fall	8,400	18	6,101.40	2,990.47
		$Winter_{co}$	9,000			
		$Winter_{cf}$	4,000	1	2,869.00	1,855.00
74		Summer	4,200	2	N/A	N/A
	N=14	Fall	8,400	18	4,978.46	2,276.00
		$Winter_{co}$	9,000			
	N=1	$Winter_{cf}$	4,000	1	3,994.00	1,948.00
75		Summer	4,200			
	N=12	Fall	8,400	16	4,966.00	2,346.00
		$Winter_{co}$	9,000			
		$Winter_{cf}$	4,000	1	N/A	N/A
76		Summer	4,200			
	N=10	Fall	8,400	15	5,718.89	3,622.67
		$Winter_{co}$	4,000			
		$Winter_{cf}$	9,000	1	3,465.00	2,701.00
77	N=1	Summer	4,200	2	3,926.00	2,325.00
	N=9	Fall	8,400	14	7,522.22	4,381.78
		$Winter_{co}$	9,000			
	N=1	$Winter_{cf}$	4,000	1	5,050.00	3,590.00
78*	N=1	Summer	5,000	2	6,639.00	2,986.00
	N=5	Fall	8,400	10	5,730.25	3,913.25
		$Winter_{co}$	9,000			
	N=1	$Winter_{cf}$	4,000	1	N/A	N/A
79*		Summer	5,000	1	N/A	N/A
	N=6	Fall	8,400	10	8,063.60	6,713.40
		$Winter_{co}$	9,000			
	N=1	$Winter_{cf}$	4,000	1	N/A	N/A

*1978-79 Production and Revenue Figures only include values for open-water harvest (Summer, Fall). Winter season values were not available.

SOURCE: Department of Natural Resources, Fisheries Branch Licensing Records. Freshwater Fish Marketing Corporation Production Records.

TABLE B-5

QUOTA ENTITLEMENTS WITH CORRESPONDING GROSS PRODUCTION (lbs.) AND REVENUE ($) FOR GIMLI FISHERMEN HOLDING 2 LICENSES (1972-79)

YEAR		QUOTA ENTITLEMENT Season(s)	lbs.	NUMBER OF FISHERMEN	MEAN GROSS PRODUCTION (lbs.)	MEAN GROSS REVENUE($)
72		SF	12,600	12	N/A	N/A
		SW	$13,200_{co}$			
			$8,200_{cf}$			
		FW	$17,400_{co}$			
			$12,400_{cf}$	1_{co} 4_{cf}	N/A	N/A
73	N=10	SF	12,600	12	9,069.70	3,910.80
		SW	$13,200_{co}$			
			$8,200_{cf}$			
	$N=2_{cf}$	FW	$17,400_{co}$	3_{cf} 3_{co}	$12,826.50_{co}$	$7,437.50_{co}$
	$N=2_{co}$		$12,400_{cf}$		$8,512.50_{cf}$	$3,989.00_{cf}$
74	N=8	SF	12,600	12	8,103.00	3,218.12
		SW	$13,200_{co}$			
			$8,200_{cf}$			
	$N=2_{cf}$	FW	$17,400_{co}$	2_{co} 3_{cf}	$13,034.00_{co}$	$6,827.00_{co}$
	$N=1_{co}$		$12,400_{cf}$		$10,291.00_{cf}$	$4,336.50_{cf}$
75	N=6	SF	12,600	11	9,451.83	3,977.00
		SW	$13,200_{co}$			
			$8,200_{cf}$			
	$N=4_{cf}$	FW	$17,400_{co}$	2_{co} 4_{cf}	$13,737.00_{co}$	$6,478.50_{co}$
	$N=2_{co}$		$12,400_{cf}$		$10,815.00_{cf}$	$4,788.00_{cf}$
76	N=6	SF	12,600	8	7,730.83	4,292.00
			$13,400_{co}$			
			$8,200_{cf}$			
	$N=6_{cf}$	FW	$17,400_{co}$	2_{co} 6_{cf}	$17,556.00_{co}$	$12,256.50_{co}$
	$N=2_{co}$		$12,400_{cf}$		$11,701.00_{cf}$	$7,573.33_{cf}$
77	N=7	SF	12,600	8	7,427.28	4,278.00
		SW	$13,200_{co}$			
			$8,200_{cf}$			
	$N=5_{cf}$	FW	$17,400_{co}$	2_{co} 5_{cf}	$17,953.50_{co}$	$10,692.00_{co}$
	$N=2_{co}$		$12,400_{cf}$		$12,182.60_{cf}$	$7,061.80_{cf}$
78*	N=8	SF	13,400	12	7,198.75	4,284.12
	N=1	SW	$14,000_{co}$			
			$9,000_{cf}$	1_{cf}	7,762.00	5,644.00
	$N=4_{cf}$	FW	$17,400_{co}$	2_{co} 5_{cf}	$7,800.00_{co}$	$5,810.00_{co}$
	$N=2_{co}$		$12,400_{cf}$		$7,849.50_{cf}$	$4,445.00_{cf}$
79*	N=7	SF	13,400	13	10,405.71	7,332.57
	N=1	SW	$14,000_{co}$	1_{cf}	6,602.00	5,958.00
			$9,000_{cf}$			
	$N=3_{cf}$	FW	$17,400_{co}$	5_{cf} 2_{co}	$9,148.33_{cf}$	$7,569.67_{cf}$
	$N=2_{co}$		$12,400_{cf}$		$8,188.50_{co}$	$6,911.50_{co}$

LEGEND: S = Summer; F = Fall; W = Winter; co = Commercial Operator (Winter); cf = Commercial Fisherman (Winter)

* 1978-79 Production and Revenue Figures only include values for open-water harvest (Summer-Fall). Winter season values were not available.

SOURCE: Dept. of Natural Resources, Fisheries Branch Licensing Records. Freshwater Fish Marketing Corporation Production Records.

TABLE B-6

QUOTA ENTITLEMENTS WITH CORRESPONDING GROSS PRODUCTION (lbs.) AND REVENUE ($) FOR GIMLI FISHERMEN HOLDING 3 LICENSES (1972-79)

YEAR		QUOTA ENTITLEMENT Season	lbs.	NUMBER OF FISHERMEN	MEAN GROSS PRODUCTION (lbs.)	MEAN GROSS REVENUE ($)
72		SFW_{co}	21,600	4	N/A	N/A
		SFW_{cf}	16,600	10	N/A	N/A
73	N=3	SFW_{co}	21,600	3	21,975.67	8,663.00
	N=7	SFW_{cf}	16,600	9	13,755.28	6,831.14
74	N=3	SFW_{co}	21,600	4	20,464.00	7,259.67
	N=5	SFW_{cf}	16,600	8	13,980.60	6,144.40
75	N=3	SFW_{co}	21,600	4	31,323.00	11,280.67
	N=8	SFW_{cf}	16,600	11	14,844.75	6,564.50
76	N=3	SFW_{co}	21,600	3	21,805.67	13,060.33
	N=11	SFW_{cf}	16,600	16	16,675.66	10,852.73
77	N=3	SFW_{co}	21,600	3	20,372.33	11,910.33
	N=13	SFW_{cf}	16,600	16	17,178.54	11,088.31
78*	N=3	SFW_{co}	22,400	3	12,507.67	9,203.11
	N=9	SFW_{cf}	17,400	15	7,032.00	5,897.56
79*	N=2	SFW_{co}	22,400	3	11,885.50	9,575.00
	N=3	SFW_{cf}	17,400	15	12,209.67	8,711.67

LEGEND: S = Summer; F = Fall; W = Winter; co = Commercial Operator (Winter); cf = Commercial Fisherman (Winter)

*1978-79 Production and Revenue Figures only include values for open-water harvest (Summer, Fall). Winter season values were not available.

SOURCE: Department of Natural Resources, Fisheries Branch Licensing Records. Freshwater Fish Marketing Corporation Production Records.

APPENDIX C

MEAN GROSS OPEN-WATER PRODUCTION ($, lbs.) By PRODUCTION CATEGORY

TABLE C-1

MEAN ($\bar{x}$) AND STANDARD DEVIATION (s.d.) GROSS PRODUCTION
1 LICENSE OPEN WATER - GIMLI (1973-79)

YEAR		QUOTA $\bar{x}$	QUOTA s.d.	NON-QUOTA $\bar{x}$	NON-QUOTA s.d.	TOTAL $\bar{x}$	TOTAL s.d.
1973	$	2,988.80	475.01	48.27	57.27	2,990.47	395.28
N=15	lbs.	5,697.33	738.13	404.07	474.28	6,101.40	896.93
1974	$	2,249.15	664.70	29.08	45.79	2,276.00	693.17
N=13	lbs.	4,717.38	1,395.35	141.50	169.94	4,978.46	1,736.19
1975	$	2,312.60	913.44	33.40	21.70	2,346.00	929.11
N=12	lbs.	4,675.40	1,740.19	291.30	191.65	4,966.70	1,866.53
1976	$	3,510.78	1,647.78	143.86	185.76	3,622.67	1,629.26
N=9	lbs.	5,022.56	2,438.51	892.57	1,308.99	5,716.89	2,469.90
1977	$	4,127.40	929.80	85.37	40.07	4,216.10	1,004.98
N=10	lbs.	6,817.90	1,567.58	500.25	323.53	7,207.80	1,637.57
1978	$	3,906.75	8,862.62	N/A	N/A	3,913.25	1,867.64
N=4	lbs.	5,640.50	2,509.66	N/A	N/A	5,730.25	2,591.63
1979	$	6,637.80	607.78	92.00	57.03	6,731.40	642.75
N=5	lbs.	7,702.60	736.54	451.25	234.54	8,063.60	808.93

SOURCE: Freshwater Fish Marketing Corporation Production Records.

TABLE C-2

MEAN ($\bar{x}$) and STANDARD DEVIATION (s.d.) GROSS PRODUCTION
2 LICENSES OPEN WATER - GIMLI (1973-79)

YEAR		QUOTA $\bar{x}$	QUOTA s.d.	NON-QUOTA $\bar{x}$	NON-QUOTA s.d.	TOTAL $\bar{x}$	TOTAL s.d.
1973	$	3,313.00	1,072.65	227.18	300.24	3,615.28	1,089.81
N=11	lbs.	6,511.45	2,191.19	1,755.18	2,391.07	7,866.14	3,260.26
1974	$	2,879.40	983.26	116.70	114.78	2,945.54	997.37
N=10	lbs.	6,224.70	2,099.98	1,270.10	1,407.69	7,281.36	2,907.06
1975	$	3,495.45	1,092.01	136.09	120.86	3,576.50	1,034.68
N=11	lbs.	7,240.82	2,248.65	1,231.82	1,084.51	8,284.00	2,125.46
1976	$	4,072.36	2,426.61	250.45	279.81	4,472.86	2,183.35
N=11	lbs.	5,832.73	3,628.13	1,613.00	1,962.20	7,517.86	3,315.86
1977	$	4,805.08	1,756.88	204.00	191.53	4,966.71	1,713.73
N=13	lbs.	7,351.92	2,911.30	1,317.08	1,271.56	8,497.50	3,032.70
1978	$	4,935.23	2,158.29	33.89	22.94	4,893.50	2,084.59
N=14	lbs.	7,660.00	3,455.56	249.00	214.77	7,903.43	3,290.34
1979	$	7,415.00	2,376.79	313.00	411.47	7,728.00	2,310.54
N=14	lbs.	8,553.33	2,901.87	1,503.42	2,252.93	10,056.25	3,360.10

SOURCE: Freshwater Fish Marketing Corporation Production Records.

TABLE C-3

MEAN ($\bar{x}$) AND STANDARD DEVIATION (s.d.) GROSS PRODUCTION
3 LICENSES OPEN WATER - GIMLI (1973-79)

YEAR		QUOTA $\bar{x}$	QUOTA s.d.	NON-QUOTA $\bar{x}$	NON-QUOTA s.d.	TOTAL $\bar{x}$	TOTAL s.d.
1973	$	3,918.00	1,024.36	254.80	239.19	5,202.40	1,523.36
N=10	lbs.	7,808.20	2,068.36	2,247.60	2,350.51	10,904.10	3,050.49
1974	$	4,091.50	413.73	330.50	253.82	4,131.62	447.64
N=8	lbs.	8,629.50	647.09	3,814.50	2,824.16	10,102.50	3,315.02
1975	$	5,419.75	594.59	90.75	833.75	5,311.73	936.06
N=11	lbs.	11,515.50	1,993.97	32.07	322.24	12,235.09	2,550.71
1976	$	6,493.83	2,532.27	121.17	86.42	7,145.00	2,653.02
N=14	lbs.	9,568.83	3,894.48	780.00	523.10	11,471.71	4,834.60
1977	$	7,032.00	2,259.87	175.62	109.92	7,645.64	1,889.73
N=14	lbs.	10,642.37	3,401.63	1,083.50	574.34	11,683.93	2,934.35
1978	$	5,876.75	1,924.12	35.67	154.57	5,966.91	1,745.69
N=11	lbs.	9,027.38	2,738.56	42.08	140.15	9,941.00	3,040.93
1979	$	8,796.40	1,399.38	325.75	349.28	9,057.00	1,486.84
N=5	lbs.	10,191.20	1,722.20	2,361.00	3,196.00	12,080.00	3,211.83

SOURCE: Freshwater Fish Marketing Corporation Production Records.

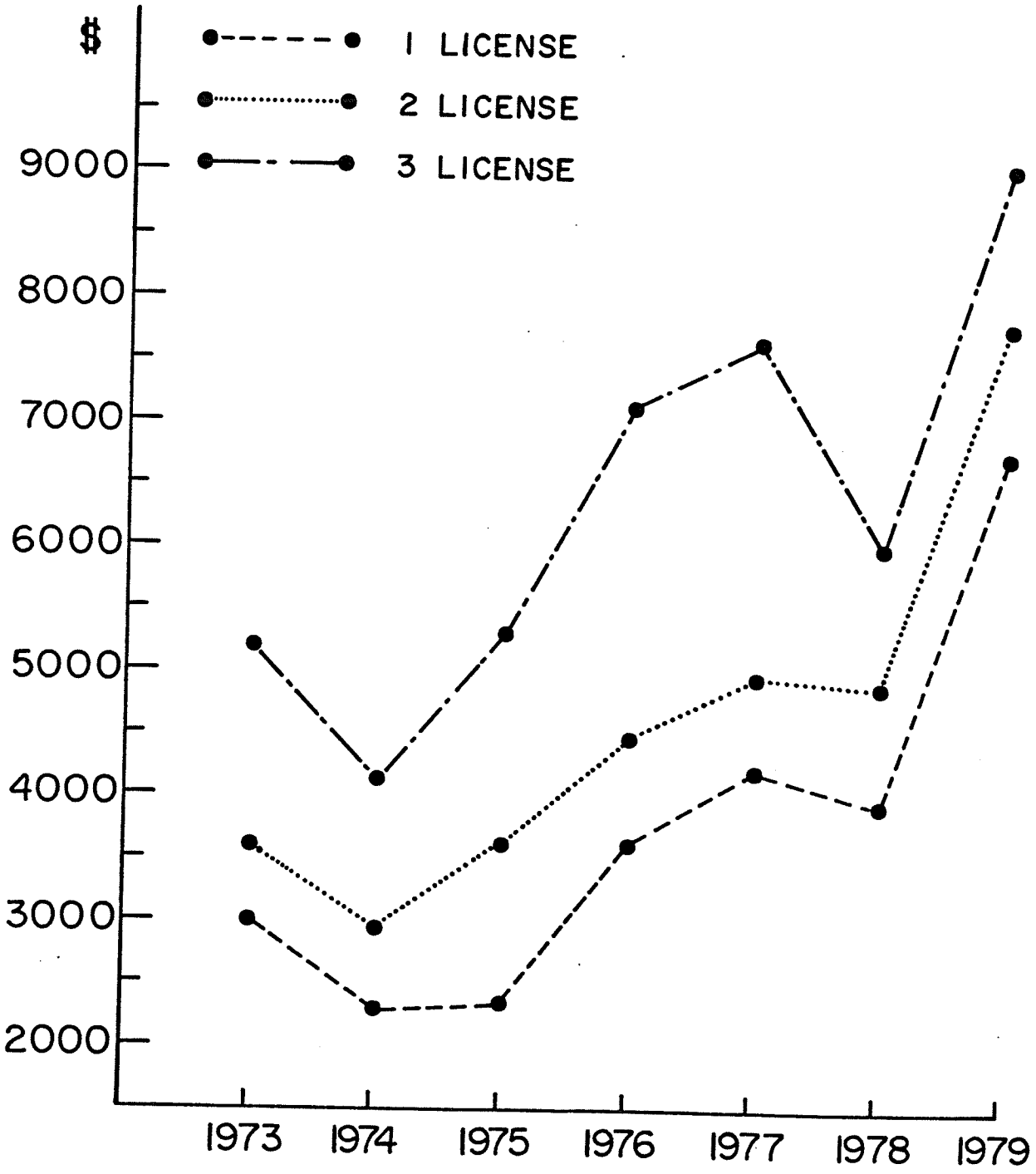

FIG. C-1 MEAN GROSS REVENUES OPEN-WATER PRODUCTION - GIMLI

TABLE C-4

MEAN ($\bar{x}$) AND STANDARD DEVIATION (s.d.) OF GROSS PRODUCTION
1 LICENSE OPEN WATER - BERENS RIVER (1973-79)

YEAR		QUOTA $\bar{x}$	QUOTA s.d.	NON-QUOTA $\bar{x}$	NON-QUOTA s.d.	TOTAL $\bar{x}$	TOTAL s.d.
1973	$	N/A	N/A	N/A	N/A	2,152.47	573.74
N=19	lbs.	N/A	N/A	N/A	N/A	4,940.00	1,217.80
1974	$	N/A	N/A	N/A	N/A	1,981.50	815.19
N=20	lbs.	N/A	N/A	N/A	N/A	5,145.15	2,057.54
1975	$	3,146.06	777.20	40.93	42.78	2,996.84	879.68
N=20	lbs.	6,704.00	1,538.53	435.67	391.28	6,832.21	1,759.95
1976	$	4,278.17	943.77	17.00	17.18	4,308.10	951.55
N=19	lbs.	5,579.17	1,222.46	133.76	143.79	5,672.10	1,079.10
1977	$	4,199.94	686.40	64.06	75.22	4,250.95	712.34
N=20	lbs.	6,252.41	676.93	419.53	492.72	6,598.82	704.66
1978	$	4,248.67	537.77	46.06	47.11	4,222.70	566.61
N=21	lbs.	7,068.89	782.68	224.47	235.03	7,268.40	696.02
1979	$	5,309.53	566.62	141.13	323.12	5,427.00	618.70
N=18	lbs.	7,399.06	423.63	127.36	389.81	7,702.76	516.66

$\bar{x}$ Mean Quota Production ($) exceeds total because Quota/Non-Quota Data were available for only 17 of 20 individuals (1975) and 19 of 21 (1978).

SOURCE: Freshwater Fish Marketing Corporation Production Records.

TABLE C-5

MEAN ($\bar{x}$) AND STANDARD DEVIATION (s.d.) OF GROSS PRODUCTION
2 LICENSES OPEN WATER - BERENS RIVER (1973-79)

YEAR		QUOTA $\bar{x}$	QUOTA s.d.	NON-QUOTA $\bar{x}$	NON-QUOTA s.d.	TOTAL $\bar{x}$	TOTAL s.d.
1973	$	N/A	N/A	N/A	N/A	4,180.92	1,003.99
N=26	lbs.	N/A	N/A	N/A	N/A	9,929.85	2,033.65
1974	$	N/A	N/A	N/A	N/A	3,947.63	736.51
N=27	lbs.	N/A	N/A	N/A	N/A	10,489.41	1,939.55
1975	$	5,887.75	929.29	47.23	37.53	5,935.54	933.85
N=28	lbs.	12,769.57	2,052.37	630.32	533.11	13,399.89	2,147.48
1976	$	8,683.77	1,720.36	34.81	32.15	8,718.58	1,724.14
N=26	lbs.	10,076.23	2,111.00	288.81	265.55	11,073.12	2,121.96
1977	$	7,771.69	1,376.61	87.59	54.39	7,856.18	1,408.38
N=28	lbs.	12,133.96	1,842.48	574.26	355.95	12,587.71	1,937.80
1978	$	8,611.65	938.36	79.14	76.91	8,687.83	965.62
N=29	lbs.	13,999.03	1,276.87	374.93	369.51	14,361.17	1,192.00
1979	$	10,747.88	1,210.49	163.00	112.52	10,910.88	1,226.30
N=29	lbs.	14,240.64	1,216.14	359.11	307.50	14,615.58	1,208.44

SOURCE: Freshwater Fish Marketing Corporation Production Records.

TABLE C-6

MEAN ($\bar{x}$) AND STANDARD DEVIATION (s.d.) OF GROSS PRODUCTION
3 LICENSES - OPEN WATER - BERENS RIVER (1973-79)

YEAR		QUOTA $\bar{x}$	QUOTA s.d.	NON-QUOTA $\bar{x}$	NON-QUOTA s.d.	TOTAL $\bar{x}$	TOTAL s.d.
1973	$	N/A	N/A	N/A	N/A	4,489.87	680.26
N=8	lbs.	N/A	N/A	N/A	N/A	10,629.75	1,693.30
1974	$	N/A	N/A	N/A	N/A	4,530.55	972.49
N=9	lbs.	N/A	N/A	N/A	N/A	13,143.22	3,459.75
1975	$	5,690.11	178.32	144.67	78.44	5,834.78	241.58
N=9	lbs.	11,837.33	168.98	1,848.00	1,038.83	13,685.33	1,085.22
1976	$	12,408.00	2,673.86	59.11	29.86	12,467.11	2,682.05
N=9	lbs.	15,329.89	3,034.21	497.00	250.40	15,826.89	3,096.51
1977	$	10,481.40	2,089.18	152.10	97.88	10,634.30	2,110.29
N=10	lbs.	15,693.70	3,100.56	997.80	642.27	16,691.50	3,110.93
1978	$	10,348.33	1,949.90	152.33	69.37	10.502.89	1,974.66
N=9	lbs.	16,723.11	2,572.23	738.78	339.51	17,464.88	2,614.23
1979	$	12,737.60	2,597.39	199.90	142.18	12,928.40	2,627.65
N=10	lbs.	16,020.30	2,538.22	557.00	378.58	16,578.30	2,542.61

SOURCE: Freshwater Fish Marketing Corporation Production Records.

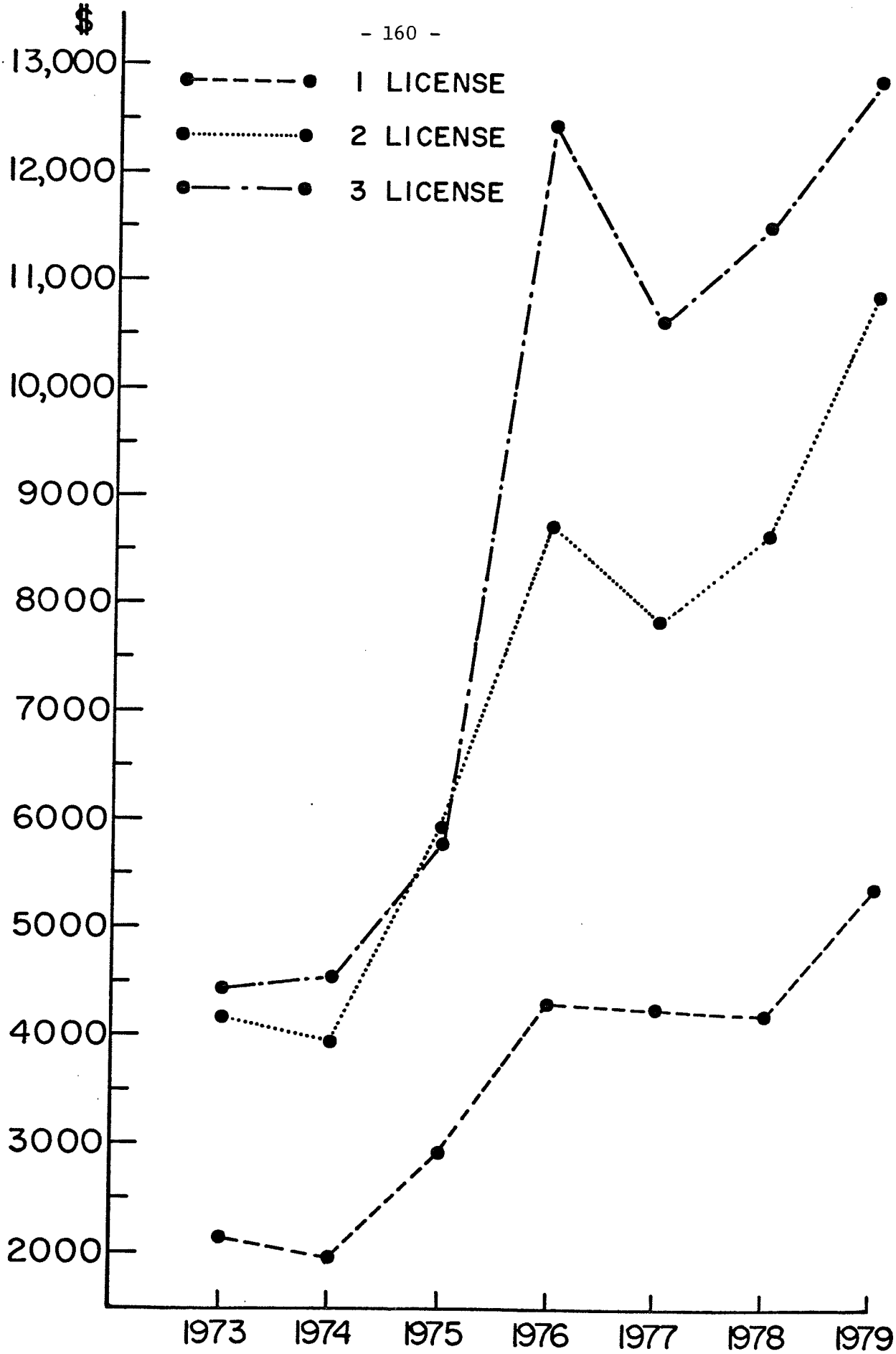

FIG. C-2 MEAN GROSS REVENUES OPEN-WATER PRODUCTION - BERENS RIVER

TABLE C-7

MEDIAN VALUES GROSS REVENUE
OPEN-WATER PRODUCTION BERENS RIVER

YEAR	PRODUCTION CATEGORY 1	2	3
1973	2,445.0	4,368.5	4,561.5
1974	2,255.5	3,849.0	5,169.0
1975	2,678.5	6,224.5	5,845.0
1976	4,176.0	8,095.0	12,457.0
1977	4,238.0	9,065.0	10,147.0
1978	4,292.0	8,910.0	10,862.0
1979	5,323.5	11,207.0	12,741.5

SOURCE: Freshwater Fish Marketing Corporation Production Records.

TABLE C-8

MEDIAN VALUE GROSS REVENUES
OPEN-WATER PRODUCTION - GIMLI

YEAR	PRODUCTION CATEGORY 1	2	3
1973	3,047.0	3,624.0	5,005.0
1974	2,194.0	3,257.0	3,919.5
1975	1,917.0	3,548.0	5,395.0
1976	2,923.0	4,615.0	6,759.5
1977	4,183.5	4,540.0	7,987.5
1978	4,154.0	4,836.0	6,186.0
1979	6,858.0	6,953.0	9,421.0

SOURCE: Freshwater Fish Marketing Corporation Production Records.

APPENDIX D

CALCULATION OF NET

REVENUES

D.1 The Skiff Enterprise (The Open-Water Firm)

Skiffs are constructed mainly of three different materials; wood plank or plywood, fiberglass, and aluminum. Most common on Lake Winnipeg is the fiberglass construction.[1] Skiff length may vary from 13 - 23 feet. Approximately 90% of Lake Winnipeg skiffs were found to be between 17 - 20 feet.[2]

The majority of skiffs (94%) are powered by twin outboard engines.[3] Eighty-one percent of outboards used are between 25 and 35 HP.[4] The average age of skiffs used by Lake Winnipeg operators was found to be 3.2 years, while the average age of the outboard engines was 1.7 years.

Gillnets are the only fishing gear utilized by Lake Winnipeg commercial fishermen. The minimum mesh size used and maximum yardage allowed are fixed by regulation. Choice of mesh depth, thickness and strength will vary with species caught. Lake Winnipeg skiffs owned an average of 3839 yards of gillnet.[5]

The average total capital investment (skiffs, outboards, and gillnets) for a Lake Winnipeg skiff operation was $5,573 (1977).[6]

D.2 Estimated Gross Revenues

In order to derive an estimate of gross revenues for a "typical" skiff operator within each production category annual mean open-water gross revenue values for each category were calculated. (Appendix C, Tables 1-6). These values were then subject to a simple least-squares regression analysis with time (years) as the independent variable (Tables D-1 and D-2 and Figures D-1 - D-6). The regression analysis removed annual variations due to price fluctuations thus providing an accurate indication of the trend gross revenues have been following

TABLE D-1

REGRESSION OF TOTAL GROSS OPEN-WATER REVENUE
GIMLI AREA

Production Category	Dependent Variable	Regression Coefficients a	b	R^2
1 License	Gross Revenue	1,389.69 (1.77)	584.55 (3.33)	.690
2 License	Gross Revenue	2,039.00 (2.81)	640.15 (3.94)	.776
3 License	Gross Revenue	3,841.71 (2.16)	627.44 (1.58)	.644

TABLE D-2

REGRESSION OF TOTAL GROSS OPEN-WATER REVENUE
BERENS RIVER

Production Category	Dependent Variable	Regression Coefficients a	b	R^2
1 License	Gross Revenue	1,389.21 (3.53)	556.65 (6.32)	.888
2 License	Gross Revenue	2,663.80 (3.37)	1,128.25 (6.34)	.902
3 License	Gross Revenue	2,769.16 (1.67)	1,502.13 (4.06)	.767

Figures in parentheses indicate the value of the t - statistic.

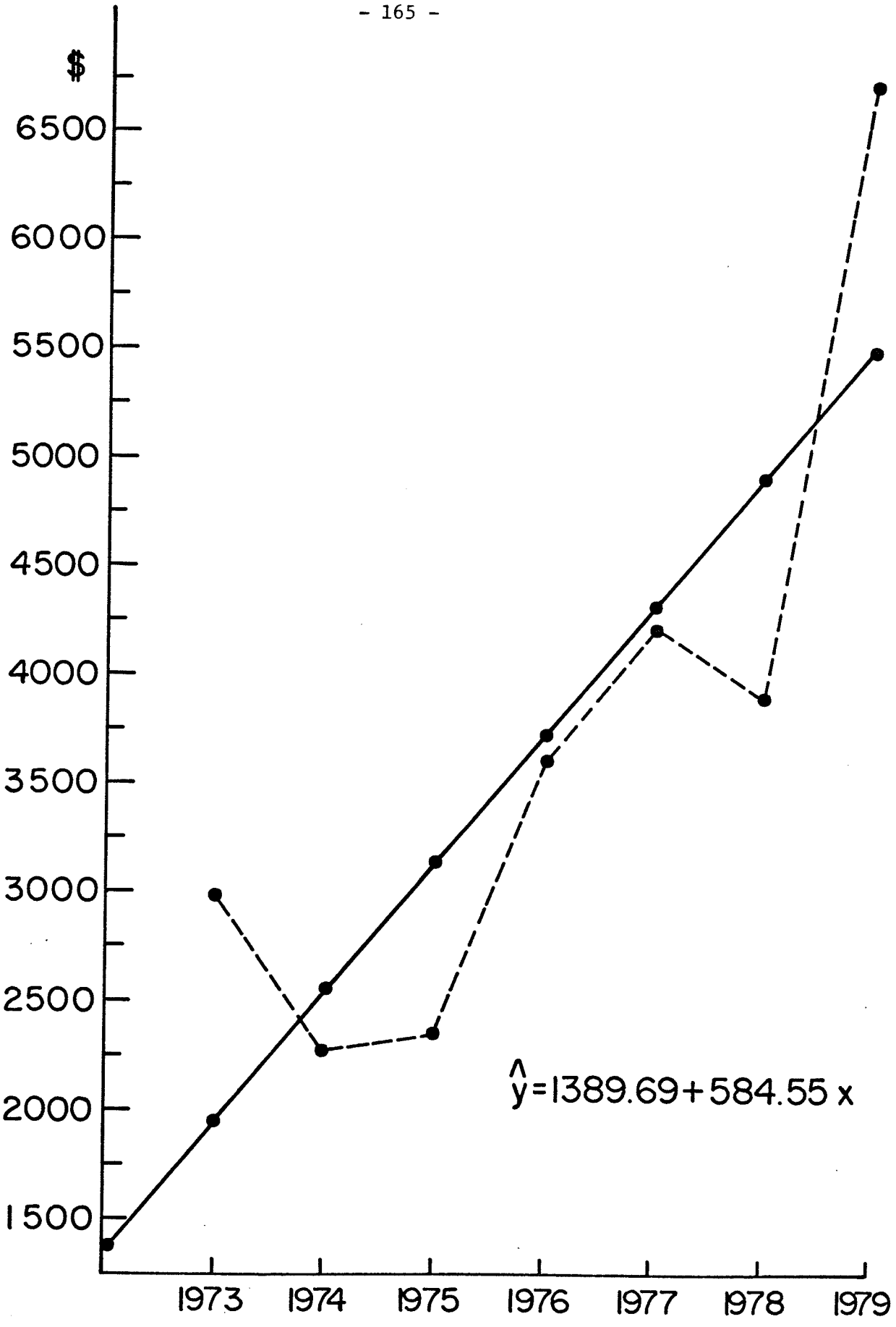

FIG. D-1 GROSS REVENUE REGRESSION ANALYSIS: 1 LICENSE
OPEN-WATER PRODUCTION - GIMLI

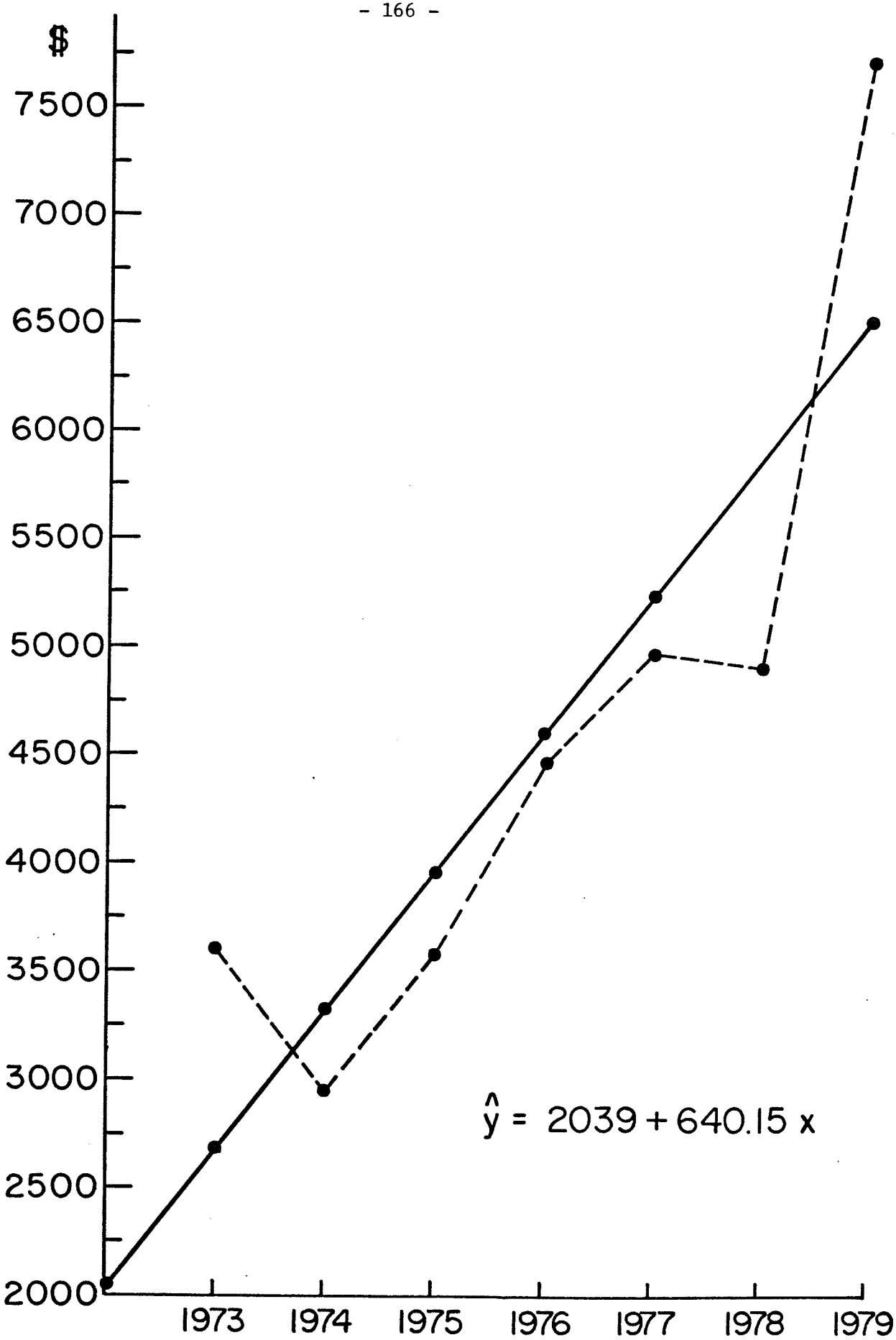

FIG. D-2 GROSS REVENUE REGRESSION ANALYSIS: 2 LICENSE OPEN-WATER - GIMLI

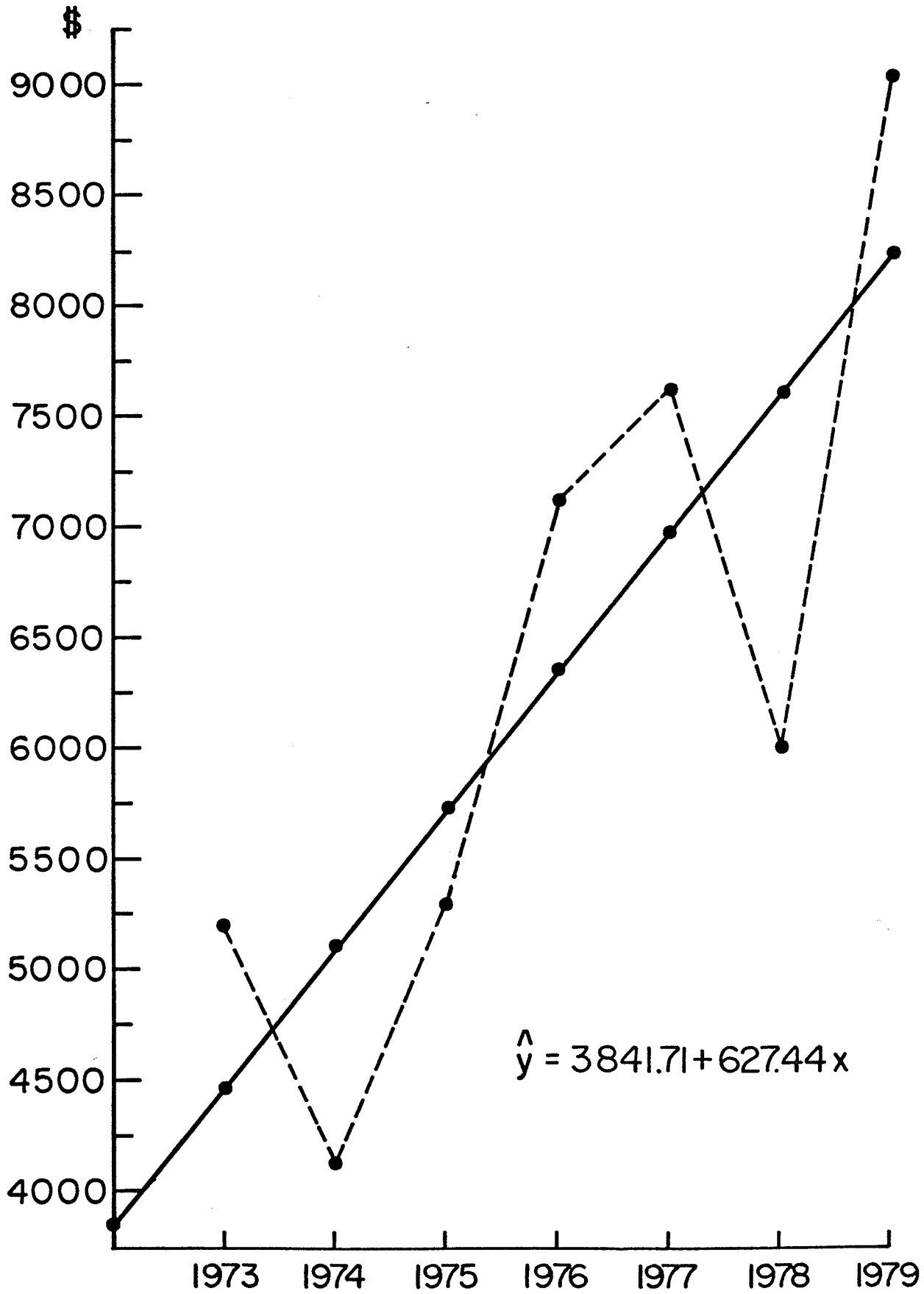

FIG. D-3 GROSS REVENUE REGRESSION ANALYSIS: 3 LICENSE OPEN-WATER PRODUCTION - GIMLI

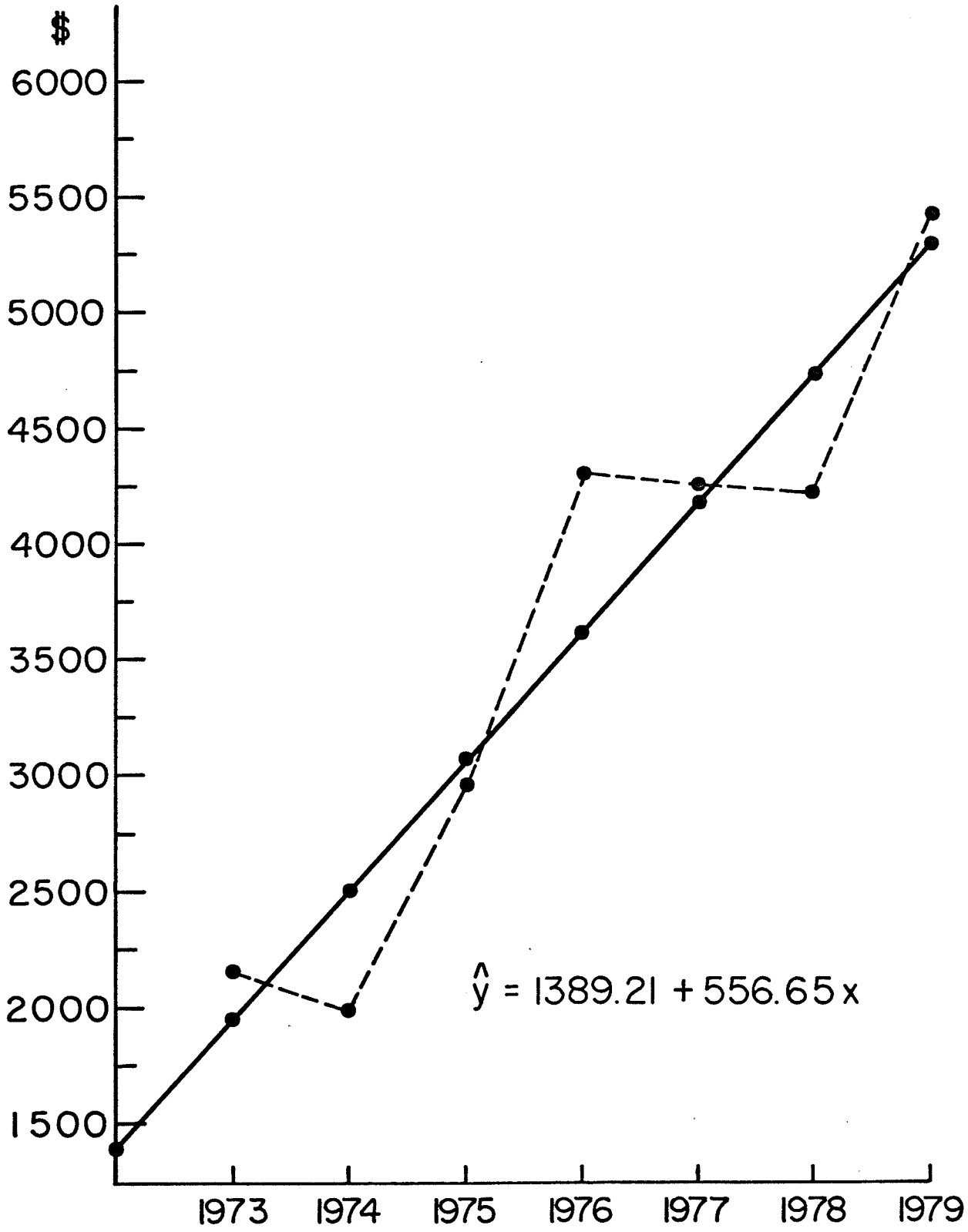

FIG. D-4 GROSS REVENUE REGRESSION ANALYSIS: 1 LICENSE OPEN-WATER PRODUCTION - BERENS RIVER

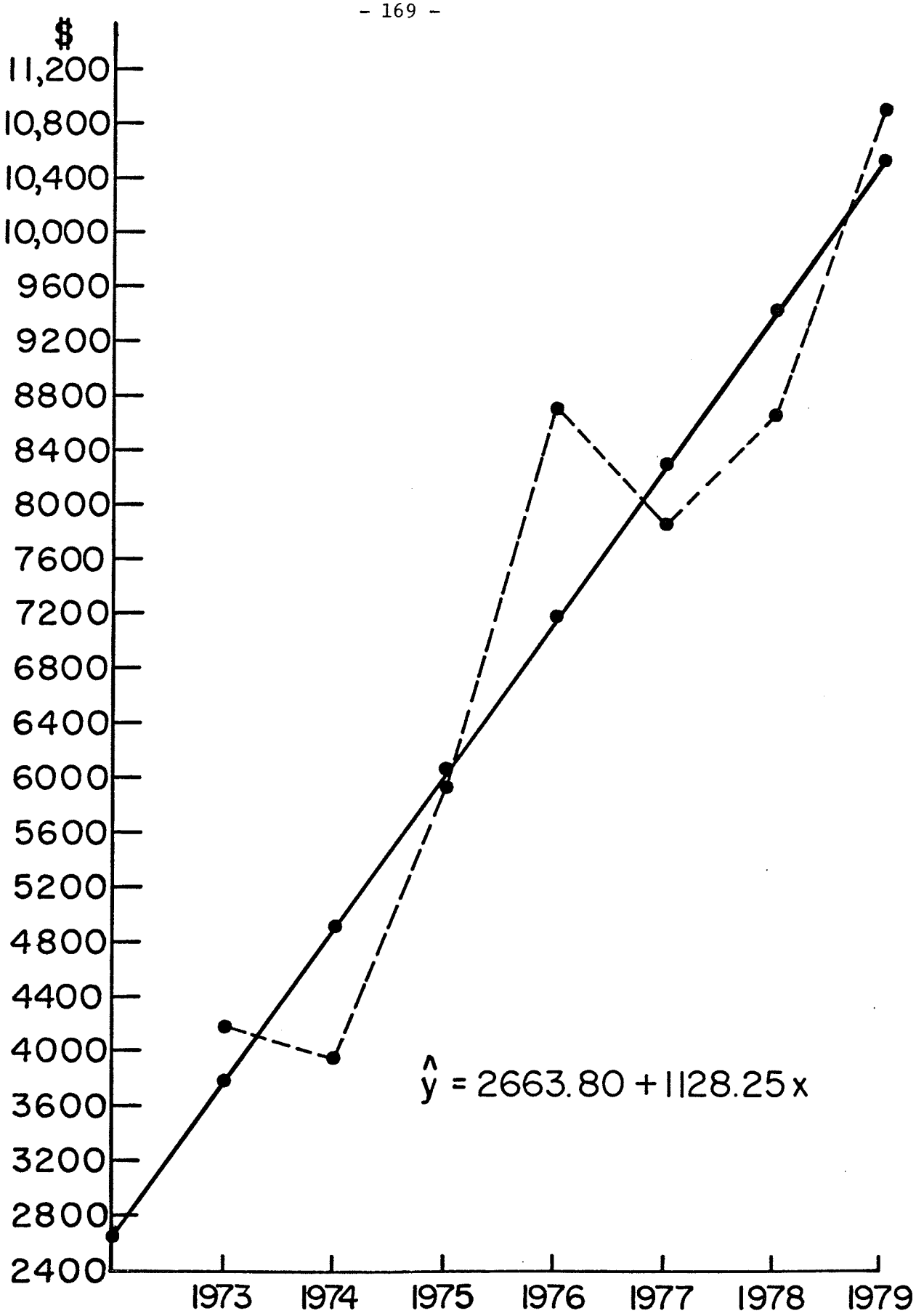

FIG. D-5 GROSS REVENUE REGRESSION ANALYSIS: 2 LICENSE OPEN-WATER PRODUCTION - BERENS RIVER

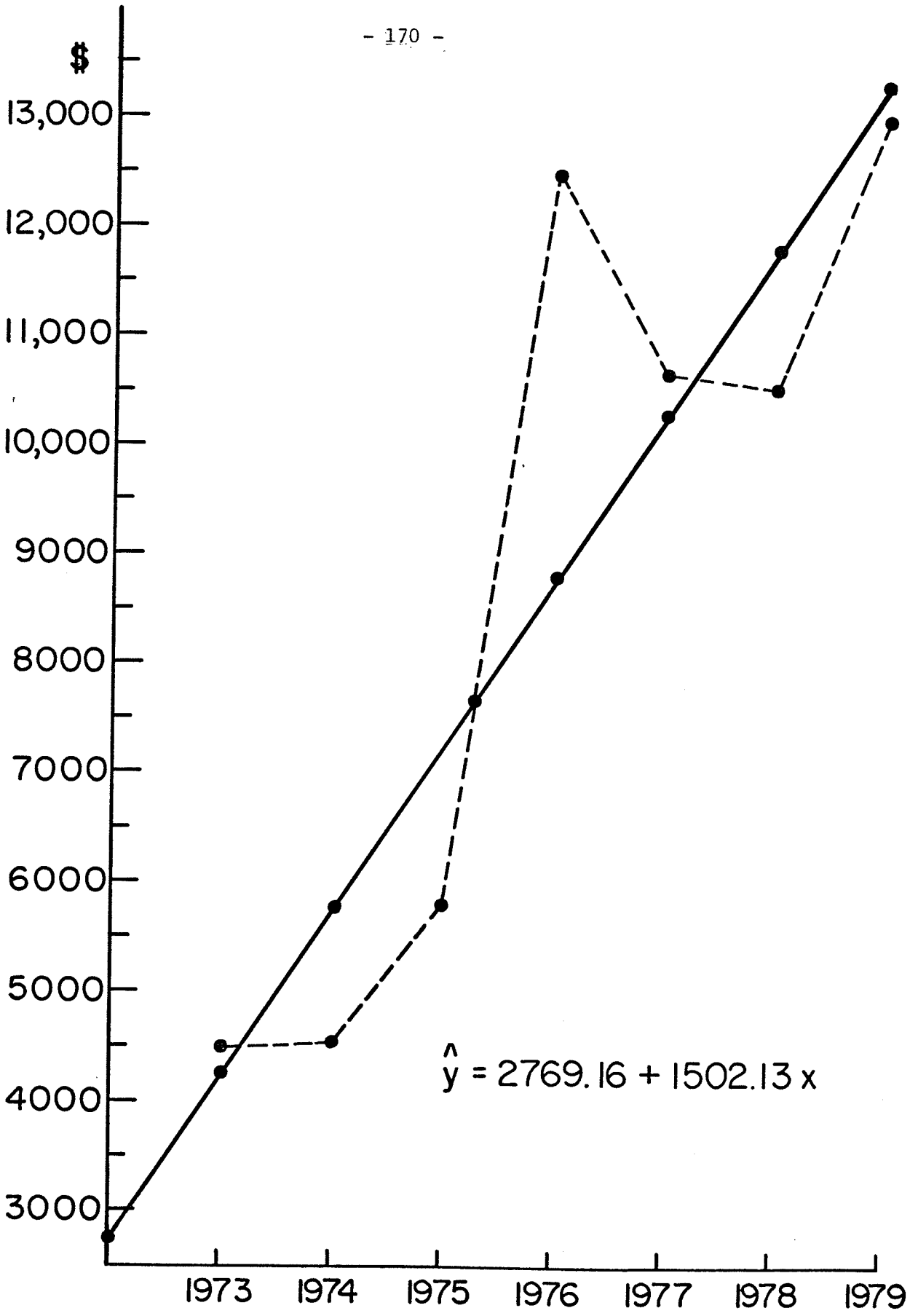

FIG. D-6 GROSS REVENUE REGRESSION ANALYSIS: 3 LICENSE OPEN-WATER PRODUCTION - BERENS RIVER

during the 1973 - 79 period. The regressed values were used as estimates of gross open-water revenues per year within each production category.

D.3 Estimated Operating Costs

Accurate cost data for skiff fishermen within the selected community areas were not available, but some general indications of the important cost items for a Lake Winnipeg skiff enterprise can be given.

Operating costs (1973) for a Lake Winnipeg skiff enterprise in the one-license production category were available.[7] When an enterprise acquires additional quota entitlements, the entitlement may be harvested by increasing the amount of time (days) spent fishing during the open-water season or increasing the yardage of gillnet set and lifted or both. Data which indicated changes in time spent fishing and yardage set on Lake Winnipeg according to gross revenue production categories which closely coincided with regressed values calculated in Tables D-1 and D-2 were available (Table D-3). These values were used as proxies for days fishing and yardage set per production category in the selected communities. It was assumed that time and yardage per category did not differ significantly between years.

D.3.1 *Fishing Costs*

Three types of general costs shall be examined: variable, fixed and interest charges. Itemized values for these costs by year and production category are found in Tables D-4 - D-9 and Figures D-7 - D-12.

D.3.1.1 Variable Costs

(a) *Fuel* - Fuel costs observed for a one license Lake Winnipeg skiff (1973) were escalated annually at the rate observed for gasoline in the Consumer Price Index (1973-1979; 1971= 100).[8] Fuel costs were

TABLE D-3

DAYS OF FISHING EFFORTS AND GILLNET YARDAGE UTILIZED BY LAKE WINNIPEG SKIFFS (1977)

PRODUCTION $	REGRESSION ESTIMATE (1977) GIMLI ($)	BERENS RIVER ($)	DAYS FISHING	AVERAGE YARDAGE OF GILLNET PER LIFT
2,567.00			23.2	983
3,978.00	4,312.44(1)	4,172.46(1)	34.3	1083
5,258.00	5,239.75(2)		45.5	1183
6,680.00	6,978.91(3)	8,305.05(2)	56.3	1100
8,865.00		10,271.81(3)	56.7	1343

Figures in parentheses indicate the number of licenses (production category) associated with production values. (See Tables D-1 and D-2 and Tables D-4 - D-9).

SOURCE: Thompson, P. 1977. "The Economic Viability of the Commercial Skiff Fishery in Western Canada". Freshwater Institute. Unpublished draft.

adjusted for the two and three license production categories in accordance with the increased time spent fishing for each category as observed in Table D-3. Fuel cost increases per category were calculated as direct proportions to increases in days fishing. Unit fuel costs per day fished were assumed to be constant. Fuel costs for Berens River were increased an additional 26% above those in Gimli for all production categories. This increase is consistent with that observed in The Spatial Indicies for Gasoline for Selected Communities.[9]

(b) *Maintenance and Repair* - These costs are of an on-going nature and are necessary to maintain vessels and engines in satisfactory operating condition. Such expenses often include engine tune-ups and overhauls, replacement parts (propellors) and vessel painting and refitting. Costs indicated for a one license Lake Winnipeg skiff operation were escalated annually at the rate observed for Services in The Consumer Price Index.[10] Maintenance and repair costs were adjusted for two and three license production categories as direct proportions to increases in days fishing.

(c) *Fishing Supplies* - These costs cover a large range of items necessary for fishing operations, such as rope, gloves, knives, and net repair equipment. Supply costs observed for a one license Lake Winnipeg skiff operation (1973) were escalated annually at the rate observed in the General Wholesale Price Index.[11] Fishing supply costs were adjusted for each production category in accordance with the increased total yardage of gillnet set per day for each category as observed in Table 14. Such adjustments assume fishing supply cost increases to be directly proportional to increases in yardage of gillnets set. The unit cost of fishing supplies is constant per yard of gillnet fished.

(d) *Labour* - Ideally, the value of the labour input to the fishing enterprise should be estimated according to the opportunity cost of an individual's labour within the selected communities. However, such a shadow pricing technique would involve at least some indication of the alternate labour skills possessed by skiff fishermen; where alternative opportunities may be and what the value of those opportunities might be. Even if such data were available, one would have to account for the variation in labour skills among individuals. Therefore, in order to overcome these deficiencies and derive a cost estimate for the labour input, labour costs were calculated in accordance with the time spent fishing within each production category and the observed provincial minimum wage rates from 1973-1979. An eight hour working day was attributed to the fishing enterprise. (Labour cost = Days fishing x 8 x Provincial Minimum Wage Rate).

D.3.1.2 Fixed Costs (License Fees)

The charge to a fisherman for summer and fall licenses is $15.00. A fisherman is charged $20.00 for a winter license. These fees remained unchanged during the 1973-1979 period.

D.3.1.3 Interest Charges

Financing costs are relatively common to fishing skiffs.[12] Several public sector agencies in Western Canada operate programs, which provide loans at subsidized interest rates to commercial fishermen. Funds are supplied at rates equal to or slightly greater than public sector cost. As a result, the skiff enterprise's equity requirements generally range downwards from 10%.[13]

In addition to subsidized financing arrangements fishermen have

access to two grant programs operated by public sector agencies. The Department of Fisheries and Oceans and the Department of Regional Economic Expansion operate the Fisheries Vessel Assistance and special ARDA programs which provide capital and equipment grants on purchases of 35% and 100% respectively for qualified commercial fishermen.

For the net revenue calculation the possibility of capital and equipment grants was ignored. Fisherman's credit in Manitoba is generally obtained through The Manitoba Agricultural Credit Corporation (MACC). The MACC finances 90% of the acquisition costs of boats and motors. Loan repayments are a percentage of gross revenues and range between 15, 20 and 25%.[14] Financing is on-going as outboard motors are usually replaced every two years. Operators with lower gross revenues usually chose to have loan repayments calculated as 25% of gross revenues, while larger operators repay loans at a rate of 20% of gross revenues. The net revenue calculations (Tables D-4 - D-9) for enterprises in the one license production category were assessed interest charges at a rate of 25% of gross revenues. Enterprises in the two and three license production categories were assessed interest charges at a rate of 20% of gross revenues.

TABLE D-4

NET REVENUE CALCULATION 1 LICENSE OPEN-WATER PRODUCTION 1973-1979: GIMLI

	1973	1974	1975	1976	1977	1978	1979
Estimated Gross Sales	1,974.74	2,588.79	3,143.34	3,727.89	4,312.44	4,896.99	5,481.54
A) Variable Costs							
1) Fuel	115.98	136.74	159.30	187.34	213.19	233.87	277.60
2) Maintenance & Repair	38.05	41.44	46.78	54.36	61.75	68.60	76.97
3) Labour (34.3 days fishing)	521.36	589.96	713.44	809.48	809.48	809.48	836.92
4) Fishing Supplies	59.49	109.61	142.82	172.53	253.79	382.46	560.68
TOTAL	734.83	877.75	1,062.34	1,223.71	1,338.21	1,494.41	1,752.18
GROSS PROFITS	1,239.91	1,681.04	2,081.00	2,504.18	2,974.23	3,402.58	3,729.36
B) Fixed Costs							
License Fees	15.00	15.00	15.00	15.00	15.00	15.00	15.00
C) Interest Expense	493.56	639.69	785.83	931.97	1,078.11	1,224.25	1,370.38
TOTAL	508.56	654.69	800.83	946.97	1,093.11	1,239.25	1,385.38
NET REVENUES	731.35	1,026.35	1,280.17	1,557.21	1,881.12	2,163.33	2,343.98

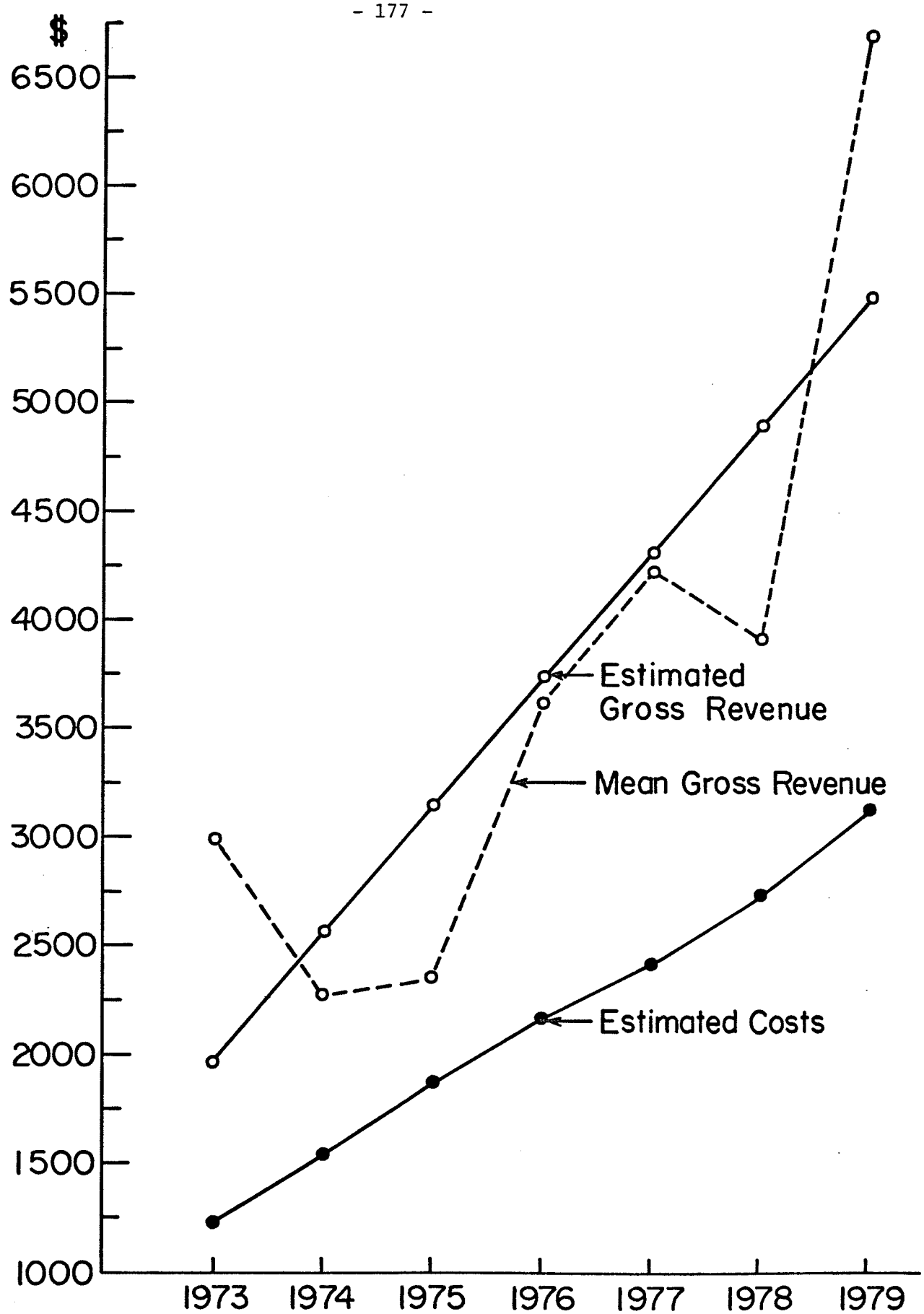

FIG. D-7 MEAN GROSS REVENUES, ESTIMATED GROSS REVENUES, AND ESTIMATED COSTS - 1 LICENSE OPEN-WATER PRODUCTION GIMLI (1973-1979)

TABLE D-5

NET REVENUE CALCULATION 2 LICENSE OPEN-WATER PRODUCTION 1973-1979: GIMLI

	1973	1974	1975	1976	1977	1978	1979
Estimated Gross Sales	2,679.15	3,319.30	3,959.45	4,599.60	5,239.75	5,879.99	6,520.05
A) Variable Costs							
1) Fuel	153.79	181.31	211.23	248.41	282.69	310.11	368.10
2) Maintenance & Repair	50.45	54.95	62.03	72.08	81.88	90.96	102.06
3) Labour (45.5 days fishing)	69.16	782.60	946.40	1,073.80	1,073.80	1,073.80	1,110.20
4) Fishing Supplies	64.91	119.69	155.96	188.40	277.14	417.65	612.26
TOTAL	960.75	1,138.55	1,375.62	1,582.69	1,715.51	1,892.52	2,192.62
GROSS PROFITS	1,718.40	2,180.75	2,583.83	3,016.91	3,524.24	3,987.47	4,327.43
B) Fixed Costs							
License Fees	30.00	30.00	30.00	30.00	30.00	30.00	30.00
C) Interest Expense	535.83	663.86	791.89	919.92	1,047.95	1,175.99	1,304.01
TOTAL	565.83	693.86	821.89	949.92	1,077.95	1,205.99	1,339.01
NET REVENUES	1,152.57	1,486.89	1,761.94	2,066.99	2,446.29	2,781.48	2,993.42

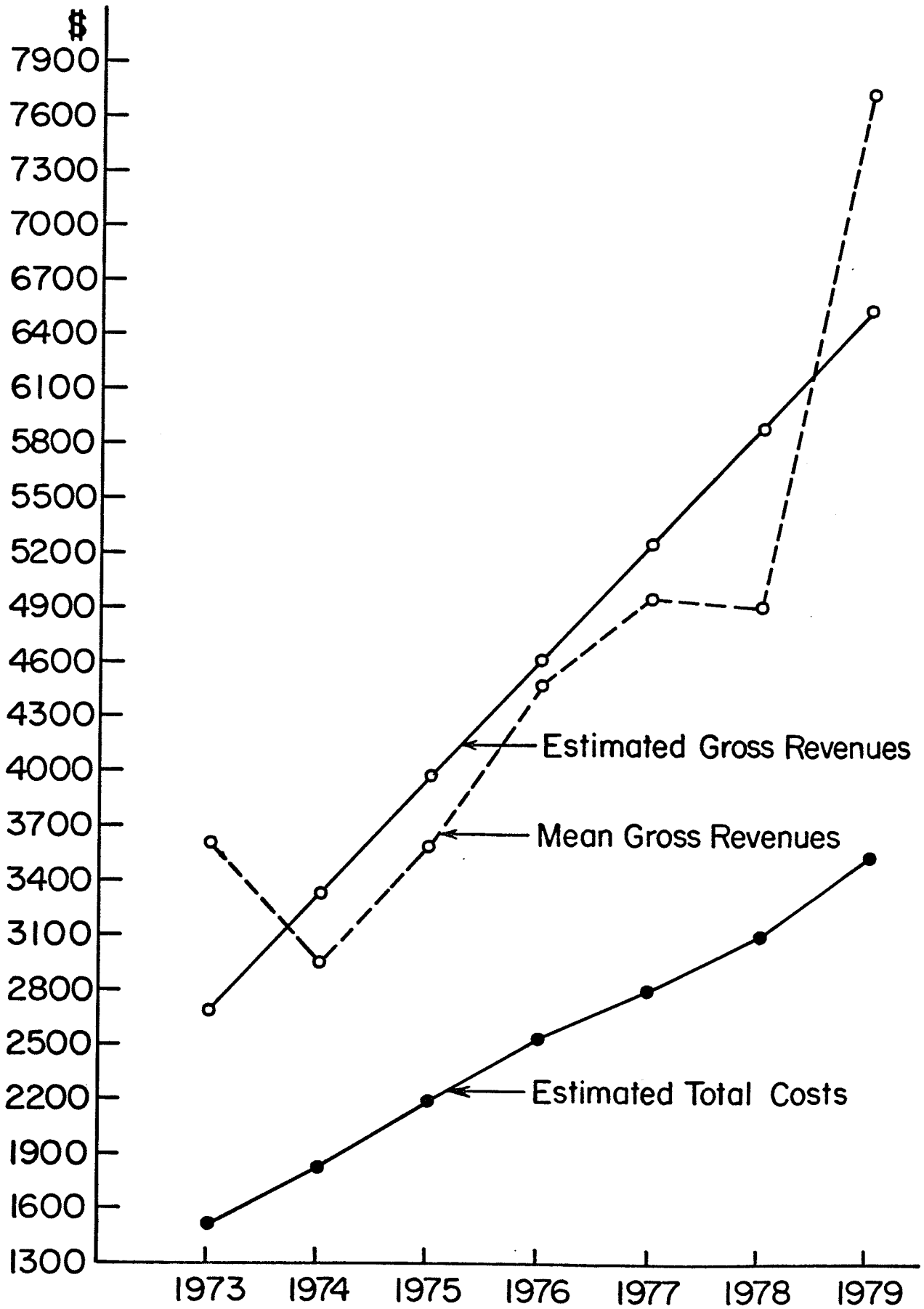

FIG. D-8 MEAN GROSS REVENUES, ESTIMATED GROSS REVENUES, AND ESTIMATED COSTS - 2 LICENSE OPEN-WATER PRODUCTION - GIMLI (1973-1979)

TABLE D-6

NET REVENUE CALCULATION 3 LICENSE OPEN-WATER PRODUCTION 1973-1979: GIMLI

	1973	1974	1975	1976	1977	1978	1979
Estimated Gross Sales	4,469.15	5,096.59	5,724.03	6,351.47	6,978.91	7,606.35	8,233.79
A) Variable Costs							
1) Fuel	189.93	223.92	260.87	306.79	349.12	382.98	454.60
2) Maintenance & Repair	62.31	67.86	76.61	89.03	101.12	112.33	126.04
3) Labour (56.3 days fishing)	854.24	966.64	1,168.96	1,326.32	1,326.32	1,326.32	1,371.28
4) Fishing Supplies	64.91	119.69	155.96	188.40	277.14	417.65	612.26
TOTAL	1,171.39	1,378.11	1,662.40	1,910.53	2,053.70	2,239.28	2,564.18
GROSS PROFITS	3,297.76	3,718.48	4,061.63	4,440.94	4,925.21	5,367.07	5,669.61
B) Fixed Costs							
License Fees	50.00	50.00	50.00	50.00	50.00	50.00	50.00
C) Interest Expense	983.83	1,019.32	1,144.81	1,270.29	1,395.78	1,521.27	1,646.76
TOTAL	943.83	1,069.32	1,194.81	1,320.29	1,445.78	1,571.27	1,696.76
NET REVENUES	2,353.93	2,649.16	2,866.82	3,120.65	3,479.43	3,795.80	3,972.85

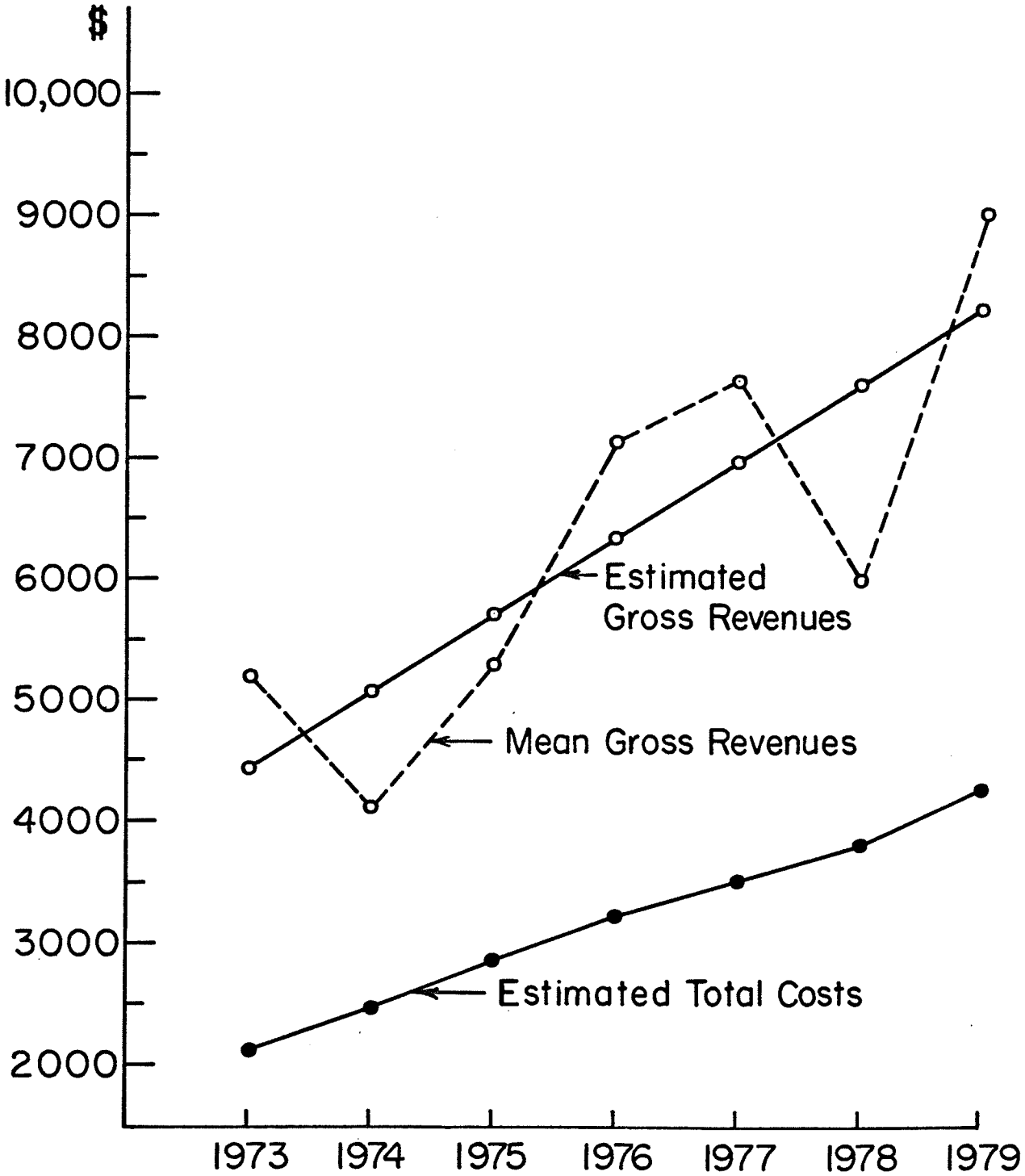

FIG. D-9 MEAN GROSS REVENUES, ESTIMATED GROSS REVENUES, AND ESTIMATED COSTS - 3 LICENSE OPEN-WATER PRODUCTION - GIMLI (1973-1979)

TABLE D-7

NET REVENUE CALCULATION 1 LICENSE OPEN-WATER PRODUCTION 1973-1979: BERENS RIVER

	1973	1974	1975	1976	1977	1978	1979
Estimated Gross Sales	1,945.86	2,502.51	3,059.16	3,615.81	4,172.46	4,729.11	5,285.76
A) Variable Costs							
1) Fuel	146.13	172.29	200.72	236.05	260.59	294.68	349.78
2) Maintenance & Repair	38.05	44.44	46.78	54.36	61.75	68.70	76.97
3) Labour (34.3 days fishing)	521.36	589.96	713.44	809.48	809.48	809.48	836.92
4) Fishing Supplies	59.44	109.61	142.82	172.53	253.79	382.46	560.68
TOTAL	764.98	913.30	1,103.76	1,272.42	1,393.61	1,555.32	1,824.35
GROSS PROFITS	1,180.88	1,589.21	1,955.40	2,343.39	2,778.85	3,173.79	3,461.41
B) Fixed Costs							
License Fees	15.00	15.00	15.00	15.00	15.00	15.00	15.00
C) Interest Expense	488.71	625.63	764.79	903.95	1,043.11	1,182.27	1,321.44
TOTAL	503.71	640.63	779.79	918.95	1,058.11	1,197.27	1,336.94
NET REVENUES	677.17	948.58	1,175.61	1,424.44	1,720.74	1,976.52	2,124.97

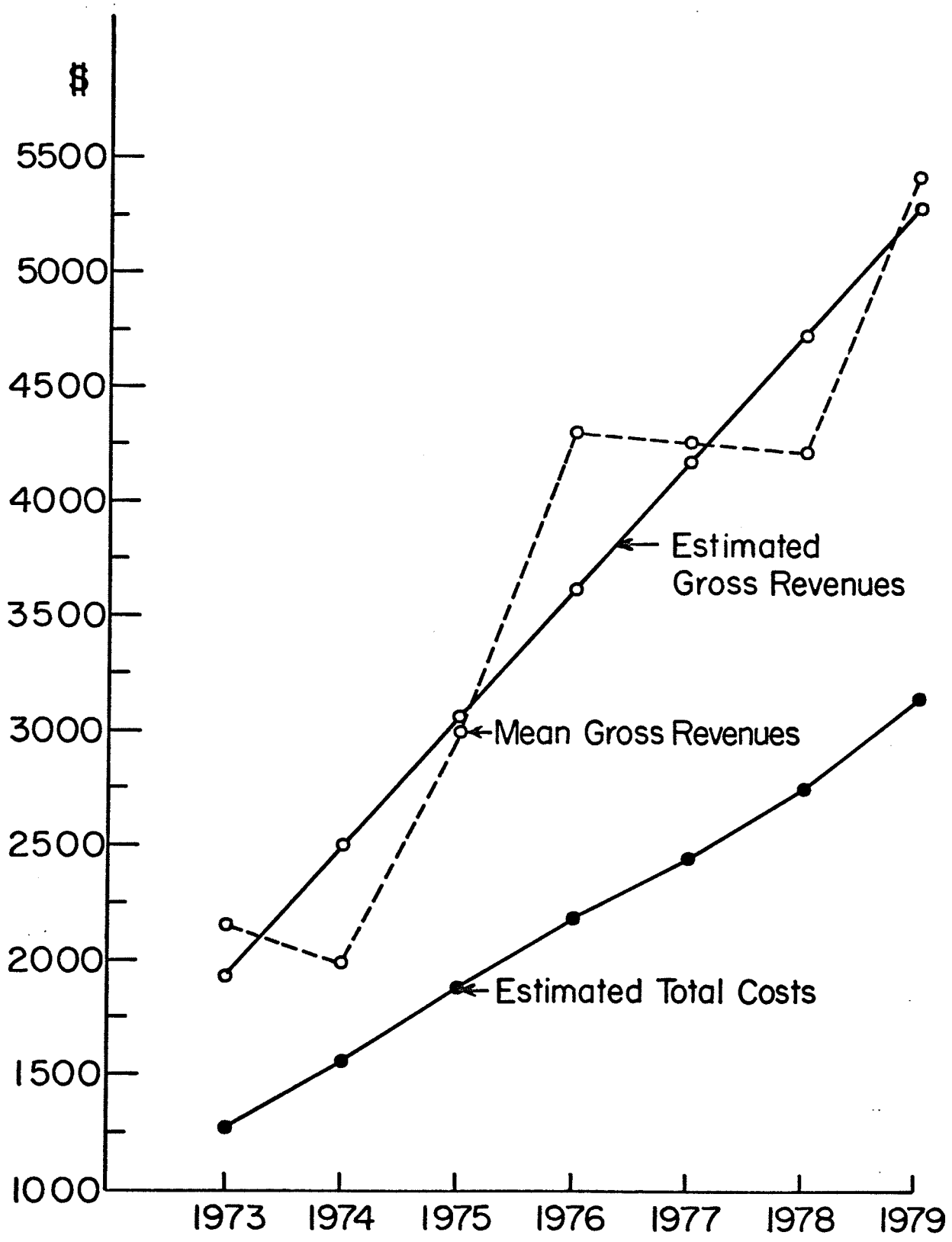

FIG. D-10 MEAN GROSS REVENUES, ESTIMATED GROSS REVENUES, AND ESTIMATED COSTS - 1 LICENSE OPEN-WATER PRODUCTION - BERENS RIVER (1973-1979)

TABLE D-8

NET REVENUE CALCULATION 2 LICENSE OPEN-WATER PRODUCTION 1973-1979: BERENS RIVER

	1973	1974	1975	1976	1977	1978	1979
Estimated Gross Sales	3,792.05	4,920.30	6,048.55	7,176.80	8,305.05	9,433.30	10,561.55
A) Variable Costs							
1) Fuel	239.36	282.21	328.78	386.65	439.95	482.68	572.84
2) Maintenance & Repair	62.32	67.88	76.62	89.04	101.15	112.53	126.08
3) Labour (56.3 days fishing)	854.24	966.64	1,168.96	1,326.32	1,326.30	1,326.32	1,371.28
4) Fishing Supplies	64.91	119.69	155.96	188.40	277.14	417.65	612.26
TOTAL	1,220.83	1,436.42	1,730.32	1,990.41	2,144.56	2,339.18	2,682.46
GROSS PROFITS	2,571.22	3,483.88	4,318.23	5,186.39	6,160.49	7,094.12	7,879.09
B) Fixed Costs							
License Fees	30.00	30.00	30.00	30.00	30.00	30.00	30.00
C) Interest Expense	745.81	984.06	1,209.71	1,435.36	1,661.01	1,886.66	2,112.32
TOTAL	775.81	1,014.06	1,239.71	1,465.36	1,691.01	1,916.66	2,142.32
NET REVENUES	1,795.91	2,469.82	3,078.52	3,721.03	4,469.48	5,177.46	5,736.77

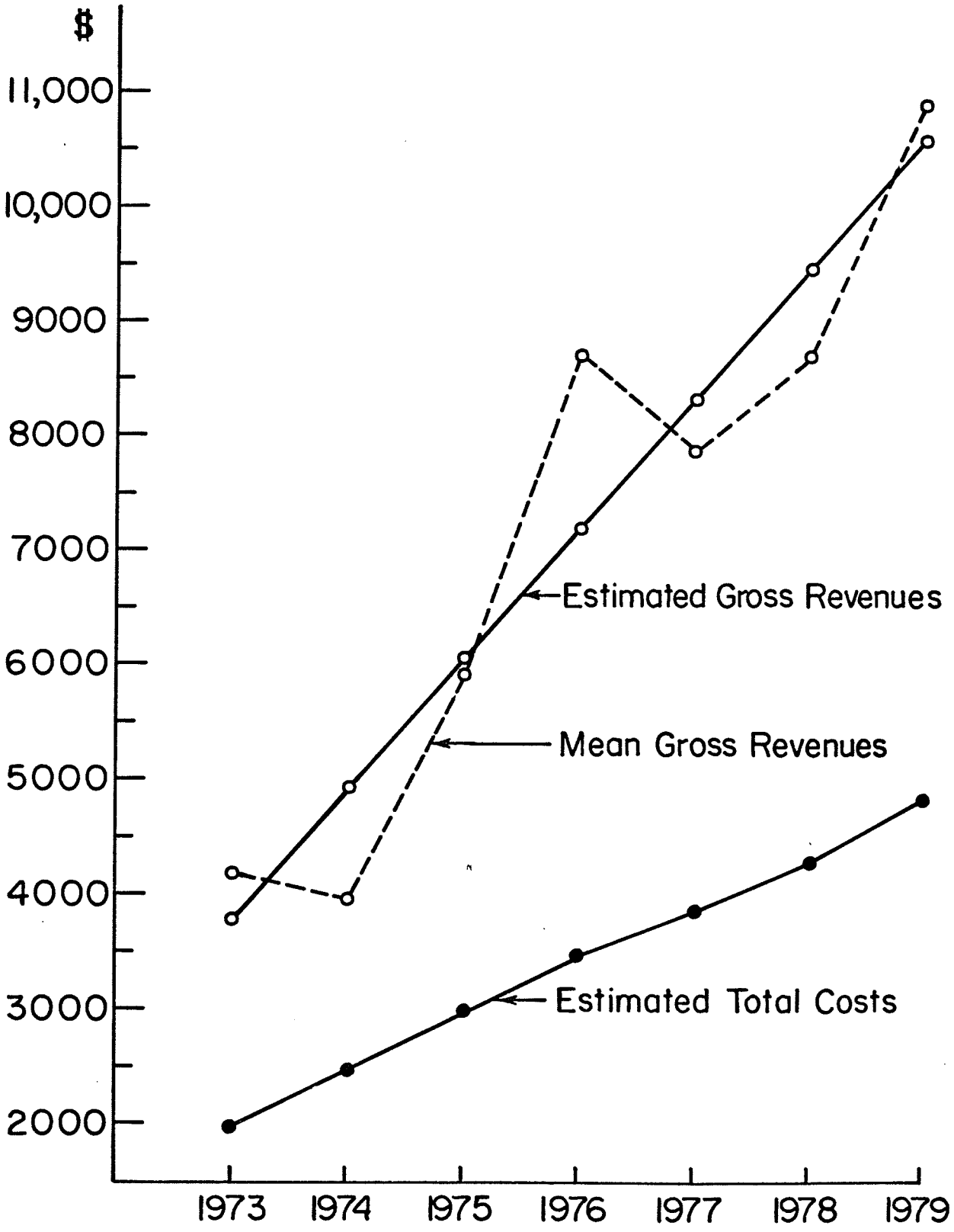

FIG. D-11 MEAN GROSS REVENUES, ESTIMATED GROSS REVENUES, AND ESTIMATED COSTS - 2 LICENSE OPEN-WATER PRODUCTION - BERENS RIVER (1973-1979)

TABLE D-9

NET REVENUE CALCULATION 3 LICENSE OPEN-WATER PRODUCTION 1973-1979: BERENS RIVER

	1973	1974	1975	1976	1977	1978	1979
Estimated Gross	4,263.29	5,765.42	7,267.55	8,769.68	10,271.81	11,773.94	13,276.07
A) Variable Costs							
1) Fuel	239.36	282.21	328.78	386.65	439.95	482.68	572.84
2) Maintenance & Repair	62.32	67.88	76.62	89.04	101.15	112.53	126.08
3) Labour (56.7 days fishing)	854.24	966.64	1,168.96	1,326.32	1,326.32	1,326.32	1,371.28
4) Fishing Supplies	73.67	135.85	177.01	213.83	314.55	474.03	694.91
TOTAL	1,229.59	1,452.58	1,751.37	2,015.84	2,181.97	2,395.56	2,765.11
GROSS PROFITS	3,033.70	4,312.84	5,516.18	6,753.84	8,089.84	9,378.38	10,510.96
B) Fixed Costs							
License Fees	50.00	50.00	50.00	50.00	50.00	50.00	50.00
C) Interest Expense	852.66	1,153.08	1,453.51	1,753.94	2,054.36	2,354.79	2,655.21
TOTAL	906.22	1,203.08	1,503.51	1,803.94	2,104.36	2,404.79	2,705.21
NET REVENUES	2,131.04	3,109.76	4,012.67	4,949.90	5,985.48	6,973.59	7,805.75

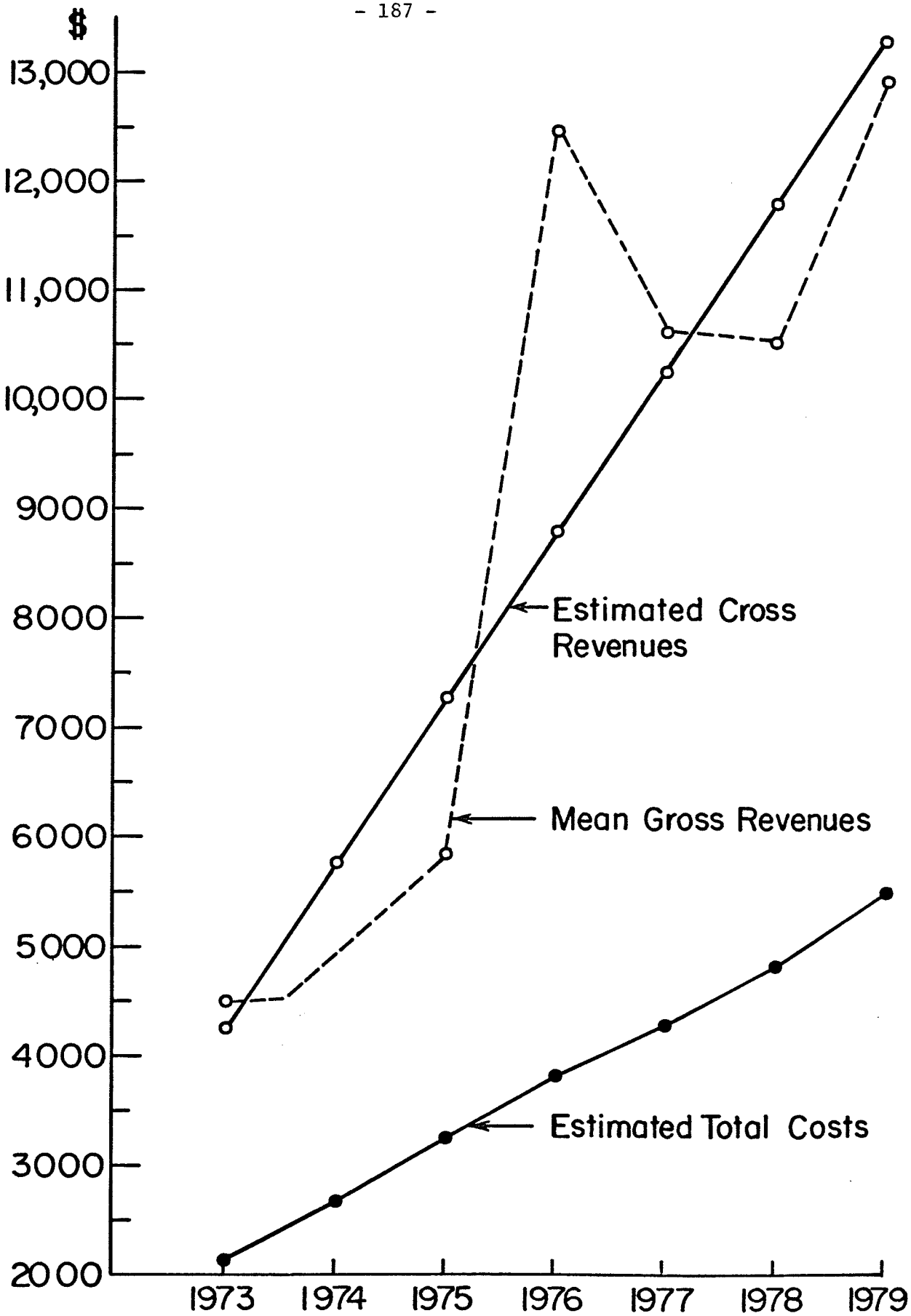

FIG. D-12 MEAN GROSS REVENUES, ESTIMATED GROSS REVENUES, AND ESTIMATED COSTS - 3 LICENSE OPEN-WATER PRODUCTION - BERENS RIVER (1973-1979)

LITERATURE CITED

1. Gislason, G. S., J. A. MacMillan, and J. Craven. 1976. "Economic Analysis of the Manitoba Commercial Freshwater Fishery". University of Manitoba. Dept. of Agricultural Economics. Unpublished draft. p. 525.

2. Thompson, Peter. 1978. "The Economic Viability of the Commercial Skiff Fishery in Western Canada". Freshwater Institute, Unpublished draft.

3. Ibid.

4. Ibid.

5. Ibid.

6. Ibid.

7. Government of Manitoba. Operational Policy Branch. 1975. "Statement of Operating Expenses for Fishermen Around Manitoba".

8. Statistics Canada: Consumer Price and Price Indices (62-010) Main Components, Sub-Groups and Selected Items, (Gasoline). 1971 = 100, 1973 - 107.6, 1974 = 125.5, 1975 = 142.0, 1976 = 169.6, 1977 = 173.9, 1978 = 183.1, 1979 = 201.8.

9. Manitoba Bureau of Statistics, Manitoba Statistical Review. 1980. Spatial Indicies for Gasoline for Selected Communities".

10. Statistics Canada: Canadian Statistical Review (11-003) Consumer Price Index for Services: 1971 = 100, 1973 - 111.6, 1974 = 120.5, 1975 = 133.4, 1976 = 149.6, 1977 = 163.2, 1978 = 174.3, 1979 = 186.5.

11. Statistics Canada: Canadian Statistical Review, (11-003) General Wholesale Price Index. 1935-39 = 100, 1973 = 376.9, 1974 = 461.3, 1975 = 491.6, 1976 = 512.4, 1977 = 559.5, 1978 = 610.2, 1979 = 656.8.

12. Thompson, Peter. Op. cit.

13. Ibid.

14. Personal Communication. March 1981. Oli Josephson, Manitoba Agricultural Credit Corporation.

APPENDIX E

COMMUNITY PROFILES

BERENS RIVER

Location[1]

The community of Berens River is located on the east side of Lake Winnipeg at both sides of the mouth of Berens River approximately 175 air miles north of Winnipeg. Berens River is accessible by air year round; by water during the open-water season and by winter road from the beginning of January to the end of March, weather, ice and ground conditions permitting.

Population[2]

As of December, 1979, Berens River had a population of 1,246 people, almost all of whom were of native ancestry. Approximately 76.3 percent were Status Indians with the remainder being either non-status or non-native. Approximately 45.3% of the population is 14 years of age and younger; about 49.6% between the ages of 15-64 and 5% - 65 years of age or older.

Income and Employment[3]

In 1977, the average total annual income for persons 15 years of age and older was $2,143.00. The average annual household income for the same year was $4,188.00. Each household had an average of 6.98 persons. Eighty-five percent of all income recipients received less than $3,000.00 annual income, 11% of income recipients received between $3,000.00 - $5,999.00 and 4% between $6,000.00 - $9,999.00. The average income received in the form of transfer payments was $1,443.00.

One hundred and ten people were considered to be in the labour force (1977). The potential labour force (15-64 age group) was estimated at 409 persons (1971). Of those in the actual labour force 80 were employed as wage earners, 50 of whom were in the government sector and 30 of whom were in trade and commerce. Commercial fishing was judged the major source of income[4] to the community. Trapping provides seasonal employment for approximately 50 people although average earnings are low.[5]

GIMLI[6]

Location

Gimli is located 58 miles north of Winnipeg on the west shore of Lake Winnipeg. The community is accessible year round by all-weather roads (PTH 8), air, and by water during the open-water season.

Population

As of December, 1979, the town of Gimli had a population of 2,247. The trading area population (including the population of the town) is 5,500. Thirty-one percent of the population is nineteen years of age or younger, 22% between the ages of 20-34, 32% between the ages of 35-64 and 15% 65 years of age or older. Approximately one-half of Gimli's population is of Icelandic origin.

Income and Employment

The community serves as a trading centre for an area of mixed farming with some specialized dairy production. The former Canadian Forces Base at Gimli was converted into an industrial park in 1971 and currently

house several industries and commercial firms, (Table E-1). Gimli is the location of a twenty million dollar distillery run by Calvert of Canada Ltd., which is the major employer. The town and surrounding area also supports a fairly large and diversified business and professional sector. The average annual income of Revenue Canada tax returns (1976) was $7,647.00.

WINNIPEG BEACH[7]

Location

The town of Winnipeg Beach is located 46 miles north of Winnipeg on the west shore of Lake Winnipeg. The community is accessible year round by all-weather road (PTH 8) and by water during the open water season.

Population

As of 1979, the resident population was 731, however, during the summer months this figure increases to 8,000. Of the 731, 24% are 19 years of age or less, 17% are between 20 and 34, 29% are between 35 and 64 and 30% are 65 years of age or older. The trading area population (including the population of the town) is 2,000.

Income and Employment

The area surrounding Winnipeg Beach is one of the mixed farming and the town functions as a service centre for this area. The business and professional sector is limited, consisting of automotive and bulk oil services, building and hardware, and food beverage operations. The average annual income of all Revenue Canada tax returns (1976) was $5,957.00.

TABLE E-1

INDUSTRIES AND MAJOR EMPLOYEES

Firm	Products & Services	Employees
Calvert of Canada Ltd.	distillery	149
Canadian National Railway	school for locomotive engineers	28
Colonial Saw Mill Ltd.	wooden furniture	5
Children's Coop Play School	day care	10
Dockside Fish Products	fish processing & packaging (June only)	2
Duha Plastics	plastic products	8
Gimli Construction Co.	transit concrete	5
Goudmar Construction Co.	house construction	10
Graf Tech Publication Services	publishing	17
Lake Winnipeg Boat Works	fibreglass boats	15
Misawa Greenwood Homes Ltd.	fabricated modular home sections	7
Ontario Central Airlines Co.	aircraft maintenance and overhaul	28
The Original Wooden Works	custom built furniture	5
Saunders Aircraft Corp.Ltd.	aircraft	3
Stasiuk's Drilling	well drilling	3
Steffensen's Woodwork Co.	wooden furniture custom millwork	4
Sveinson Construction	house construction	10
Triple E Industries	motor homes and travel trailers	54

Literature Cited

1. Government of Canada, Canadian Transport Commission, 1977, "Isolated Communities Digest of Transportation Social and Economic Data,", p.111.

2. Personal Communication, May 18, 1981, Department of Indian Affairs and Northern Development (Winnipeg) and Manitoba Health Services Commission (Winnipeg).

3. Op.Cit., Canadian Transport Commission 1977, p. 111, 117, 118, 119.

4. Kok, E.W., 1978, "Community Development: An Evaluation of Channel Area Loggers Ltd., in Berens River, Manitoba -- A Case Study" "Unpublished, Natural Resources Institute). p. 132-133.

5. Ibid., p. 134

6. Government of Manitoba, Department of Economic Development and Tourism, 1979 Community Reports (Queen's Printer, Winnipeg)

7. Ibid.