MANAGING A HARVESTABLE RESOURCE:

INDIVIDUAL TRANSFERABLE HARVEST QUOTAS

IN THE LAKE HURON COMMERCIAL FISHERY

by

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ABSTRACT

Much has been written on the theoretical implications and postulated impacts of individual transferable harvest quotas (ITHQ), but there have been few empirical studies of the development and implementation process, the impacts of this process and the impacts of ITHQ in a Great Lakes fishery. In 1984, Ontario implemented ITHQ for selected commercial fish species. The objectives of this study are: (1) to identify and understand the impacts of ITHQ; (2) to detail the linkages between these impacts and the application of fisheries management interventions derived from the bioeconomic model (which is the theoretical origin of ITHQ); and (3) to further our understanding of the process of ITHQ development and implementation and the impacts of this process of development and implementation, by utilizing theoretical perspectives in the co-management theory of resource management and in three policy process models.

The study area was the Canadian portion of the Lake Huron commercial fishery. Data were obtained from annual harvest reports filed by commercial fishers over the 1980-1985 time period and through interviews with commercial fishers, fisheries managers and scientists. Data on 1986-1989 harvest amounts and values was also obtained from the provincial data base.

In the two years following ITHQ implementation, there was little traceable impact on either the harvest amounts or values of the two principal commercial species, but there was a trend toward a reduction in capacity of the fishery. ITHQ's most important effects appears to have been on the organization of labour and capital in the fishery. Commercial fishing activities have not generated major instabilities; it is the ecological phenomena that most affect harvest amounts, species and values.

Other policy impacts, however, are complex and difficult to identify and analyze. Future administrative costs are not easy to estimate; the social impacts from changes in the structure of the industry are intricate; and some aspects of policy implementation may

be too inflexible. Analysis of qualitative data suggests several conclusive linkages between the process of ITHQ development and implementation and its effectiveness. In this regard, adequacy of stock assessment information, effectiveness of consultation and level of attention to social context were found to be of importance.

The co-management model was found to provide a strong basis for explanation and understanding of the impacts of the process of ITHQ development and implementation in the community of resource users because the relationships it incorporates overtly address decision-making processes related to the adaptation of new ideas, arbitration of power relationships, and the rate, timing and extent of change. The co-management model suggests that incorporation of resource users' collective strengths and organization in an arrangement wherein regulatory interventions are developed and implemented cooperatively with resource users would lead to more efficient, effective and sustainable management regimes. Transaction costs, in particular, may be significantly reduced in a co-managed fishery where specified community characteristics exist.

Development and implementation processes for ITHQ in Lake Huron were viewed as the interaction of rational, incremental and interest group decision-making processes. Findings suggest that social issues of autonomy, equity and a broad basis of understanding are as important as those of economic efficiency, and that if not dealt with, these issues can significantly impact the efficacy of management interventions.

This study is significant because it addresses analysis of common property problems through utilizing the analytical powers derived from models dealing with biological, economic and political relationships to examine a regulatory policy application in a field situation (after Ostrom 1992).

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1.0 INTRODUCTION

This research describes and analyzes expected and unintended outcomes of the individual transferable harvest quota (ITHQ) policy in the Canadian portion of the Lake Huron commercial fishery.

This chapter introduces the research topic, briefly describes the research objectives, rationale, problem statement, and the geographical, temporal and conceptual parameters, and outlines the organization of the study.

Fisheries management is just beginning to recognize and incorporate information on Canada's Great Lakes fisheries derived from the social sciences. In the past, managers of fisheries have relied on biological data bases built on stock assessment and narrowly selected environmental indicators. More recently, in accordance with an international agreement to encompass an "ecosystem approach" (i.e. Great Lakes Water Quality Agreement 1978) (IJC 1978) and a general shift towards a more holistic, environmentally-oriented perspective, these managers have incorporated a broader, systemic approach in their management decisions. Coincident with this shift in thinking is the growth of societal interest in environmental and resource management, and increasing pressures on the fishery.

These pressures have taken many forms. Some of the more significant originate from societal uses of the fishery resource and habitat. Activities such as waste disposal, agricultural practices and near-shore developments have impacts on the environment, in terms of water quality degradation and destruction of habitat. Increased harvesting by commercial and sport fisheries and predation by lamprey (first introduced into the Great Lakes through activities associated with commercial shipping) constitute additional stresses originating in human activities.

These stresses may often act synergistically, creating a complex, interactive environment hostile to the fishery. It has been apparent for some time that biological interventions alone (e.g. conservation-oriented measures to protect spawning) are an inadequate management tactic, and that effective management practices must encompass societal as well as biological aspects of management. In working to maintain a healthy fishery, managers are explicitly seeking a range of management solutions which take account of socially embedded contributing factors, not biological ones alone.

Initial steps towards an understanding of how both natural and social sciences can contribute to resource management are encouraging. An important part of the research presented in this document is a case study examination of the application of a policy strategy derived from the bioeconomic model[1] of resource management which depends on inputs from both biological and social sciences.

1.1 Objectives

This study examines the implementation of ITHQ in the management of the Lake Huron commercial fishery. The objectives of the study are:

(1) to identify and understand the impacts of ITHQ itself;

(2) to detail the linkages between these impacts and the application of fisheries management interventions derived from the bioeconomic model (which is the theoretical origin of ITHQ); and

(3) to further our understanding of the process of ITHQ development and implementation and the impacts of this process of development and implementation, by utilizing theoretical perspectives in the co-management theory of resource management and in three policy process models.

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[1] Usage of the definite article notwithstanding, the version presented in this thesis is a very simplified version of the bioeconomic model.

These objectives will be met by pursuing the following lines of inquiry.

(1) Describing the theoretical background, and the process by which ITHQ was developed as a management strategy.

(2) Assessing ITHQ with reference to the theoretically expected advantages (i.e. effectiveness in controlling capacity, distribution of benefits, adaptability to changing conditions in technology, reduced administrative complexity, and provision of increased security for fishers about their fishing rights) and extensive data requirements (i.e. requirement for stock assessment data, need for species-specific quotas, difficulties in adjustment of quotas),[2] as well as some new findings in the area of social impacts (i.e. autonomy, market innovation, etc.).

(3) Utilizing the analytical approaches of the incremental and interest group models of public policy to understand how the process of policy development and implementation can affect ITHQ policy outcomes so that the outcomes may either vary from those expected or may be alternatively explained.

The theoretical constructs behind ITHQ do not always transfer easily to the real world (Larkin 1977; Regier and McCracken 1975). This research does not evaluate the ability of alternative models of public policy to explain what happened. Rather, it applies a variety of models in order to better understand how theoretically derived management options may work in application.

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[2] These criteria are similar to those discussed by Pearse (1980) and others (e.g. Anderson 1987; Beddington and Rettig 1984; Scott and Neher 1981).

1.2 Rationale for the Study

This case study examines the impacts of the implementation of a theoretically derived regulatory strategy (i.e. ITHQ[3]) in the Lake Huron commercial fishery. Much has been written on the theoretical implications and postulated impacts of ITHQ, but there have been few empirical studies of the process and impacts of ITHQ in a Great Lakes fishery (Berkes and Pocock 1987 is a notable exception. Studies from elsewhere are cited in section 2.3.2).

The method of this case study incorporates some elements of a sociological or anthropological case study (i.e. open-ended interviews with key actors) and complements this qualitative information with broader statistical descriptions of the economic and biological components of the fishery. The method of this thesis combines the strengths of biological, economic and institutional analyses to address some of the weaknesses in previous research.

1.3 Statement of the Problem

The specific research questions are:

(1) what were the impacts of ITHQ (over the study period) and the process of development and implementation of ITHQ in the Lake Huron commercial fishery; and

(2) how does the co-management process of resource management and the descriptive powers of selected public policy models help to improve understanding of ITHQ as a management option?

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[3] ITHQ refers to a harvest allocation assigned to a commercial fishing licence, specific to species and area. ITHQ, as regulated by the government of the province of Ontario, can be transferred through sale, lease or repossession by government.

1.4 The Study Area

The commercial fishery in the Canadian portion of Lake Huron[4] is the area of study. The period 1980-1985 brackets the implementation[5] of ITHQ in the fishery. The Lake Huron commercial fishery supports a relatively modest number of fishing operations (less than 100), and is based on two principal commercial species, whitefish (Coregonus culpeaformis) and chub (Coregonus spp.). These conditions, together with recent efforts focusing on Great Lakes' fishery management, and the initiation of ITHQ in the Lake Huron fishery, make it an attractive choice for a study of this type.

1.5 Definition of Individual Transferable Harvest Quota

ITHQ is defined as an exact allocation of a number of pounds of a specific species of fish. The allocated number of pounds of the specified species can legally be harvested and sold. The allocation is attached to the commercial fishing license issued by the province of Ontario. One or more commercial fishing licenses may be held by: (1) an individual; (2) jointly by individuals; and (3) a business enterprise. Any license can have ITHQ for one or more species of fish. Allocations are fully divisible, and any portion of the allocation can be transferred to any entity, at any time, at any price, by sale or lease at the discretion of the ITHQ holder. Only another provincially licensed commercial fisher can proceed to harvest the fish specified in the transferred ITHQ. For the purposes of sale or lease, ITHQ is usually valued on the basis of a per pound price, generally related to the unprocessed value of a pound of fish. No official records are kept of transfer prices among fishers and it is likely that intra-family transfers may occur at a nominal price. From time to time, the provincial government may purchase an

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[4] Hereafter, except when otherwise specified, "Lake Huron" will refer to the Canadian portion of the Lake Huron fishery, including the south basin, the Georgian Bay basin and the North Channel.

[5] ITHQ policy was approved in 1983 and first took effect in the 1984 season.

allocation and/or an entire commercial fishing operation and records of these transactions are confidential.

1.6 Organization of the Thesis

The research is presented in seven chapters. The first chapter introduces the research problem and the study area and states the study objectives. The second chapter presents a review of selected fisheries management and public policy literature with reference to how this literature has been interpreted and applied by managers. The third chapter describes the quantitative and qualitative data used for this research and the methods of data collection and analysis. The fourth chapter reviews the policy context, describing the background and development of ITHQ in the Lake Huron commercial fishery. The fifth chapter presents the results of analysis of the data. The sixth chapter reviews the results of the analysis of the empirical and qualitative data associated with ITHQ with reference to selected models of public policy and resource management. The seventh chapter outlines some conclusions and implications of this research. References for the research are listed in the bibliography.

There are three appendices. Appendix 1 contains a sample of an annual commercial fishing report (Form CF.8A), the source of part of the quantitative data base. Appendix 2 details how the interview schedule for the qualitative data base was developed, and lists the interview questions. Appendix 3 lists interview respondents and their affiliations.

2.0 SURVEY OF THE LITERATURE, ITS INTERPRETATION AND APPLICATION

Development of an understanding of the social and economic impacts of ITHQ on commercial fishing operations in Lake Huron is enhanced by an analysis of events using selected models of resource management and the public policy process. It is thus of particular importance to this study to review the literature on specific regulatory aspects of fisheries management, as well as the literature on selected resource management and public policy models that may offer some insight into important influences on regulatory impacts. The intent is to:

(1) understand the origins, management options and experiences related to the definition and resolution of fisheries management problems with regard to harvest regulation;

(2) examine selected resource management and public policy process models with a view to combining some of their analytical strengths and overcoming some of the conceptual limitations associated with specific models;

(3) derive from these models a composite of explanations of relevance to the research problem;

(4) review the relationships among these explanations; and finally,

(5) theorize as to how the relationships in the commercial fishery may respond to changes in the regulatory environment.

The first part of this chapter examines the theoretical underpinnings of fisheries management, as derived from biological and bioeconomic models. These models are seen to be based on an idealized, rational approach to decision making. The assumptions underlying this rational approach have had a critical influence on how fisheries management problems are defined and solved. The chapter also examines managers' evolving interpretations of the relationships expressed in these models, and how these understandings have been expressed in fisheries management practice.

Recent literature on co-management of fisheries resources has argued that a broad range of contextual factors influence the way policy is developed and implemented, and how well it will work. The literature review in this chapter examines alternative models of policy development and discusses a co-management model of resource use that is more consistent with a broad, inclusive approach to policy-making.

Each of these models offers some insight into the policy development process and/or policy, the potential outcomes resulting from the policy, or the process of implementation. As with almost any model, each explains at least one composite of decisions, impacts and/or interactions very well, but must be adjusted or augmented when seeking a comprehensive explanation. In general, these various resource management and public policy models are useful in this study to construct an understanding of ITHQ development, implementation and impacts.

Incremental and interest group models of policy making reflect and incorporate a wide range of contextual factors that influence policy development and thus determine policy outcomes. Therefore, these approaches more realistically represent aspects of the policy process and aid in understanding policy outcomes.

2.1 The Common Property Paradigm

2.1.1 Definition

For the purposes of this discussion, four categories of property rights within which common-property resources are held are defined as follows (Feeny et al. 1990).

(1) Open access. The absence of well-defined property rights, in which access is unregulated, free and open to everyone.

(2) Private property. The rights (usually exclusive and transferable) to exclude others and to regulate the use of the resource vested in a specific entity (e.g. individual, corporation).

(3) Communal property. Rights to the resource are held by an identifiable community of interdependent users who can exclude others and regulate use by members of the community.

(4) State property. The rights to the resource are vested exclusively in government, which regulates resource access and use.

The term "community" refers to a "community of interest," which is a group of individuals who have a shared interest or point of view with respect to resources or property. The basis of this shared interest may be influenced by geography (i.e. the individuals live in an place where the resource or property is very important to their lives) or activity (i.e. the individuals may not live near the resource or property, but still wish access to the resource).

Basic to the bioeconomic and other related models is a notion of exploitation of open access resources that has come to be associated with the concept of the "tragedy of the commons" (Hardin 1968)[6]. In this version of the common property paradigm, a common property resource is defined as open access (i.e. one that is available to a specific community or group of users, so that it is impossible to exclude any particular member of the group from using the resource). As interpreted by Hardin (1968), this model ascribes destructive overuse of common property to the unequal distribution of benefits and disbenefits which can occur in a common property situation. A central (though often unstated) assumption of this model is that resource use is open access.

Hardin (1968) popularized the concept in grappling with the potential resource use conflict generated by projected population pressures. Hardin used the example of unrestricted grazing-rights in an hypothetical (and, by Hardin's assumptions open access)

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[6] Hardin (1968) did not distinguish between open access systems and communal property and thus confuses the few genuinely open access systems with those that have entry restrictions.

village "commons." He described the economic calculus as follows: in this socially stable situation, an individual herder would realize a positive utility of nearly +1 from the addition of one animal to the herd, while any negative utility through over-grazing is only a fraction of -1, leaving the rational herder to conclude that the sensible course is to add another animal to the herd. Eventually, the addition of too many animals overburdens the common resource, with the tragic result of a ruined grazing area. In order to avoid similar desecration of our common property resources, Hardin called for legislated allocation of these resources. This "tragic" interpretation of the common property paradigm has been an enduring conceptual framework in resource management.

2.1.2 The common property paradigm as adapted for fisheries

Berkes[7] (1985) has adapted Hardin's "tragedy of the commons" concept for fisheries.

> Consider a body of water which has a certain finite capacity for fish production. If the first fisherman or the first few fishermen find fishing profitable, their success will attract other fishermen. In this way, more and more boats will enter the fishery, some of them belonging to existing fishermen who have turned into multiple boat-owners to increase their individual capacities. With the increased fishing effort, the individual catches of fishermen per unit of fishing effort expended will fall, and at some point over-fishing will occur -- inevitably when the total yield exceeds the natural ability of the fish populations to renew themselves on a sustained basis.

The principal adaptations of Hardin's conceptualization of the tragedy of the commons to fisheries are the analogues of (1) overgrazing to overharvesting and (2) additional animals to additional vessels and gear (i.e. overcapacity). Within this framework, the calculus of the resource use generally remains the same.

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[7] Berkes (1985) prefaces this adaptation with acknowledgement that Hardin's (1968) idea was based on the assumptions of "unrestricted grazing-rights in a hypothetical village 'commons,' and the collective tragedy caused by the rational individual greed of the cattle owners."

In both open and limited-access fisheries, fishers can realize short-term benefits in catching fish before their competitors. Racing to harvest the greatest amount of fish can, however, result in many inefficiencies, including over-sized and over-equipped boats, too many fishers, and the harvesting of fish of lesser market value and those not yet sexually mature. Even limiting entry to the fishery through restricting the number of commercial licenses may not be effective if the limitation comes into force after the fishery has attracted several fishing units (Regier and Grima 1985).

Two major schools of thought have developed in relation to the basic "tragedy of the commons" notion popularized in Hardin's work. One was the bioeconomic model of resource management. The concepts of allocated resource rights and government intervention to administer the regime of rights play important roles in the management systems typically derived from the bioeconomic model.

A second, less precisely defined, resource management model, the co-management model, emphasizes the range of management options available along a strong-to-weaker continuum of community-shared ownership/management of resources. Co-management systems typically include a degree of government involvement in a management partnership, but with somewhat less reliance on government interventions than evidenced in management systems derived from the bioeconomic model. The bioeconomic model emphasizes competition rather than cooperation, and assumes supremacy of individualism rather than communitarianism (Berkes and Farvar 1989). Sections 2.2., 2.3 and 2.4 review selected literature of relevance to both of these schools.

In summary and conclusion, this section has defined the common property paradigm and its relation to the bioeconomic and co-management models of resource management. Within the common property paradigm, institutional and regulatory mechanisms can be applied to address overall management problems. As interpreted in the bioeconomic model, problems of overcapacity and overharvesting are attributed to open access and the lack of ownership of the resource. Fisheries are viewed as being

consistently overexploited, unlike private property, which can be protected (or exploited) by its owner(s). Some social scientists, economists in particular, have thus suggested that management problems of this nature ought to be addressed through the allocation of exclusive private property rights to resources (Pearse 1988a). Scott (1973; Scott and Neher 1981) has suggested that exclusive private property rights in combination with market mechanisms should be left to allocate resources rationally over time.

The co-management model of resource use suggests a role for collective property rights in resource management and emphasizes the potential for building community-based institutional arrangements for resolving resource management problems (Ostrom 1990). In this approach, fisheries might be viewed as communal property, to be utilized according to mutually understood, accepted and monitored agreements or regulations, within some degree of government oversight.

The process by which a policy is developed and implemented also influences its effectiveness and the range of policy impacts. The theoretical basis for this is examined in section 2.5, in a review of the literature on three policy process models.

2.2 Development and Application of the Bioeconomic Model in Fisheries Management

This section outlines the development of the bioeconomic model, tracing its origins in biological and social science and reviewing the application of fisheries management interventions derived from this model of resource use.

2.2.1 Biological models in fisheries management

Biological models focus on biological and environmental factors affecting fish stocks. These models address concerns related to the biology of the organism, ecological habitat relationships and especially reproductive and predatory behaviours. The indicators in biological models were specific measures of water temperature, biological oxygen demand, population dynamics, predation and the like. The management interventions suggested by biological models related primarily to protection of reproduction through season and area closures and size limits.

Management systems consistent with biologically-based remedies first focused on conservation. Subsequently, management initiatives included measures to protect immature fish and safeguard reproduction (e.g. seasonal closures; areal limitations) (Needler 1979). Historically, fisheries managers attempted to control human and animal predation through a range of interventions, including lamprey control programs, harvest (e.g. limiting amount of harvest for a particular fishery) and gear restrictions (e.g. mesh size). In this way, managers sought to control variables associated with resource users' interference with fish reproduction. These types of management interventions are consistent with the cause-effect relationships suggested in the biological models that provided a basis for managers' understanding of the fishery.

These biological investigations did not adequately address the economic and social factors prevailing on resource users in their relations to the fishery. In application to a real world fishery, under a regime limiting the total amount of harvest, one of the unwelcome responses to regulations directed at the protection of reproduction was an increase in fishing capacity. In order to catch the most fish within the allowed window, fishers could purchase vessels with increased storage capacity and more powerful engines, and equip their boats with more lethal gear and additional crew. In effect, they could increase the capacity of the fishing fleet. The fleet would then be less efficient, however, as much of this capacity would be underutilized (i.e. inefficient) except for

season openings, or other windows of opportunity.[8] In addition, pressure of increased debt loads would prompt fishers to request increases in the allowable harvest, so that they might have a chance to increase their revenue. The resulting situation would be the opposite of that intended by management interventions.

2.2.2 The bioeconomic model

The bioeconomic model posited a set of relationships, based on economic behaviour of the enterprise and the known biology of the resource, that modelled the observed tendency of resource utilization over time, given a range of market responses, and the likely results of this utilization on the continued viability of the resource. (See Figure 2.1.) This "second generation" model is much more of a hypothetical model. It is not directly derived from empirical measures, but rather from the theoretical relationships among the variables that had been measured and studied in earlier models. A major advance was that it asserted a pattern of use that would reach equilibrium[9] at, or very close to, a harvesting level which, if unregulated, could be consistent with a collapse of the fish stocks and permanent damage to the resource. (See Grima and Berkes 1989 for a detailed description of the sustained yield concept in resource science.)

The bioeconomic model thus contributes to resource management theory in its conceptualization of a commonly held belief about commercial fishing; "although fisheries in an early stage of development may show high returns, or mature fisheries

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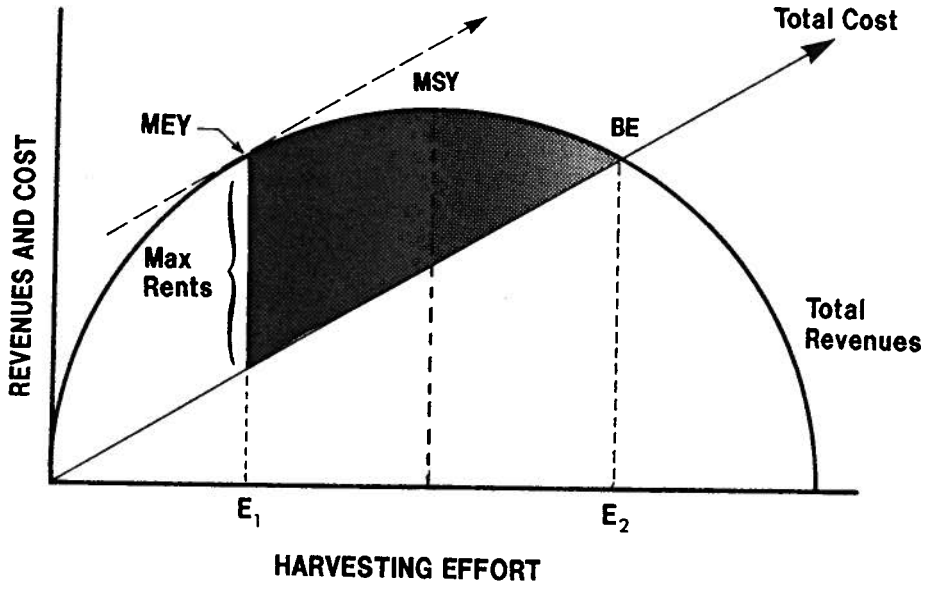
[8] The implied meanings are those of the bioeconomist, not those of the enterprise operators.

[9] I. e. bionomic equilibrium, where the value of the sustained catch is no greater than the cost of the factors employed to harvest it, and all the potential resource rent is thus dissipated. In the more valuable fisheries, this equilibrium condition is reached only when the stocks are depleted. (Pearse 1980)



MEY Maximum Economic Yield

MSY Maximum Sustainable Yield

BE Bionomic Equilibrium

FIGURE 2.1: The Bioeconomic Model. Source:Grima and Berkes 1989

may be highly profitable following new developments in markets or technology, they tend, inexorably, toward . . . economic stagnation" (Pearse 1980). As Pearse (1980) notes, this state of stagnation "is fundamentally a problem of excessive costs, resulting from employment of more labour and capital than is necessary to harvest the catch." This is the inefficiency which leads to the "tragedy of the commons."

Using a fisheries example, Pearse (1980) summarizes the economic analysis of the open access category of the common property model, emphasizing the role of the concept of "resource rent" as a pivotal factor in understanding how we can manage renewable resources:

> Economicaly valuable fish stocks are, by definition, capable of yielding harvests of a value greater than the costs of harvesting. This surplus or net value is referred to as resource rent.

He continues:

> The process can be explained briefly as follows. Whenever a fishery yields rent, and no agency appropriates this surplus, it will accrue to the fishing enterprises as profits (in excess of the minimum return required to cover the cost of existing capital and entrepreneurship). If access to the fishery is unrestricted, these profits will, in the long run, attract additional entrants to the fishery and induce existing enterprises to expand their fishing power. A profitable fishery is therefore unstable. As the fleet expands, the catch of individual fishing units will decline as larger numbers compete for the yield, especially if the stocks are diminished under the increased fishing pressure. This process will continue until, on the average, the earnings of fishing units are reduced to the minimum required to cover the costs of the labour and capital they employ. At that point, the fishery reaches a state referred to as a bionomic equilibrium, where the value of the sustained catch is no greater than the cost of factors employed to harvest it, and all the potential resource rent is thus dissipated. In the more valuable fisheries, this equilibrium condition is reached only when the stocks are depleted.

Adopting this bioeconomic model, the "tragedy of the commons" may be discussed in terms of the ability of valuable fisheries to yield resource rent only up to the point where the stock is depleted. In order to avoid stock collapse, some form of

management intervention is necessary. In practice, this is often a government intervention, in the form of regulation.

Combining knowledge accrued in the development of fish stock population models with a theoretical economic measure of units of "fishing effort," resource economists developed the bioeconomic model (Schaefer 1957; Gordon 1954; Scott 1979). Schaefer (1953), Gordon (1954) and Scott (1955) were three of the earliest to formulate the open access type common property resource theory for fisheries. The biological Schaefer (1953) model shows a production or yield function in relation to fishing effort. In this model, the underlying population responsible for this yield function is seen to grow when the natural rate of growth exceeds the reductions from the combined effects of natural mortality and fishing effort. Under Schaefer's logistic, this yield is at its maximum when the population biomass is half its maximum size. It is the yield from fishing effort that is of interest to economic analysts, however, not the magnitude of the underlying population whose maximum size does not correspond with the highest yield. None the less, the Schaefer model showed that increased fishing effort can result in an increased yield only up to a maximum, the maximum sustainable yield (MSY), after which further increases in effort result in a lower yield (and a possible strain on the reproductive capability of the population).

The static[10] economic model developed by Gordon has its origins in the biological Schaefer-logistic model (Mitchell 1979). Gordon's (1953) seminal article integrating the unique aspects of fisheries owing to the biological behaviour of fish and the open access nature of the resource was an important step in the development of

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[10] It is'static' in the sense that "the Gordon model does not take into account the dynamic nature of economic forces, for example, changes in prices due to increased demands for fish products, and fishing costs that do not necessarily occur at a constant rate" (Mitchell 1979). Mitchell (1979) describes 'dynamic' economic analysis as using "discount rates, which in effect measure how society regards or values present consumption in comparison with future consumption, . . . [and] indicates whether it makes sense to underexploit or overexploit the resources." (Mitchell 1979).

fisheries economics. The economic model, first expounded by Gordon, introduced economic variables to the biological model. This was done by turning the production yield function into a total revenue function and by introducing a total cost function[11], assumed to be increasing linearly with fishing effort, which encompasses all costs, including alternative returns to the factors of production. In economics, the economic optimum occurs when net returns are greatest: when the marginal revenue equals marginal cost. Based on this, the economic optimum level of exploitation is, in Figure 2.1, MEY. The economic optimum in this model indicates that this is at a lower level of landings than the MSY. The MEY level is where the factors of production are most efficiently employed, in that any incremental increase in returns to the factors of production would be offset by the increased cost. The basic thesis of the Gordon model, "that uncontrolled exploitation of a common property [i.e. open access] resource leads to overexploitation and poor economic returns has never been refuted" (Mitchell 1979). Most importantly, the economic model indicated that in instances of free entry, economic forces could lead to overexploitation in both a biological and economic sense, but the economic optimum would be at a level of exploitation less than the MSY. More sophisticated dynamic analyses by Scott (1955) have shown that economic forces could lead to even greater overexploitation of resources than the Gordon model shows (Mitchell 1979).

2.2.3 Interpretation and application of the bioeconomic models

For the purposes of this research, the important distinction between the Schaefer and Gordon models is how they have been interpreted by managers. In the past, when the management focus was biological, and directed towards conservation, the model was taken to indicate that fishing effort should not exceed the MSY level. This level was also, "erroneously considered the optimum economic level of exploitation by biologists"

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[11] 'Total cost' includes: all fixed costs; all operating costs; "normal" profits; and all opportunity costs (i.e. alternative returns to the factors of production).

(Mitchell 1979). The principal attraction of the static economic model to fishery managers concerned with conservation is that MEY occurs at a lower level of exploitation than MSY. Thus the goals of conservation were assumed to be reinforced by the application of rational, economic criteria to the decision-making process.

A more dynamic approach is exemplified, for example, in the work of Pearse (1980). This equilibrium modelling approach is based on the biologically-determined stock-growth/stock-size relationship, linking economic and biological factors, and assigning a fixed amount of the stock to each unit of fishing effort. Modelling biological and economic forces influencing the fishery illustrates how a profitable fishery could attract additional fishing effort (in the form of more fishers and/or more vessels and gear), to the point where individual fishers' harvest amounts may decline. If this continues, the fishers would be making only enough money to cover their costs. This breakeven point, at which the harvest value is no greater than the cost of obtaining it, is represented in the model as the bionomic equilibrium (denoted as BE, see Figure 2.1.). This is an economically inefficient situation. In this theoretical state of equilibrium, for the fishery as a whole, the value of the harvest is no greater than the cost of harvest activities. This leads to both biological and economic problems: the former exemplified by overfishing and lower sustainable yields, the latter by low returns and incomes and no rent from fishing (Mitchell 1979). For this reason, this is also an inherently unstable state for the economic activities associated with the fishery. If there are any fewer fish (e.g. stock collapse), fishers will leave the fishery (even if only temporarily). If there is a greater number of fish (e.g. large year class in any of the principal commercial species), more entrants will be attracted to the fishery.

Economic inefficiency is manifested most commonly in the fishery in the form of excess harvest capacity. For fisheries managers, excess harvest is seen as a regulatory problem requiring limitations on capacity. Thus, interventions derived from the causal relationships defined in the bioeconomic model focus on increasing the efficiency of a limited number of resource users through reducing overall capacity and limiting entry.

The instruments for achieving this are consistent with the restrictions prescribed by the biological model: season and area limits, restrictions on vessels and gear, licenses to control entry and limitations on harvest species and amounts. Two principal methods were suggested for the latter: overall, species-specific harvest restrictions for the fishery or allocation of individual harvest quotas. In this way, economic models utilized the basic biological assumptions, but focused on capacity, suggesting interventions that manipulate this factor primarily by limiting entry and harvest amount.

In summary, this section has explored the bioeconomic model of resource use. Early efforts in fisheries management focused on biological and environmental factors affecting fish stocks, and related primarily to protection of reproduction through season and area closures and size limits. Economic models looked at market context and the behaviour of supporting factors affecting decisions about how and how much harvesting was done. Economists have thus suggested management interventions relating to fishing effort (e.g. entry limitations, vessel and gear restrictions, harvest limitations). Combining knowledge accrued in the development of fish stock population models with a theoretical economic measure of units of fishing effort, resource economists developed the bioeconomic model. Analysis of this model suggests that allocation to fishers of individual shares of the harvest (i.e. ITHQ), which would combine exclusive property rights (including the ability to transfer ownership, through sale or lease) with harvest limitations, is a promising management intervention to address problems of overharvest and overcapacity.

2.3 Rationale For and Use of Individual Transferable Harvest Quotas in Fisheries Management

This section reviews the theoretical arguments for ITHQ as a regulatory intervention effective in limiting inefficiencies in commercial fishing. The strengths and weaknesses of ITHQ in application are also examined. ITHQ is different from harvest limitation regulations that pertain to a fishery as a whole, in that ITHQ introduces the

concept of individual ownership of the resource. By imposing ITHQ, a specific share(s) of the resource is linked to each individual enterprise, or decision-making unit, thereby (so the theory goes) encouraging individuals to become more efficient (in terms of matching their harvest capacity with their allocations), usually within a pre-existing regulatory framework of season, area and entry restrictions.

2.3.1 The case for ITHQ

The bioeconomic model as described above implies a particular set of relationships which are helpful to managers in understanding how we use our fishery resource. Overharvest and overcapacity are recognized problems in fisheries management. Based on the theory of resource use presented in the bioeconomic model, economists have examined a range of interventions for their effectiveness in fostering custodianship of the resource and removing economic incentives that encourage overfishing.

Much of the ITHQ literature comprises theoretical discussion and prediction regarding the potential advantages, disadvantages, methods and potentially successful combinations of an array of direct and indirect[12] regulatory options (e.g. Moloney and Pearse 1979; Mitchell 1979; Clark 1980). This literature is examined here, and the following section (2.3.2) looks more closely at actual experiences with ITHQ.

Three major reports on Canada's commercial fisheries cite government allocation of exclusive property rights, in the form of ITHQ, as an innovative addition to the

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[12] Direct methods of regulation are those which directly control the amount of fish harvested, such as limits on harvest. Indirect methods of regulation are those which attempt to control fishing effort by manipulating some of the inputs (e.g. gear and vessel restrictions) and/or opportunities (e.g. area and season restrictions) to the harvest of fish.

existing range of management interventions (Kirby 1982; Pearse 1982; Pearse 1988).[13] They also examine the effectiveness of entry limitation, buy-back programs, overall harvest quotas and a variety of royalty schema as means to address the troubling issues of overcapacity and overharvest.

Pearse (1982) reviews the Pacific fishery. The report addresses a set of problems related to resource use, as well as problems related to regulation. Excessive fleet development, linked to unrestricted access to the fishery as an open access resource, is identified as the main barrier to economically efficient exploitation of the commercial fisheries of the Pacific coast. The report's recommendations of imposition of entry limitations and quota regulation, are particularly directed to address this specific formulation of the problem. The report's recommendations are aimed at:

> . . . keeping fishing capacity in balance with the resources available, encouraging the fleet's structure to develop efficiently, providing security to fishermen and vessel owners, enabling the government to adjust fishing privileges as conditions change, recovering for the public the returns from resources in excess of reasonable returns to fishermen and vessel owners, and simplifying administration. (Pearse 1982)

The primary regulatory measures suggested were entry limitation (and entry fees) and quota regulation (such as ITHQ). These methods of direct regulation were intended to encourage fleet rationalization and permit the relaxation or abolition of much of the intricate, indirect regulation imposed on vessels, gear and fishing times. With resource rent thus assured, royalties were also recommended, in order to capture a portion of this revenue for the public purse. Explicit resource allocation among competing users was also recommended.

In examining Canada's Atlantic fisheries, Kirby (1982) identifies the "common property problem" as underlying most of the difficulties in the harvesting sector of the

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[13] The recommendations in OMNR and OCCF 1982, a major report on Ontario's commercial fisheries, are detailed in section 4.3.2.

commercial fishery. Specifically, he cites the existence of too much harvesting capacity, relative to (then) current and anticipated resource availability, to generate adequate annual incomes and adequate returns on investment for fishermen. He recommends limited-entry provisions and discusses the advantages of quota regulation:

> . . . while the institution of a system of quota licenses would result, over time, in some reduction in the number of fishermen . . . . the incomes of those remaining in the fishery will rise. . . . In addition, the quota licence system would enable fishermen to obtain more economically efficient vessels, while simultaneously freeing them from a great deal of the regulatory burden to which they are now subjected. This would allow more technological innovation and hence a reduction in harvesting costs.

The creation of exclusive property rights to the fishery[14] through allocation of harvest quotas is intended to create conditions whereby fishers can minimize operating costs by overcoming the competitive effects of the open access nature of the fisheries. With an assured share of the harvest, fishers do not have to invest in additional capacity. They can harvest their allocation with the optimum amount of effort, without having to race to compete with other fishers.

Identifying "common property" as the source of the problems shown by the bioeconomic model suggests manipulation of property rights as a feasible management option (Scott 1955; Pearse 1982). Manipulation of this type can take the form of definition and allocation of exclusive property rights, such as quota regulation. Quota regulation is identified as the most promising means of regulating the catch and promoting fleet rationalization. Moloney and Pearse (1979) suggest quota regulation could be expected to maximize resource rents and permit the gains to be distributed flexibly. Pearse (1988) suggests the outstanding advantage of ITHQ to be elimination of the basic cause of overcapacity in the fishing industry, which he sees to be the

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[14] Although in the Great Lakes the inshore fisheries (i.e. seines, hooks, pound nets, trap nets, hoop nets) all had quasi-property rights to particular locales since sometime in the 19th century, ITHQ explicitly assigns comprehensive (i.e. specifying a maximum harvest) property rights to harvest amount (H. A. Regier, pers. comm. 1992).

existence of incentives to individual fishers to protect and increase their share of the catch.

If ITHQ works as the bioeconomic fisheries theory predicts, harvest would be controlled within a predetermined amount, prompting changes in resource users' behaviour, such that capacity would be reduced and therefore the remaining capacity would be utilized more efficiently (Grima and Berkes 1989). (No timeframe is specified.) Some resource users would be prompted to retire their operations and leave the fishery because not all operations would be able legally to harvest enough fish to cover their costs and provide a reasonable profit. This would allow a reallocation and consolidation of ITHQ with fewer, and therefore more efficient operations.

A reduction in capacity will be measured by a reduction in the amount and value of vessels and gear involved in the fishery (with a concomitant reduction in the number of fishing operations). Control of harvest will be indicated by the amount of harvest of principal commercial species. Efficient utilization of capacity will be indicated by a trend towards those enterprises with lower investment, or capacity, harvesting lesser amounts of fish than those with a higher investment, and those with a higher investment harvesting greater amounts. These hypotheses, suggested by the theory/model, are examined in chapter five.

Reviewing several previous studies, Townsend and Wilson (1988) report that, in nearly every open access fishery examined, there was excessive investment in harvesting capacity, low economic returns to fishermen, and increasing signs of stock decline. These conclusions are consistent with interpreting the relationships modelled in the bioeconomic model to suggest overharvest and overcapacity as the two principal problems in fisheries management (Pearse 1988; Scott 1979; Townsend and Wilson 1988).

Clark (1980) has developed a model of the commercial fishery to predict the consequences of various methods of regulation, including : (1) total catch quotas; (2) vessel licenses (for the purpose of limiting entry); (3) taxes on catch); and (4) allocated catch quotas (analogous to ITHQ) (or effort). Based on a general model of the open-access fishery, his findings indicate that the customary methods of preventing depletion of fish stocks (i.e. total catch quotas, closed seasons, etc.) generally lead to expansion of fleet capacity. Typically, managers then respond by tightening existing restrictions (e.g. shortening the fishing season). ITHQ, however, are predicted to be theoretically equivalent to taxes in terms of economic efficiency, and both are thought to be capable, in principle, of optimizing exploitation of the common-property fishery. Cautioning against a too literal interpretation of the theoretical equivalence of taxes and allocated quotas, Clark supports the benefits of direct control over harvest provided by ITHQ.

In summary, the theoretically predicted advantages of ITHQ can be categorized from the sources cited in section 2.3.1 as follows.

(1) Operational advantages, including: (a) reduced vessel and gear regulation; (b) increased technological innovation; (c) reduction in the number of vessels and amount of gear; and (d) opportunity for better logistical planning for seasonal price and processing opportunities. These benefits would accrue principally to those fishers remaining.

(2) Economic advantages, including: (a) increased incomes for those remaining in the fishery; (b) reduced harvest costs; (c) security regarding harvest share for fishers; and (d) removal of incentives to protect and increase catch share (i.e. removal of competition that could be harmful to fish stocks). These benefits would accrue principally to those fishers remaining.

(3) Administrative advantages, including: (a) direct control of harvest; (b) opportunity to raise revenue through fees and royalties; (c) ease in modification of regulation; and (d) reduced administrative costs (e.g. particularly in the area of enforcement). These benefits would accrue principally to managers (and indirectly to the ultimate owners of the resource, the public).

Many theoretical investigations indicate that in removing the incentive to compete for available stocks, ITHQ can be expected to facilitate reaching the fisheries management objectives of reducing overcapacity and overharvest. The findings of the researchers cited in this section hint at some additional, "administrative and enforcement costs." The potential confounding influence of problems likely to accompany the transition of ITHQ from theory to practice, however, have not been directly addressed.

2.3.2 Applications of ITHQ

Little empirical research has been published on the subject of ITHQ. Having examined the theoretical expectations associated with ITHQ, however, this section goes on to outline some of the significant research on implementing and operationalizing ITHQ in a variety of fisheries worldwide.

Management Concerns

The practice of fisheries management derives from managers' worldview of the fishery and resource users. Managers have a conceptual model of the fishery in which they see causal relationships. In order to manage the fishery, they select, from among these causal relationships, components they think will respond to manipulation, or that can be manipulated. Choices that result from those decisions determine the policy instruments that are introduced.

In the past, fisheries management was thought to be solely within the purview of biological science. Accordingly, managers proposed biological mechanisms to deal with the special problems it posed. In effect, this led managers to formulate biological solutions for problems that were, in fact, rooted in the institutional framework of resource development. The institutional nature of these problems becomes particularly evident in cases where entry into fishing activities is relatively easy or where fishing effort is not effectively regulated. Where initial management responses focused almost exclusively on a concern for conservation -- "protect the young and do not interfere with

reproduction" (Needler 1979) -- overdependence on biological solutions created further management problems.

Regulation to protect spawning (i.e. minimum sizes of fish to be retained, minimum net sizes, closed seasons and area limitations), while generally effective in conserving the fishery, has typically also resulted in increased competition within the commercial fishing industry. Thus, each fisher purchased more and better gear in order either to 'outfish' competitors or to make work safer or more comfortable. This situation, defined as overcapacity, has led to an increase in effective fishing effort, bringing a new round of regulations on engine power, length of fishing season, size of boat, and other components of the fishing effort, as managers attempt to reduce pressure on fish stocks.

In 1986, New Zealand implemented an individual transferable quota (ITQ) system for selected inshore fish species to "promote conservation of stocks and to improve the economic efficiency of the fishing industry." Dewees (1989) surveyed 62 commercial fishers and fishing company managers as well as 14 fisheries managers to assess the 1986 implementation of ITQ with regard to perceived problems and benefits and ITQ's effect on the fishing industry. Dewees found that 77% of the fishers reported making substantial changes in their business in response to ITQ. Changes in fishing methods and reductions in costs (cost minimization strategies were not specified) and effort resulted in maximizing revenues received for their harvest. These two changes were seen to be consistent with the theoretically predicted behaviours associated with ITQ. The two major revenue-maximizing strategies were development of innovative on-board handling methods and harvest of non-quota species.

The most significant problems with ITQ included: (1) discarding of incidental catch for which the fisher had no quota and culling of the harvest to insure that only the highest priced portion of the harvest was landed; (2) enforcement difficulties to do with stopping illegal and unreported sales, enforcement at sea, harassment for minor offenses

and strained industry/government relations; (3) business-related concerns with aggregation of quotas by large fishing companies, cutbacks in fishers' potential catch, such that their business was uneconomical; and (4) a set of issues related to the high cost of ITQ, including economic barriers to young people entering the fishery, the increased capitalization required to obtain an adequate quota and to change fishing practices to maximize prices received for fish, and the high price of quota. Dewees concludes: "After 6 months under ITQs, 56% of the fishermen and 100% of the agency staff interviewed felt this new system of managing fisheries would be successful." With specific reference to the difficulties encountered in New Zealand's attempt to convert theory into practice, Dewees' concluding recommendations focus on the importance of: (1) education and communications; (2) understanding the benefits, problems and consequences of ITQ before implementation; (3) equitable allocation and appeal systems; and (4) adequate administrative resources to support costs associated with necessary information and reporting systems, transition to the new system of ITQ and additional daily operational and assessment activities.

Dewees' recommendations are consistent with other research in fisheries management which has identified improved stock assessment and enforcement of a much-simplified set of regulations as principal requirements for successful implementation of quota regulation in limited-entry fisheries. Robinson (1986) pinpoints "catch monitoring and enforcement . . . as the potential 'Achilles heel'" of a quota regulation system for the Australian southern Bluefin Tuna fishery. Similarly, in discussing development of management measures to control commercial fish harvest in Ontario, Haxell (1986) details the interdependence of stock assessment and adjustment of quotas. He goes on to stress the importance of ensuring compliance with regulations and licensing conditions related to: (1) incidental (i.e. non-quota, sport fish species) catch and (2) the enforcement of individual quotas.

Clark and Duncan (1986), in reviewing the impact of ITHQ policies in New Zealand's fisheries management, describe "the flouting of quotas due to inadequate

monitoring, enforcement and penalties" as the reason for "strong support within the fishing industry for rigorous enforcement and severe penalties." The authors also emphasize the connection between stock assessment and quota enforcement, through the use of selective logbook monitoring of catch/effort to detect changes in stock abundance. Similarly, agreement on assessing and partitioning stock declines, licensing, and other restrictions were key issues in Fraser's (1986) description of the development of enterprise allocations in the offshore groundfish fishery in Atlantic Canada. In a theoretical exploration of policy alternatives for controlling fishing effort, Crutchfield (1979) also identified enforcement as the most pressing administrative problem in implementing ITHQ.

Anderson's (1987) analysis of "the economic problem of running a fishing agency" supports the significance of enforcement and co-operation among managers and resource users in a fisheries management regimen ("monitoring is the real driving force behind management"). Citing a far-reaching literature on the economics of fisheries management,[15] he points out that "only a very small part deals with enforcement issues."

In his own analysis, Anderson (1987) finds the type and amount of monitoring required can be very extensive for instruments such as ITHQ. In fact, he concludes that despite their production inefficiencies, indirect restrictions (i.e. gear and areas, etc.) may not be as undesirable in an overall sense as commonly believed. He argues ease of enforcement and effectiveness in influencing fishers' behaviour as their main strengths. Anderson suggests that this literature:

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[15] The question of which types of controls will meet economic efficiency or other objectives has received considerable attention (Crutchfield 1961; Rettig and Ginter 1978; Pearse 1979; Sturgess and Meany 1982; and Anderson 1986, Chapter 6). The question of how non-compliance, avoidance and other illegal activities, and enforcement costs affect the economically efficient level of fishing and the relative efficiency of the various control types has only recently been analyzed. (Sutinen and Andersen 1985; Anderson and Lee 1986; and Milliman 1986).

> . . . has clearly shown that one difference between quotas [i.e. total allowable catch], gear restrictions, closed areas, etc., on the one hand and those instruments which try to limit effort (i.e., taxes, transferable individual quotas, etc.) on the other is the efficiency with which effort is produced (Rettig and Ginter 1978; Pearse 1979; and Sturgess and Meany 1982).

Experience with ITHQ in Manitoba has led to criticism of transfer of "access rights" (i.e. quota allocations) where the result is a windfall profit to the first generation of allocation holders (MNR n.d.). However, the authors of the MNR (n.d.) report agree that judicious reallocation can improve viability of a fishery by: (1) allowing harvest rights to be matched with production capacity of equipment; (2) allowing fishers to increase individual harvest levels (income) without decreasing the harvest levels available to fellow fishers; and (3) providing fishers with greater flexibility to respond to seasonal price differentials, availability of fish, and cost of operation and equipment (MNR n.d.). The MNR (n.d.) conclusions are consistent with the findings of other researchers on the subject of allocation of exclusive property rights to commercial fisheries resources (Kirby 1982; Munro 1982; Pearse 1982; Scott 1979).

Social Impacts

Fisheries regulation, based on the bioeconomic model described above, does not adequately encompass the social factors that may support or confound regulatory efforts. There is, however, considerable agreement amongst fisheries economists that the socioeconomic rationale for decision-making by fishers needs to be better understood (Charles 1988). Given the amount of research directed to measures of "fishing effort," Opaluch and Bockstael (1984) argue that "the fishermen's decision as to effort level is perhaps the most important type of behaviour to be understood." Similarly, Karpoff (1985) offers quantitative evidence that non-pecuniary factors are important to an understanding of decision-making behaviour of fishers, particularly low-revenue fishers who are so often the targets of economically-driven efforts to "rationalize" a fishery (in that these efforts at rationalization tend toward consolidation of several smaller (i.e. low

revenue) operations into a fewer number of economically "efficient" unit sizes.) This concern for the impact of ITHQ on small fishers is shared by Crutchfield (1979) in his discussion of the social impacts of fishery regulation.

Social impacts associated with small-scale fishers are a focus of Berkes and Pocock (1990) in their review of diversity in Great Lakes fisheries. Their research examines aspects of the regulatory environment that have encouraged larger-scale fisheries to the detriment of small-scale ones. In particular, they cite implementation of ITHQ in the Lake Erie commercial fishery as initiating a trend of small-scale fishery buy-outs that has since continued. In comparing larger-scale Lake Erie with Lake Ontario fishing operations, they find that "small-scale Lake Ontario fisheries are capital- and energy-efficient . . . [and] obtained almost twice as much fish per unit of fuel energy used and created three times as many fishing jobs per unit of investment." As important aspects of managing resource allocation and user group conflicts, the authors' identify: (1) flexible quotas; (2) the ability to switch fishing gear often to accommodate seasonal cycles; and (3) negotiation approaches to manage user group conflicts.

Crutchfield (1979) also gave some consideration to the social impacts of fishery regulation, and he emphasized the importance of undertaking a quota repurchase system, in order to protect small-scale operators and isolated fishing communities whose efficiency is lower. In particular, he cautioned against an abrupt implementation of ITHQ. He saw ITHQ as a "drastic departure in regulatory techniques," that could have complex and uncertain impacts on the individual. He concluded that "any system to reduce excess capacity in a marine fishery will be suboptimal in a formal economic sense" and sets a modest goal for such management interventions: rationalization programs should aim, first and foremost, not just to reduce management costs, but to produce net benefits. (No timeframe specified.) He feels that this goal can be achieved, but only if resource users, managers and researchers in the field can develop adequate program design criteria and implementation procedures.

The economic logic of the "common property problem," (i.e. open access) describes a situation in which competition for resources plays a crucial role in resource depletion. This reasoning is consistent with theoretical formulations that argue for the important role of exclusive property rights, such as are embodied in ITHQ, in providing incentives for efficiency by internalizing social costs. However, Anderson and Hill (1988) point out that the process of defining and enforcing such property rights may eliminate or reduce potential gains from their creation. Although they focus primarily on the prediction of how different processes of defining private property affect efficiency, their conclusion is pertinent to ITHQ in fisheries :

> . . . under certain institutional arrangements, the establishment of private rights to resources can leave a society no better off than when rights were held in common. In other words, . . . rent dissipation . . . can result in the process of private property establishment.

Anderson and Hill conclude that gains from the assignment of exclusive property rights can be lost in efforts to define and enforce them. Further, this is more likely to be the case when the rule makers are not those who would benefit from an increase in resource rent. They warn us that removing the inefficiency of open access through privatization or other entry restrictions can simply shift dissipation of resource rent from fishers' operations to the administrative arena.

In a review of the flaws and limitations of the biological approach to resource management, Freeman (1989) finds orthodox reductionist, "linear" thinking (e.g. as in the bioeconomic model) inadequate for the solution of resource management problems of an ecological nature. He suggests rather, that we look to the local level to manage resource systems. He cites two important advantages:

> . . . access [through oral tradition] to a lengthy time-series of data by species, season and locality, in addition to extensive information that tends to emphasize relationships between species and various environmental parameters.

He continues:

> First, such an empirically-based approach represents a movement away from the highly abstract modelling techniques currently in vogue among managers -- techniques that depend upon large inputs of unknown, and often unknowable, data. Second, this tradition-based approach is especially significant as it relies upon data and techniques of analysis that local resource users can control and utilize in real time, so as to take locally sanctioned corrective actions with a minimum of delay. And third, it moves the focus of responsibility for management to those with the greatest direct stake in the sustainable utilization of the resource stock.

Freeman concludes that resource management can be improved through cooperation between resources users and managers. The objectives would be to overcome some of the serious limitations of mechanistic approaches in investigating natural processes and to develop more effective management institutions in order to ensure socially aware sustainable utilization of resources.

In concluding an extensive review of fishery regulation, Beddington and Rettig (1984) stress the importance of recognizing the limitations of the science of fisheries. They express the belief that successful programs of fisheries management will involve a mix of regulatory and other devices, and see no point in seeking a mixture which will provide some perfect solution for all time. The development of variable economic and social situations, and unpredictability in the behaviour of fish resources, are cited as principal reasons for maintaining flexibility in fishery regulation. Finally, they call for the involvement in the management process of fishers and others engaged in the fishing industry. Aside from facilitating management flexibility, an initiative of this type would reduce the likelihood of costly and difficult enforcement of misunderstood or unpopular measures.

In summary and conclusion, the following are emerging as the most significant issues in the transition of ITHQ from theory to practice: (1) the need for reliable information on actual landings and stock assessment; (2) the requirement for separate quotas for each stock needing management, (in order to maintain areal licensing requirements); and (3) assessment problems with timing and quantification in adjusting

quotas in fisheries in which stocks fluctuate widely and unpredictably. For fisheries managers, addressing these issues means substantial increases in efforts directed towards monitoring, enforcement, stock assessment and liaison with resource users.

The major critiques of ITHQ application focused on failures in implementation related to lack of support and acceptance from resource users affected by ITHQ. This is seen to result from an inadequate or ineffective administrative infrastructure to support ITHQ. ITHQ may work effectively to address problems of overharvest and overcapacity only as part of a pre-existing administrative network. It cannot evoke such a network. The important components of this network are cited above; assessment, monitoring and enforcement are seen to be the most significant. As part of a new regulatory regime, ITHQ was seen to require more extensive communication and consultation efforts than is usual in fisheries management.

2.4 The Co-Management Model

2.4.1 Definition of co-management

The co-management model describes a cooperative decision-making process of resource management based on collective property rights (but exclusive of those not belonging to the collectivity). In this model, resource users are incorporated as significant decision makers. Policy is developed and implemented not by the regulatory agency alone, but by the agency in cooperation with resource users. Governance of the common resource rests, at least to some degree, with the resource users.[16] The role of the regulatory agency thus becomes more one of setting an institutional definition for the group of resource users in order to protect the resource base from degradation through

[16] Resource users often have more power in decisions about use rights than they do in decisions about access rights, and thus may often "co-manage" within a context set by outsiders.

incursion, while the details of resource policy are determined primarily by the users of the common resource.

Recent work by anthropologists and other social science researchers has focused on social and institutional arrangements for the management of communal property resources.[17] This research has raised questions regarding the equity and efficacy of resource management systems based on individual property rights (McCay and Acheson 1987; Pinkerton 1989; Berkes 1985). Some of these researchers (e.g. Peters 1987; Grima and Berkes 1989) question basic assumptions of the common property model (e.g. the absence of historical and institutional analyses; definition of commons, as distinct from open-access, regimes; and the role ascribed to the individual). In general, this approach leads to a reexamination of existing, community-based resource use regulation (e.g. Acheson 1989; Pinkerton 1987), and identification of institutional arrangements for managing resources which incorporate the strengths of these types of indigenous, local-level systems. Clearly, these researchers see limitations in the extent to which Hardin's (1968) example of a theoretical commons accurately portrays resource management problems in some cases.

2.4.2 Errors in understanding commons systems

In their critique of resource managers' efforts to maximize resource rents, co-management theorists suggest that the theoretically derived solutions can encounter transitional problems when applied in the real world. This thesis is examined in chapter five.

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[17] In practice, there are virtually no major fish resources which are truly open-access "commons" (Berkes 1985). In those fisheries where access and other limitations are in place but there are no individual harvest limitations, the collection of resource users granted access could be considered to be a "collectivity," using the common resource.

Acheson's (1989) case study of the Maine lobster industry challenges the proposition that the users of common-property resources display no interest in the long-term well-being of those resources. Assumptions of destructive self-interest (i.e. that "the users of common property are interested only in short-term material gain and that they cannot or will not erect institutions to preserve the resources on which their livelihood depends") underlie common property theory as it is applied to fisheries (Acheson 1989). Acheson's description of the lobster fishers' self-defined territorial rights and their efforts to conserve the resource belie these assumptions. In his view, the "tragic" common property model suggests that "resources such as fish can only be preserved through draconian and not very democratic government action" and "economists interested in the management of such resources see salvation only in the institution of private property." Acheson distinguishes communal ownership from private ownership, and emphasizes the former's potential for conservation. In the Maine lobster industry, the fishers now work within an innovative management strategy that involves both local and state mechanisms. At the local level, they have both informal and illegal entry limitations through the territorial system. At the state level, they have co-management with the state of Maine based on legislation which reflects their successful lobbying efforts. Many management efforts of this kind, however, are only in the formative stages.

In reviewing thinking on open access and communal common property models, Peters (1988) identifies a number of recurrent weaknesses: (1) the confusion of communal systems with open-access regimes; (2) the individualist bias of interpretive models; (3) the tendency to misspecify the relation between individual property rights and other systems of rights to resources; and (4) the absence of historical and institutional analyses which would provide an interpretive context.

Confusion of communal systems with open access regimes does not distinguish situations in which a limited number of owners are co-equal in their rights to use the resource (i.e. a communal system) from an open-access system, in which there are no

features of exclusion. This confusion leads to the incorrect assumption that there are no restrictions or limitations on the numbers of those who use common property.

Dominance of individualistic models has confounded interpretation of common property systems because they are not valid models for collective decision-making. Taking an example from game theory, the "Prisoner's dilemma" produces a "noncooperative" solution in which two rationally motivated individuals will act in their own self-interest, but their own ultimate disadvantage. This individualistic model is not a model for interdependent, group, or collective action, and does not explain social systems that can affect use of a communal resource.

Misspecification of the relation between individual property rights and other systems of rights to resources overlooks the influence of "conflict among users and among different rights and competing uses in a situation of political and economic change" (Peters 1988). For example, Thompson (1976) suggests that a long process of commercialization in which owners of private land used the English commons as a "free good" for their large flocks of sheep to the detriment of those commoners without access to private land explains the eighteenth century enclosure movement more accurately than collective careless use and overgrazing.

Peters (1988) explains the popularity of the allocation of property rights as a solution to many resource management problems as follows:

> The shortcomings of models premised on the behaviour of "rational" individuals to explain such essentially social systems as the organization of a common resource are compounded by the tendency of some theorists to invest these models with a normative cast. They assume a necessary connection between communal rights and the inefficient or destructive use of resources on the one hand and individual property rights and the efficient use of such resources on the other. This hierarchical opposition thus justifies the development of private rights to property in order to avert tragedies of the commons.

She cites "empirical studies that contradict the assumption that private property guarantees responsible and efficient management of resources" (Peters 1988, p.177).

In refuting the logic of private property as the panacea for over-exploited common property resources, Gilles and Jamtgaard (1981) identify two questionable assumptions.

> The first is that the benefits derived from converting common range into private pastures will exceed the costs. The second is that persons whose survival depends upon the maintenance of common pastures are incapable of acting collectively to protect these resources. An examination of existing common systems reveals that under many circumstances the elimination of common pastures is neither feasible nor desirable. In addition, it is clear many pastoralists have developed ways to protect and effectively utilize common pastures, just as agriculturalists have learned to manage collectively owned irrigation systems.

The authors go on to cite three empirical examples of properly managed communal pastures (i.e. one from the Peruvian Andes, one from the Swiss Alps and one from pastoral Africa).

Consistent with this approach, recent research in resource management finds the bioeconomic model and the ideology and practice associated with it to lead to "exploitive development" (Regier, et al. 1989). Arguing the case for "sustainable redevelopment," the authors cite "the complexity and ecosystemic processes together with the expanding and intensifying impacts by humans on ecosystems" as contributing to a trend toward institutional adaptation. This trend is seen to take the "generalized form of co-management or joint management [Dorcey, 1986]" (Regier, et al. 1989). Emphasizing the significance of growing awareness of the complexity and unpredictability of managing natural systems, Regier, et al. (1989) go on to point out the inappropriateness of doctrinaire ideological preoccupations with ownership and access questions, suggesting instead, a more community-based, self-regulatory approach. In particular, attempts to remediate impacts of exploitative regulation of the resources of the North American Great Lakes are cited as an example:

> As summarized in Regier [1986b], we have had to move from exploitive development to sustainable redevelopment; . . . from reliance on government to community-based self-help; from laissez-faire to more equitable regulation and husbandry of resources. (Regier, et al. 1989).

Critical of the belief in the market as guarantor of efficient use and a regard for efficiency as the sole criterion of a "correct" set of property rights, DeGregori (1974) argues for the importance of historical and institutional analysis. By pointing out "the historic factors of privilege that give some market power and . . . leave others powerless," he illustrates how lack of contextual analysis can confound analysis of resource use.

Peters (1988) also finds "romanticized notions of a precommercial, precapitalist past when communal rights preserved the land and permitted all to use it on an equal footing" to be as overly simplistic and deterministic as Hardin's (1968) common property "tragedy." She postulates that it is the critical role assigned to the individual which distinguishes these two types of models. In the "tragedy" model, individual well-being is in opposition to the social context. In the idealized communal model, the two are identical: the individual is a non-actor, blending into a preordained social order. Peters argues for a middle ground, the "social embeddedness of a commons," and suggests that alternative models put forward by some political scientists, anthropologists and economists better explain the interaction between "socially and politically embedded commons [common property]" and the "individual calculus." Such models may incorporate elements of cooperation among, as well as within, societal entities, such as government agencies at various levels and communities of resource users.

Peters concludes that the "tragedy" of a commons emerges not from an absence of social ties between the individual user and others, but from competing rights and claims to legitimate use. If this is true, then the practice of resource management would benefit from a deeper understanding of the social origins of this competition, and its use in the development of acceptable regimes of sustainable resource use.

Ostrom (1990) advocates the use of institutional arrangements originating, at least in part, from the resource users themselves, arrangements that do not depend entirely on imposition of full private property rights or centralized regulation by external authorities. In reviewing three influential models[18] frequently used to provide a foundation for recommending state or market solutions, she finds them useful for "explaining how perfectly rational individuals can produce, under some circumstances, outcomes that are not "rational" when viewed from the perspective of all those involved." Specifically, there are four problems with these models:

> First, the individuals using CPRs [common-pool resources] are viewed as if they are capable of short-term maximization, but not of long-term reflection about joint strategies to improve joint outcomes. Second, these individuals are viewed as if they are in a trap and cannot get out without some external authority imposing a solution. Third, the institutions that individuals may have established are ignored or rejected as inefficient, without examining how these institutions may help them acquire information, reduce monitoring and enforcement costs, and equitably allocate appropriation rights and provision duties. Fourth, the solutions presented for "the" government to impose are themselves based on models of idealized markets or idealized states. (Ostrom 1990)

In instances where conditions do not approximate the "extreme assumptions" utilized by the models, however, these special models cannot predict outcomes (Ostrom 1990). She finds it inappropriate to apply models that assume no communication, and no capacity to change the rules, to management of smaller-scale "common pool resources."

Ostrom (1992) argues:

> "that when a small number of homogeneous users share similar norms and a low discount rate, live near a resource, and are involved in many situations together, the likelihood of their finding better rules for governing their commons [shared resource] is increased."

She recognizes that other factors also affect the likelihood of success: (1) attributes of the resource; (2) the impact of external economic market factors; and (3) of the

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[18] The models are: (1) the tragedy of the commons; (2) the prisoner's dilemma game; and (3) the logic of collective action. Ostrom (1990) sees the free-rider problem "at the heart of each of these models."

government external to the community (Ostrom 1992). In particular, she sees the role of government as significant in facilitating or hampering the capacity of individuals to achieve, monitor and enforce agreements. Ostrom (1992) concludes that:

> Without some specialists who monitor, record information and interpret the rules in a consistent way, the shared community of understanding can so erode that the rules become meaningless. If the specialists are not themselves subject to review by others -- including all members of the community -- their shared understanding of the rules can also disintegrate and be replaced by a local despotism. Thus, I would argue that neither community nor enforcers are sufficient. Both are needed, and both can enhance the other. [emphasis added]

Singleton and Taylor (1992) put forward an argument about common property resources based on an analysis of the "transaction costs of solving a collective action problem." "Transaction costs" are defined as the costs of: "identifying the possibilities for mutual gains and those of them which are Pareto-optimal; negotiating an agreement on one of them and monitoring and enforcing it." They conclude that these costs are lower where specified community characteristics exist (i.e. (1) shared beliefs; (2) stable set of members; (3) expectation of continuing interaction; and (4) direct and multiplex interactions) exist, thus creating a situation of "mutual vulnerability." Singleton and Taylor (1992) acknowledge that "as the strength of community varies [as measured by the degree to which the defining characteristics are present], we would expect to move through a range" of resource management systems -- the strongest communities exhibiting more fully decentralized management and the regulatory agency taking a more prominent role where community is weaker. They see co-management "taking the form of an overall agreement, mediated and partly monitored and enforced by the state, which allows the subgroups to regulate their own members' behaviour consistently with the agreement" (Singleton and Taylor 1992).

In her review of several examples around the world of successful collective management of environmental resources, McKean (1992) specifies the characteristics of regimes that circumvent tragedy. Shared characteristics include: (1) well defined

communities of eligible user-managers; and (2) clear, easily enforced rules that are environmentally cautious (i.e. constrain resource use). There were striking differences, however, in how the harvested supply of the resource was distributed. Distribution systems ranged from hierarchial systems of rights with unequal allocation of the resource to very egalitarian systems that assign equal shares by lottery.

Although McKean (1992) found some variability in characteristics typical to users of communal resources, some general features prevailed:

(1) users must be present, and able to contribute (sale of shares may be allowed, but only to other eligible users of the communal resource, not to outsiders);

(2) communal control was exerted over the number of users;

(3) users had to convene regularly to make decisions about managing the communal resource;

(4) independent jurisdiction over the management of the commons (i.e. protected from interference in its management of the communal resource from other resource users or jurisdictional bodies -- in some examples where this protection was unavailable or ineffective, resource users utilized illegal means to protect their resource); and

(5) detailed, readily enforceable regulations both to restrict use when environmental health of the communal resource is threatened and to keep track of contributions and withdrawals from the commons.

These attributes contributed to efficiency of communal management by reducing transaction costs inherent in mobilizing the resource users to make decisions and rules (Ostrom 1982) and providing a measure of control over potential free-riders.

In terms of distribution of rights, McKean (1992) distinguishes three different kinds of rights: (1) eligibility for a share and participation in decision making; (2) entitlement to a share in the flow of income; and (3) entitlement to a share of the capital stock itself, or some portion of the proceeds when the resources are sold or subdivided

into private parcels. Inequality in eligibility for rights to communal resources was almost universal and, McKean (1992) hypothesizes, probably essential, in resolving tensions arising as user communities grow in size and new members wish for a share of the resource. Unequal distribution of eligibility functions by:

> . . . keeping the number of co-owners of the commons manageably small, but buying the cooperation and allegiance of groups large enough to destroy the commons when they become sufficiently angry at being disenfranchised -- [this] seem[s] to require inequality between co-owners of the commons and non-owners, and to encourage some additional stratification between senior co-owners and junior co-owners. (McKean 1992)

Distribution of the products of the communal resource was generally by rules that would distribute these products in direct proportion to private holdings, thus again reproducing existing inequalities in private wealth.[19] McKean (1992) cites, for example, several instances of hierarchial division of products of the commons based on private holdings. This "neutral distribution rule (one that does not alter the distribution of private wealth)," is economically efficient (1) in reducing transaction costs; (2) signifying a balance between costs and benefits to individuals of using the commons; and (3) maximizing production levels from private holdings (in instances where there was a ratio between various private and common components of the productive system).

McKean (1992) has little to say with respect to distribution of the proceeds when communal resources are partitioned or sold off to private buyers, but suggests that egalitarian rules awarding equal shares may be usual. She reiterates that the important distinctions are among fundamental rights, management practices and distribution at the time of partition.

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[19] Some exceptions are cited, in which the products of the commons are divided into equal shares, but the predominant practice is determined to be that entitlement to products of the commons was almost always based on private holding and thus reproduced the inequality in private wealth (McKean 1992).

Grima and Berkes (1989) examine the theoretical bases and allocative instruments for both community-based resource management and an alternative, management by central government agencies. They argue that the need to allocate resources, "either through the market process, communal agreement, kingly fiat or coercive decision" is key to making resource management consistent with an ecosystem approach. Some combination of instruments is likely to be required under both private and communal ownership.

> For example, the government needs to regulate the activities of private-resource users; the community needs to enforce regulations to members. Regulation, monitoring, policing and enforcement -- all these are the instruments of 'mutual coercion'. The rhetoric of the ecological romantics and of the hard-nosed economists differ; the instruments for allocating rights-to-use are quite similar. (Grima and Berkes 1989)

They note that there has been little progress in integrating community-level and government-level management measures. Grima and Berkes (1989) go on to suggest that, in addressing common property problems, the creation of communal-property rights consistent with traditional and neotraditional practices, where they exist, is a more effective management approach than 'top down' solutions.

Berkes' (1985) finds that Lake Erie fishers make informal arrangements to distribute resource rights among themselves and that these community management measures can extend beyond government regulation.[20] In Lake Huron, the indigenous system of "gentlemen's agreements" broke down about 1982, when there were some new entrants to the fishery whose goals and debt loads were significantly different from those of many of the traditional Lake Huron fishers.

In creating property rights for individual users, ITHQ can be inconsistent with traditional practices. Local-level management, such as Grima and Berkes propose,

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[20] This was true of Lake Erie only prior to 1979. From 1980 to 1984, with many new entrants, there was a free-for-all in the commercial fishery.

generally results in the creation of communal rights. It also has the advantage of linking the consequences of management decisions more closely to those who depend most on the resource.

Pinkerton (1980) discusses the use of allocated vessel quotas (a form of ITHQ) and argues that, in order to achieve their full long-run potential in facilitating resource conservation and efficiency, the quotas must be community-based and nontransferable. She reports on the Japanese experience, in which transfer of quota to parties not primarily interested in fishing had a deleterious impact on the ability of the remaining fishermen to bring to bear the community pressures which had earlier curbed over-fishing and illegal practices.[21]

Another potential weakness of the strict application of the property rights solution to fisheries management is that it overlooks the long tradition in Canada of social planning as part and parcel of resource regulation. A strong argument for inclusion of social planning in resource management in Canada is an instrumental one; policies which do not account for social factors are likely to be ignored, opposed or merely ineffective. Whillans and Berkes (1986) point out that fishery regulation may meet with considerable resistance from fishers when the regulations are not seen to be maintaining the social and economic benefits of the fishery. Karpoff (1987) developed a model of fishery regulation that incorporates realistic "self-interest" objectives of fishers. He describes the persistence of many traditional fishery regulatory techniques (e.g. restricted access and limitations on the use of capital equipment) despite theory and data that demonstrate "suboptimality," and suggests that such regulations are the natural products of socio-political processes, reflecting the "redistribution of wealth that is favoured by the majority of fishermen in the regulatory body's jurisdiction."

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[21] In this regard, it would be interesting to observe on-going developments in the Lake Erie fishery. Carling-O'Keefe, a large multi-national corporation, now owns Omstead Foods Ltd., formerly a family-owned harvesting and processing operation of long standing in the Lake Erie fishery.

2.4.3 Features of co-management regimes

In working to study more closely co-management ideas and their application to resource management, theorists have identified a number of features typical or desirable to co-managed resource regimes. These characteristics delineate management systems capable of equitably coordinating inputs of both resource users and managers. The following list summarizes salient characteristics of co-management, drawn from both the theoretical and case study literature.

(1) *Reliance on cooperative (rather than competitive) approaches to resource use (as discussed in section 2.4)* This quality exemplifies the communitarian aspects of resource use decision making, in contrast to the rational arguments towards individual property rights (Peters 1988).

(2) *Political independence (McKean 1992) and definition of property rights such as to limit access (Grima and Berkes 1989)* These features serve to protect the resource users from interference and challenges to their management authority (McKean 1992)and to restrict access to the resource to a pre-defined community (Grima and Berkes 1989). Grima and Berkes (1989) see some combination of instruments as likely to be required under both private and communal ownership: "For example, the government needs to regulate the activities of private-resource users; the community needs to enforce regulations on members."

(3) *Resource-users' input to the regulatory process (Buck 1989) and shared decision making (Pinkerton 1989b)* These related concepts include: the practice of (a) individuals' and groups' provision of comment during rule-making, and information and opinions to elected representatives (e.g. Chesapeake Bay fisheries); and may result in (b) altering the relationships among the actors in the fishery (between fishers and government, as well as among individual fishers and fishers' interest groups), allowing a

community of users to reduce the costs of sharing a resource, while capturing the benefits which can accrue to collective users (Ostrom 1977; Ostrom and Ostrom 1977).

Lobbying and negotiation with regulatory bodies and resource managers also addresses power sharing in institutional arrangements for resource management. Pinkerton (1989b) emphasizes the importance of decentralizing management decisions in fostering "more appropriate, efficient and equitable management."

(4) *Joint performance of management functions*[22] *to compare different systems of co-management (Pinkerton 1989b) and co-operation between the government and others and among scientists of different institutions and agencies and between scientists, fishers and managers in the form of shared decision making and responsibilities in managing the resource (McCay 1989)* Systems in which some, but not necessarily all, management functions are performed jointly may still deliver some of the benefits of co-management, and/or have potential for more comprehensive co-management. McKean (1992) also emphases the importance of users' involvement in setting, monitoring and enforcing rules governing resource use. Ostrom (1992) supports an emphasis on the role of external "specialists" as an important one in supporting co-management.

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[22] Pinkerton (1989b) defines these management functions as:

> (1) data gathering and analysis . . .; (2) logistical harvesting decisions, such as licensing, . . . timing, . . . location, . . . and vessel or gear restrictions . . . ;(3) harvest allocation decisions . . . ;(4) protection from habitat or water quality damage by other water resource users . . .; (5) enforcement of regulations or practices guiding harvesting logistics . . . ;(6) enhancement and long-term planning . . . ; and (7) broad policy decision-making.

(5) *Varying systems of distribution of rights and shares of the resource, such that inegalitarian and/or egalitarian traits support economic efficiencies or reduce the incentive to harvest heavily (McKean 1992)* "Neutral" distribution rules that maintain inequities can reduce transaction costs and may reflect resource users contributions. Egalitarian rules can invert the "free-rider" dynamic, creating a disincentive to overzealous harvest.

2.4.4 Sub-section summary and conclusion

This section has focused on literature that explores the contextual social and operational factors in resource management, looking carefully at some of the assumptions on which ITHQ is based and at factors affecting implementation of ITHQ. Co-management researchers see the failure to recognize and incorporate resource users' collective strengths and organization as a major weakness in the policies based on the bioeconomic model, from which ITHQ is derived. They see the root of this failure to be the assumption that competition for a common resource will be destructive, and that exclusive property rights will remedy the situation. Proponents of co-management propose an arrangement wherein regulatory interventions are developed and implemented cooperatively with resource users, and have identified characteristics typical of such arrangements. By incorporating some of the strengths of traditional resource use systems (e.g. cooperation, reciprocity), it is thought that such community-derived management systems, particularly those that are supported by an external governing agency, are potentially more efficient, effective and sustainable management regimes.

The bioeconomic literature resulting from the melding of biological and economic research reflects a strong theoretical approach but a weak on when applied. In general, this literature acknowledges, but does not examine, the importance of contextual social and operational factors in resource management. The body of literature created by maritime anthropologists, cultural ecologists and culturally-oriented common property theorists, on the other hand, does examine theoretical and practical social factors, but

here the emphasis is predominantly descriptive and socio-political. The approaches taken in these two bodies of literature have tended to meet in varying prescriptive measures for resource management, but they have not directly addressed some of the obvious relationships to do with the transition from a strict "tragedy of the commons" paradigm to more community-based and user-influenced resource development. The failure to address these transitional impacts stems in part from the paucity of empirically-based assessments of selected biological, social, administrative and economic conflicts and changes that result from the imposition of new or modified regulatory regimes. As a result, a valuable data set on process-related impacts in implementation of resource regulation has not been fully utilized.

2.5 Policy Process Models

A considerable amount of the foregoing discussion on the specifics of implementing ITHQ refers to the problems encountered in transition from theory to practice (sections 2.3.1 and 2.3.2). Fisheries researchers have linked these problems to the processes by which ITHQ was developed and implemented. The literature reviewed addressed some of the theoretical and actual advantages and consequences of ITHQ, and identified some of the problems encountered in its implementation. This section now goes on to introduce literature that questions some of the assumptions on which policy measures such as ITHQ are based. The commons research reviewed here has contributed to our understanding of the positive aspects of collective, cooperative decision making, and the confusions that can result from a poor understanding of how property rights function in cooperative resource use (section 2.4). Some fisheries researchers and advocates of co-management identify the important influence of policy process and understanding of social context on the efficacy of resource use policy such as ITHQ. Policy process models are relevant to analysis of the consequences of ITHQ in that they help explain not only the decision to adopt ITHQ but, more importantly, why implementation of ITHQ occurred as it did, and thus, how "deficiencies" in implementation have affected the fishery.

This section identifies and describes three perspectives which provide insight into the adoption and implementation of ITHQ in the Canadian portion of the Lake Huron commercial fishery. These perspectives are exemplified in: (1) the rational actor model, an idealized, rational decision-making process; (2) incrementalism, a conservative policy process, in which policy changes in only small steps; and (3) interest group theory, which depicts the policy process as a power struggle among various interest sectors. In illustrating alternative views of the policy process, these models help to explain how ITHQ came to be developed and implemented in the way that it was. Deficiencies in the method of ITHQ development and implementation partially explain the observed consequences of ITHQ.

Each of these models offer some insight into the manner of how policy alternatives gain prominence and are selected and implemented. Each theory explains at least one group of decisions and interactions very well, but must be adjusted or augmented when seeking a comprehensive explanation. As utilized in this study, the models are largely complementary, (as opposed to competing). By drawing on this array of conceptual models it is possible to create a more informative analysis of the decision making and impacts associated with the development and implementation of ITHQ.

2.5.1 The rational actor model

The rational actor model, with its operative assumptions of rationality, shares some commonalities with the bioeconomic model that resource economists have developed for the management of renewable resources. (See Figure 2.2.)

Rationality refers to consistent, value-maximizing choice within specified constraints. The power of the theory of rational action derives from its rigor. Policy is considered rational when it is most efficient, or when objectives and actions/consequences are clearly linked. This idea of efficiency, according to Dye (1972), involves "...the calculation of all social, political, and economic values sacrificed

or achieved by a public policy, not just those which can be measured by quantitative symbols" (emphasis in original). Dye (1972) outlines the theoretical imperatives of the process by which a rational policy is selected (see Figure 2.2):

> . . . policy makers must: (1) know all of the society's value preferences and their relative weights; (2) know all of the policy alternatives available; (3) know all of the consequences of each policy alternative; (4) calculate the ratio of achieved to sacrificed societal values for each policy alternative; (5) select the most efficient policy alternative.

These assumptions lend power to any model. Downs (1967) elaborates:

> If a theorist knows the ends of some decision-maker, he can predict what actions will be taken to achieve them as follows: (1) he calculates the most reasonable way for the decision-maker to reach his goals, and (2) he assumes this way will actually be chosen because the decision-maker is rational.

This rigor depends on assumptions that are too restrictive for many empirically oriented applications. For example, an assumption of comprehensive rationality entails an accurate mapping of all consequences resulting from the choice of any alternative action or policy. The rational actor model also accommodates an alternative assumption of "limited rationality," which permits consideration of a more limited range of information and alternatives.

The bioeconomic model stipulates, within the rigorous rational model, a situation of limited rationality. This none the less confines analysis to a narrow range of values and consequences within which value-maximizing activity can be identified (Allison 1971).

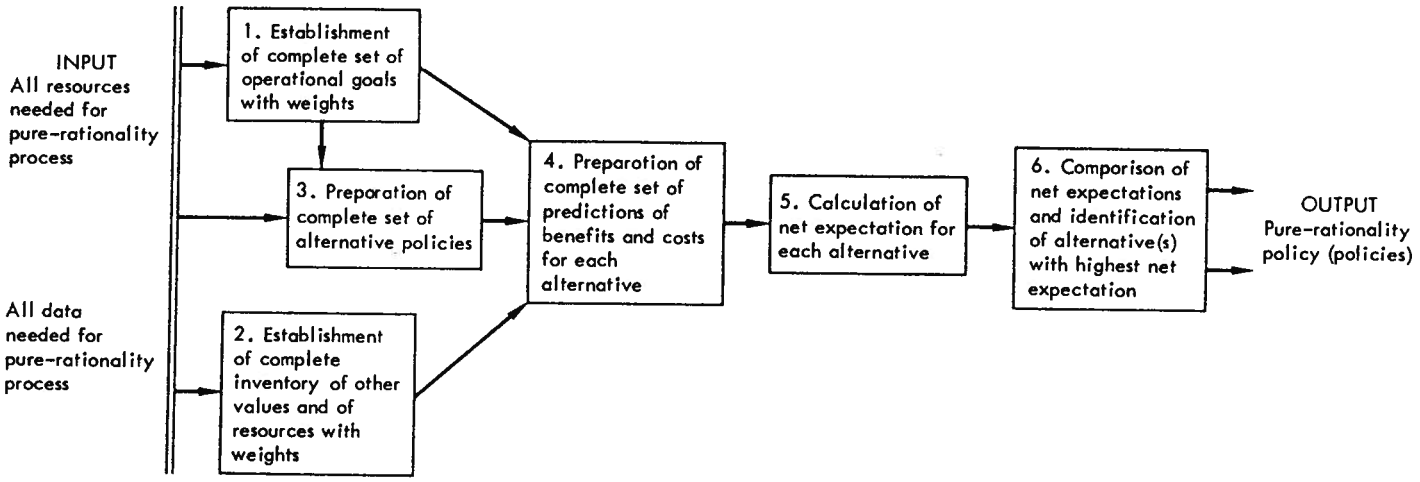

FIGURE 2.2: The Rational Model

SOURCE: Dye 1972

In exploring the influence of often unrecognized assumptions on analyses of policy decisions, Allison (1971) identifies the classical rational actor model as the basic frame of reference used by many analysts.[23] As Allison (1971) explains, conceptualizing policy makers "as if they were centrally coordinated, purposive individuals provides a useful shorthand for understanding problems of policy." He continues:

> But this simplification -- like all simplifications -- obscures as well as reveals. In particular, it obscures the persistently neglected fact of bureaucracy: the "maker" of government policy is not one calculating decisionmaker [sic] but is rather a conglomerate of large organizations and political actors. (Allison 1971)

He argues that the rational actor model must be supplemented ("if not supplanted") by frames of reference that focus on the organizations and political actors involved in the policy process.

In reference to economic theory and the policy process, Lindblom (1959) recognizes these same limitations, and suggests a remedy:

> Only in relatively restricted areas does economic theory achieve sufficient precision to go far in resolving policy questions; its helpfulness in policy-making is always so limited that it requires supplementation through comparative analysis.

2.5.2 The incremental model

This section describes the incremental model of public policy and its contribution to understanding implementation of ITHQ.

The incremental model recognizes the practical limitations of the classic rational actor model and describes a more realistic process of decision making. The rational

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[23] Although Graham Allison's (1971) seminal work, Essence of Decision, focuses on foreign policy, his thinking and conclusions have been widely applied to policy analysis in many fields.

model assumes that the ideal solution, once identified, is persuasive to all involved in the decision making process. Thus the "politics" of decision making become immaterial. Lindblom (1959) outlines two factors that limit the usefulness of classical analysis in policy making: (1) a great deal of information on all possible alternatives is required; and (2) the analysis is at too large a scale for application to a policy process that moves through small changes. Incremental analysis economizes on the need for data and directs attention to the information that is relevant to the crucial choices faced by policy makers. In general, Lindblom (1959) finds it unrealistic to assume that policy makers: (1) review the whole range of existing and proposed policies; (2) identify societal goals; (3) research the benefits and costs of alternative policies in terms of the ratio of benefits to costs; and then (4) make a selection on the basis of all relevant information.

Incrementalism describes policy making as a continuation of past activities, with only minor modifications (see Figure 2.3). First presented and further articulated by Lindblom (1959 and 1979) to explain decision making used by public administrators, incrementalism describes a decision-making method based on successive limited comparisons that achieves change by small steps. Lindblom (1979) distinguishes the following three types of incremental analysis.

(1) Simple incremental analysis, which is limited to consideration of alternative policies all of which are only incrementally different from the status quo.

(2) Disjointed incrementalism, which is marked by a mutually supporting set of simplifying and focusing stratagems, including simple incrementalism and the following:

   (a) limitation of analysis to a few familiar policy alternatives;

   (b) an intertwining of analysis of policy goals and other values with the empirical aspects of the problem;

   (c) greater analytical preoccupation with ills to be remedied than positive goals to be sought;

   (d) a sequence of trials, errors, and revised trials;

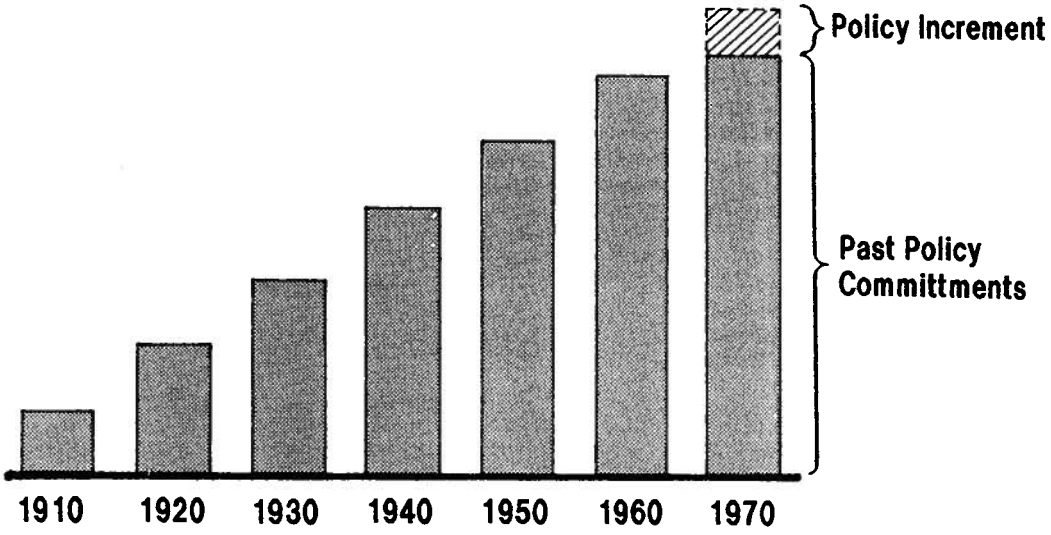

FIGURE 2.3: The Incremental Model

SOURCE: Lindblom, 1959

(e) analysis that explores only some, not all, of the important possible consequences of a considered alternative; and

(f) fragmentation of analytical work to many (partisan) participants in policy making.

(3) Strategic analysis, which is limited to any calculated set of stratagems to simplify complex policy problems, in a short-cut of the conventionally comprehensive 'scientific' analysis.

The strength in disjointed incrementalism lies in its recognition of the impracticalities inherent in policy making along the lines of the classical rational actormodel, and its description of a more conservative[24] decision-making process disposed to maintaining existing institutions (Dye 1972). These strengths are exemplified in the following characteristics, inherent to incrementalism (Dye 1972).

(1) Existing programs, policies and expenditures are considered as a base, and attention is concentrated on new programs and policies and on increases, decreases, or modifications of current programs.

(2) There is seldom the time, intelligence or resources to investigate all of the alternatives to existing policy.

(3) As the consequences of completely new or different policies are uncertain, previous policies are accepted as legitimate.

(4) There may be heavy investments in existing programs which preclude radical change.

(5) Politically expedient agreement is more readily reached when discussion focuses on increases or decreases in budgets or modifications to existing, not new, programs.

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[24] The term "conservative" is used throughout in the sense of adverse to rapid or radical change.

The incremental model is related to the concept of "satisficing," as popularized by Simon (March and Simon 1958), wherein people will settle for a less than a totally efficient solution, one that is "good enough."

The incremental model does not assume a comprehensive survey of the various alternatives. It models a decision-making process that builds in a limited, self-referencing way, upon what has gone before. Thus there are a number of recognized limitations in the incremental model. First, it does not include a review step for all relevant values, and may lead to oversight of appropriate policies because they are not suggested by the preceding chain of policy. This type of omission would most seriously affect policy making during a time when there was a significant shift in societal values, such as in the 70s, when environmental issues were first becoming significant in policy making, but had not previously been major considerations. Second, information may be excluded arbitrarily. This would result from a focus on information of relevance to previous policy, rather than on a new definition of the policy problem. Third, it assumes a fragmented approach to policy making. Given that only a limited policy area is given consideration, the incremental model describes a policy process that is detached from developments in other areas which might affect or be affected by developments in the area under study.

As elucidated by Lindblom (1979), these exclusions are deliberate, systematic and defensible. He sees that " . . . carefully considered disjointed incrementalism is an improvement on conventional attempts at formal completeness that always lapse, for complex problems, into undefensible makeshifts." In any form of analysis, information will be excluded, the choice between comprehensiveness and disjointed incrementalism, is thus between accidental, uninformed incompleteness on one hand and deliberate, informed incompleteness on the other. Lindblom (1979) defends fragmentation of policy making as a method of curbing power and raising the level of information and rationality brought to bear on decisions. Lindblom's defense of incrementalism introduces the concept of power into the decision-making process, and offers a method of diffusing its

impacts. The process by which this is achieved is by selecting alternatives that (1) minimize risk by making only small changes and (2) seek consensus in the process of selecting alternatives.

2.5.3 The interest group model

This section describes the development of interest group theory and its role in our understanding of public policy.

As expounded by Truman (1951), group theory, or as termed here, interest group theory, begins with the proposition that interaction among groups is the central fact of politics. Individuals with a common interest band together formally or informally to promote their demands with policy makers. According to theorists of this tradition, individuals are important in politics only when they act on behalf of group interests. The group thus becomes the link between the individual and policy makers. In relation to interest group actions, Dye (1972) identifies the task of the political system as that of managing group conflict by (1) establishing rules; (2) arranging compromises and balancing interests; (3) enacting these compromises in the form of policy; and (4) enforcing these policies.

Interest group theory is a model in which equilibrium is determined by the relative strength of influence of interest groups competing to sway public policy (see Figure 2.4). Changes in the relative influence of the various interest groups would be seen in policy modifications which reflected the wants of the more powerful group(s). The most effective groups tend to (1) have strength of numbers, relative to other groups active in the interest area; (2) represent members who closely share similar attitudes towards the issues affecting group interests; (3) have adequate economic and organizational resources to communicate effectively with their membership and the general public; (4) have effective leadership; and (5) have access to policy makers.

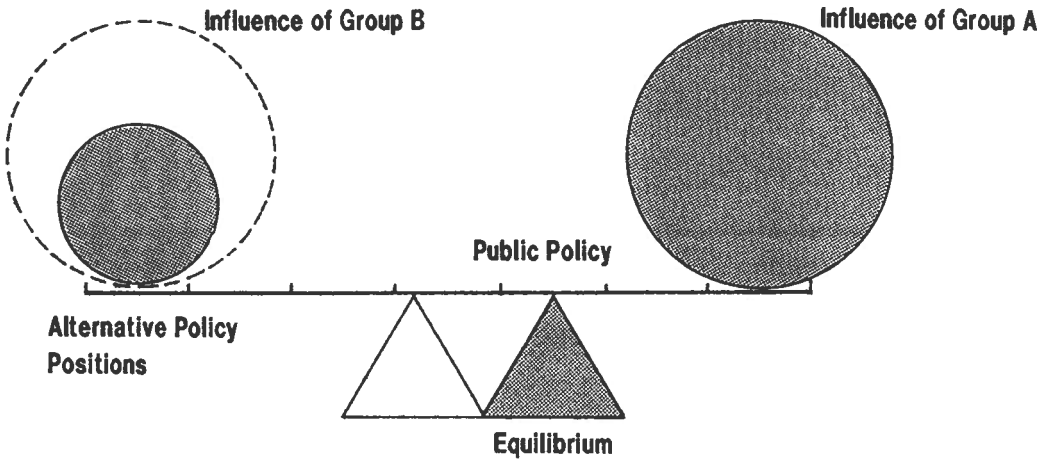

FIGURE 2.4: The Interest Group Model
SOURCE: Dye, 1972

As outlined by Dye (1972) the major characteristics of the policy process from the group theory perspective are: (1) policy makers are responding to group pressures through bargaining, negotiating and compromising among competing demands of influential groups; (2) a large, nearly universal latent group favours the status quo, and can be motivated to support it; (3) individuals may be affiliated with a number of different groups, and this moderates the demands of groups, who must avoid offending their members who have other group affiliations; and (4) competition among groups operates to check the influence of any single group.

In the interest group model, the power and influence of the interest group is used to maintain or challenge existing policies. Change is instigated from outside the status quo. In the incremental model, power is vested at the centre, with the status quo, as represented by existing programs and policies, and changes originate from this centre.

2.6 Chapter Summary and Conclusion

Hardin's discussion of the "tragedy of the commons" popularized an enduring interpretation of the common property paradigm in resource management (1968). Two major schools of thought refer to this paradigm. One is the bioeconomic model of resource management. A second resource management model, the co-management model, emphasizes community-shared stewardship of resources, including government as a management partner, but with somewhat less reliance on government interventions than evidenced in management systems derived from the bioeconomic model.

These two approaches differ conceptually. The bioeconomic model emphasizes competition and supremacy of individualism and the co-management model communitarianism (Berkes and Farvar 1989). This pivotal difference between these approaches hinges on the need to specify exclusive property rights. In developing the co-management model, commons researchers specify a common property resource as being utilized in common by a distinct group of individuals. The approach reflected in

the assumptions that form the basis of the bioeconomic model assumes a common property resource is "open access," without specific ownership. The most important distinction between the assumptions of these two approaches is that the bioeconomic model assumes a common property resource as open access and the co-management model defines a common property resource as accessible only by a specific group.

The bioeconomic model of resource use has been a dominant paradigm in resource management for the past twenty years. Relying on this model as a rationale for intervention to control the expansion and deployment of fishing capacity (Pearse 1980), fisheries managers have promulgated policy, supporting regulations and administrative infrastructure consistent with its precepts. Based on an understanding of interrelated biological and economic forces illustrated in the bioeconomic model, fisheries managers have suggested interventions to reduce harvest capacity and protect fish stocks.

The relatively recent emphasis on co-management systems of resource use has meant that very little interdisciplinary research exists on the possible impacts of theoretically-derived, property rights-based regulations (such as ITHQ) with respect to: (1) the impacts of the process of developing and implementing these regulations; and (2) the impacts of these regulations on the resource, resource users, and resource management. This thesis begins to address this need by examining and analysing the ITHQ-related changes in the organization and management of the Lake Huron commercial fishery that occurred between 1980 and 1985, and assessing the impacts of these changes and the impacts of the process by which ITHQ was developed and implemented. Assessing the processes of ITHQ development and implementation examines, to the extent that they are evident, the nascent aspects of co-management in the Lake Huron fishery during the study period.

In the transition from theory to practice, ITHQ encounters a number of significant problems. The most pressing of these problems include: (1) the need for reliable information on landings and for consistent, accurate stock assessment; (2) the

requirement for separate quotas for each stock needing management; (3) allocation/equity issues; and (4) assessment problems with timing and quantification in adjusting quotas. In practical terms, addressing these issues means substantial increases in monitoring, enforcement, stock assessment and liaison with resource users.

Co-management researchers see the failure to recognize and incorporate resource users collective strengths and organization as a major weakness in ITHQ assumptions. They see the root of this failure to be the assumption that competition for a common resource will be destructive (as exemplified in the "tragedy of the commons"), and that exclusive property rights will remedy the situation. Proponents of co-management propose an arrangement wherein regulatory interventions are developed and implemented cooperatively with resource users. By incorporating some of the strengths of traditional resource use systems (i.e. cooperation, reciprocity and husbandry of the resource), it is thought that such community-derived management systems would be more efficient, effective and sustainable management regimes.

The bioeconomic model is very good at defining specific important biological and economic interrelationships, and the narrow range of economic performance likely to be observed in nearly all mature, unregulated fisheries (Pearse 1980). The bioeconomic model is not a decision-making model. It does not address a number of significant aspects of policy development and implementation. The creation and implementation of policy requires an understanding of the range of forces that are brought to bear in the policy process. The complex processes of negotiation and compromise that underlie the attainment of consensus are the management of influence, and are better illustrated by examination of the models of decision making explored in this study.

This extended literature review has surveyed work relating to: (1) theoretical aspects of biological, bioeconomic and co-management models of resource management; and (2) the results of implementation of management systems derived from these theoretical models, in particular the use of ITHQ to address problems of overharvest and

overcapacity in fisheries. Analysis of this literature indicates that in implementation, ITHQ does not always work as theoretically predicted, and focuses attention on problems relating to administrative, enforcement and social/cultural aspects of the process of ITHQ development and implementation. Review of selected policy process models picks up on this thread of concern regarding the process aspects of ITHQ development and implementation. In so far as these policy process models help to explain how ITHQ came to be developed and implemented in the way that it was, the analysis provides an explanatory link between the theoretical expectations of ITHQ and the observed consequences of its application, as illustrated in this case study.

Based on the literature review presented in this chapter, the specific issues to be addressed in the case study are as follows.

(As identified in section 2.3.1.)

- Reduction in capacity. Measured by a reduction in the amount and value of vessels and gear involved in the fishery (with a concomitant reduction in the number of fishing operations).
- Control of harvest. Indicated by the amount of harvest of principal commercial species.
- Efficient utilization of capacity. Indicated by a trend towards those enterprises with lower investment, or capacity, harvesting lesser amounts of fish than those with a higher investment, and those with a higher investment harvesting greater amounts.

(As identified in section 2.3.2.)

- Elements of administrative infrastructure such as monitoring, enforcement and stock assessment.
- Communication and consultation with resource users in policy development and implementation.

(As identified in section 2.4.)

- Roles of resource managers and users in co-operative development and implementation of regulatory interventions.

(As identified in section 2.5.)

- Management of power through processes of negotiation and compromise.

3.0 DATA COLLECTION

This chapter describes the sources of, rationale for, and strengths and limitations of the data utilized in this research.

The ideal evaluative process begins with a set of hypothesized causal relationships that relate to a realm of policy choice. Evaluation of ITHQ is an attempt to understand the impacts on existing conditions that are associated with the introduction of this policy. Impacts can be expected or unanticipated. In the context of this study, the primary causal relationships are derived from the bioeconomic model. The outcomes of ITHQ will also be examined using the filter of three policy process models to discern whether the results of ITHQ are better explained by the rational process factors or by some of the less well defined elements associated with the development and implementation of policy. The incremental model of the policy development process defines some of these elements as attributable to a conservative process of incremental changes, in which previous conditions are very influential in defining new policy. Interest group theory models a policy process based on influence and bargaining, in which political and social strengths of interest groups or sectors are instrumental in policy development and implementation.

A major impetus for examination of fishery policy is the requirement for an understanding of the objectives and behaviour of fishing communities and individual fishers as an aid to development of economic policies and regulations in fisheries (Charles 1988). The method of this case study incorporates quantitative and qualitative analysis. Qualitative information from key actor interviews, written and other sources, and quantitative information such as broad statistical descriptions of the economic and biological components of the fishery are utilized. This research uses all available or readily produced data on a wide range of impacts for the purpose of providing information for distinguishing the early impacts of ITHQ regulation.

The data set is described below.

3.1 The Quantitative Data

In chapter two, the assumptions and causal relationships that underlay the development and implementation of ITHQ were explored. It is suggested that in an open access common property resource the tendency is for equilibrium to be achieved at the point where total revenue equals total cost, and all resource rents have been dissipated. This equilibrium point is associated with conditions of overharvest and overcapacity in the fishery. Overharvest is related to attempts to maximize the total revenue of individuals or firms and to reduce the economic inefficiencies related to overcapacity. Overcapacity is a competitive response of individuals or firms to the existence of indirect regulatory devices such as those that control gear, season and area.

In theory, ITHQ addresses the perceived problem of open access in common property resource use by creating exclusive property rights. This should reduce the need for excess capacity, since the fisher is assured some defined share of the resource. In addition, control of the total annual harvest should reduce the likelihood of overharvest if levels are appropriately defined.

To examine the impact of ITHQ on harvest and capacity this study analyzed data on: (1) number and association of licensed operations; (2) harvest amounts; (3) harvest value; (4) investment; and (5) employment. The specific variables measured were: (1) number of licensed operations; (2) harvest amount and value of whitefish and chub; (3) investment in vessels and gear; and (4) number of persons employed.

3.1.1 Source and limits of the quantitative data

A statistical description of major elements of the fishing industry is drawn from harvest and investment reports the government required the commercial fishers to file annually until 1986 using Form CF.8A (Form CF.8A is obsolete, see Appendix 1). Analysis of these time series data supplies a picture of the significant harvest and

investment trends in the industry before and immediately following the introduction of individual transferable harvest quotas. Empirical descriptions of changes in the numbers of fishing operations, harvest amounts and values of the two principal species, employment, and existing and new investments in gear and vessels, make an important contribution to the interpretation of ITHQ impacts.

The time series of the data is short (i.e. generally four years preceding, and two years following quota regulation) and there are relatively small numbers of commercial fishing operations on Lake Huron (e.g. ranging from a peak of 86 in 1980, to a low of 58 in 1985). The findings of this preliminary research are presented as tentative factors only, and probable linkages are interpreted with caution. The analysis, however, does indicate some initial trends in ITHQ impacts.

OMNR has continued to collect data on the commercial fishery, utilizing since 1986 a modified instrument. For this and other reasons, the quantitative data set compiled for this research is not perfectly compatible with the post-1985 OMNR Commercial Fish Harvest Statistics data base. Nevertheless, the 1986-1989 harvest amounts and value of harvest from this data base are depicted graphically in section 5.1.1 in order to give some indication of changes in these data since the conclusion of the study period.

3.1.2 Method of analysis of quantitative data

Empirical information on the numbers of fishing operations, harvest amounts and values of the two principal species, and existing and new investments in gear and vessels was derived from the OMNR Form CF.8A, Annual Commercial Fishing Report, completed by each fisher in the study area. Copies were obtained from OMNR of the completed forms for all commercial fishing operations, for the years 1980 to 1985 inclusive. In order to preserve confidentiality, the reports were coded with numerical identifiers for each operation.

A data record (defining the case, record number, variable name, variable label, value range, value label and field) was designed to compile the information from the reports onto Fortran coding forms. Seven, eighty-column records were required for each completed report. The coded information was then transferred (in verified form) to computer tape for analysis.

The data set was 'cleaned' through a series of checks for logical errors, including, but not limited to, searches for inappropriate maximum and minimum values, errors in data field parameters and random comparisons with selected original reports.

Analysis of the data set utilized SPSSx[25] to assess variable distribution, develop data categorization and compute frequency, average and percentage statistics.

3.2 The Qualitative Data

Although the causal relationships defined in the bioeconomic model have been interpreted to indicate that the development and implementation of ITHQ should control harvest and capacity, the co-management model described earlier argues that the assumptions of individual economic rationality inherent in the bioeconomic model are unrealistic. This criticism suggests that the outcomes of ITHQ may be a function of the manner of development and implementation and administration of the policy process. Impacts attributable to the policy process are not easily accessed by way of aggregate quantitative data.

This key research component of the study was addressed through a series of open-ended interviews with fourteen senior and intermediate level fisheries researchers and managers in Ontario as well as twenty-one representatives of a major user of the

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[25] SPSS[x] User's Guide, Edition 2, 1986.

resource, the commercial fishers (see Appendix 3: Interview Respondents and Affiliations).[26] Consistent with accepted research methods in policy analysis (Patton and Sawicki 1986), key actor interviews were used to gather information on ITHQ policy because: (1) it is a new topic in the study area; (2) there is little written information on the Lake Huron commercial fishery; (3) respondents were reluctant to put certain answers in writing; and (4) quantitative information on investment and harvest practices is incomplete. Key actor interviews were considered to be the best of a number of alternative methods for obtaining comparable information. Other methods considered were associated with significant drawbacks. Structured questionnaire delivered in person by the author (would not be accepted by many respondents as confidential and anonymous, could overlook significant information). Mailback survey (assumes literacy on the part of the respondent, would be associated by many respondents with "the government," would not be accepted by many respondents as confidential and anonymous, requires a large sample size). Use of a number of interviewers (would introduce inconsistency in delivery of the interview and recording of responses). Facilitated workshop(s) (would not be anonymous or confidential, the formal structure would be intimidating to some respondents, would not allow an in-depth discussion of as broad a range of topics).

The data provide qualitative descriptions of: (1) fishing and marketing practices; (2) attitudes towards ITHQ development and implementation; and (3) expected and unexpected impacts of ITHQ.

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[26] The analysis in this section focuses most closely on the results of the interviews with the commercial fishers. Information from interviews with fisheries managers and scientists, although important in interpreting the results of the interviews with the commercial fishers, was most useful in piecing together the policy context, as reviewed in Chapter 4.

3.2.1 Source and limits of the qualitative data

The interview schedule is organized under eight governing areas of inquiry. Areas one and two focused on an understanding of the causal relationships and the behaviour modifications that could be logically anticipated. Areas three and four looked at the perception of change introduced by ITHQ. Area five queried the process of consultation. Areas six, seven and eight examined details of the response to the way ITHQ was developed and implemented. (See Appendix 2 for the interview schedule and details of its development.)

The interview schedule comprised open-ended questions based on a modified version of the Guttman mapping sentence (Shye 1978; Guttman 1972). (See Appendix 2.) The interview schedule was not structured as a survey. Therefore, the result is not a highly structured empirical data set in which any pair of observed attitude and information profiles is perfectly comparable. The information collected through these lengthy key actor interviews provided primary information on the impacts of ITHQ and the impacts of the process of ITHQ development and implementation on the fishery. It also provided an interpretive context for analysis of the fisheries data base.

3.2.2 Selection of respondents and interview strategy

Potential respondents were identified on the basis of the following primary criteria: (1) involvement with commercial fishing in Lake Huron; (2) involvement in ITHQ development and implementation; (4) positions as industry and/or government spokespersons; and (5) agreement to be interviewed. Individual managers and scientists were identified on the basis of the following secondary criteria: (1) general managerial or scientific responsibility for aspects of commercial fishing in Lake Huron; (2) involvment in ITHQ development and implementation, both at head office and in the district offices through inquiries at Fisheries Branch, OMNR. A listing of commercial fishers in Lake Huron was obtained from OMNR. Individual fishers were selected from

this list on the basis of the following secondary criteria: (1) location, size and type of operation; (2) fishers who had initiated legal action against OMNR on the subject of ITHQ and/or were themselves the object of legal action initiated by OMNR on the subject of ITHQ; (3) the functional economic linkages (i.e. fishers who fish their several licenses and vessels as one operation) among license holders that were not evident from the listing of individual licenses; and (4) individuals who fit the above criteria and requested to be interviewed.

Willing respondents were approached on the basis of their involvement with the development and implementation of quota regulation on the lake. Not all respondents were equally familiar with all of the issues covered in the interview schedule, and so their responses varied widely in subject and depth. For example, fishers spoke most knowledgeably about the changes that affected them personally. Respondents were selected as informed representatives of the people most involved and affected by the policy. In order to study a wide variety of possible impacts, respondents were chosen to represent a breadth of circumstances (e.g. small and large operations, processors, producers, scientists, managers and enforcement personnel).

The interviews took place in the respondents' place of work or their home. All interviews and follow-up conversations were conducted exclusively by the author. Sometimes respondents' family members or colleagues would sit in on the interview and offer comment or prompt the respondent. In general, respondents were unguarded in demeanour and eager to provide information on their views and behaviours. Most interviews took two hours or longer. Where appropriate, additional time was available for a tour of fishers' and processors' facilities and equipment. Both the respondent and the interviewer had a copy of the interview schedule, which was used as a discussion guide, although respondents were encouraged to introduce additional topics if they wished. In general, few wholly new topics were broached, and variation among interviews was mostly in terms of variance in emphasis on different topics. The interviewer took extensive notes throughout the interview. The interview process

extended beyond a one-time only run-through of the interview schedule. As issues became defined in more detail, they were cross-checked through telephone or face-to-face conversations with other respondents and in written documentation. Seldom did any one individual ever relate "the full story" of a particular situation or issue. Where the following analysis is based on confidential interview sources, quotes are anonymous; a primary reason for this is that most sources asked that the interviews remain confidential. The sources, however, are cited where possible and appropriate.

While the results of the interviews did not cause revision of the study objectives, they did confirm the significance of distinguishing the impacts of ITHQ from the impacts of the process aspects of ITHQ development and implementation. Fishers in particular were at pains to distinguish their opinions of ITHQ itself, from how ITHQ was developed and implemented.

Beyond general references to harvest of more or fewer fish, or receipt/expectation of a better or worse price at one time or another, quantitative data was not used in the interviews.

3.2.3 Method for analysis of qualitative data

Following an accepted method in informant investigation, information garnered through key actor interviews was reviewed in reference to information from official documents, academic literature, historical information and reports (Savatsky and Freilich 1981). After selecting those traits central to the inquiry, results were compared and contrasted in order to suggest any change owing to ITHQ. This analysis of field research findings (in the form of key actor responses) enabled exploration of less quantifiable, but highly revealing parameters of ITHQ impacts.

The key actor interview method is a highly cost-effective field technique. Following field work and the amassing of background data, key actor interviews can be

effectively analyzed without the barriers of many computerized analyses. Further, the methodology has the advantages of an open ended process capable of yielding intensive data on many aspects of the research question, a broad scope of information for minimal cost, and a flexibility to allow development of hypotheses based on intensive personal contact (Savatsky and Freilich 1981).

Interview responses were analyzed inductively. The patterns, themes and categories of analysis emerge from the raw responses, rather than being decided prior to data collection and analysis (Patton 1987). Two patterns emerged from analysis of the data: (1) categories developed and articulated by respondents to organize presentation of particular themes; and (2) categories or patterns for which respondents did not have labels or terms, for which such terms were generated. Themes in regard to 'incidental catch' are examples of the first category. Themes referring to 'autonomy' are examples of the second category.

As described in Appendix 2, the interview schedule was structured in a certain way in order to cover a specific range of topic areas. To preserve the integrity of the interview responses, the analysis is presented in the same order as the topics in the interview schedule, with specific reference to the questions pertaining to each issue.

This analysis followed an established procedure in analysis of qualitative interview data (Patton 1987; Savatsky and Freilich 1981). The effort at uncovering patterns, themes and categories was a creative process requiring considered judgments about what is really significant and meaningful in the data. Once identified, either using respondent-generated constructions or analyst-generated constructions, these dimensions describe linkages between processes and outcomes in ITHQ implementation. These linkages are a fundamental issue in policy analysis (Patton 1987). This analysis describes the causal linkages suggested by, and believed by, respondents. While the literature in this field acknowledges that insights derived by this method must be qualified (as in this study),

they are, nevertheless, accepted as informed and data-based hypotheses, grounded in field observations (Patton 1987). As such, they provide valuable information about ITHQ.

3.3 Summary and Conclusion

The data base for this study included information from key actor interviews, written and other sources, as well as quantitative information on the economic and biological components of the fishery. The quantitative data base was compiled from the completed Annual Commercial Fishing Report forms (Form CF.8A). It provided information on harvest amounts, species and values, numbers of fishing operations, employment and investment. The qualitative data base was compiled from key actor interviews with fishers and fisheries managers and scientists. It provided information on association of licensed operations, changes in fishing and marketing practices, attitudes towards ITHQ development and implementation, and expected and unexpected impacts of ITHQ.

4.0 A CRITICAL EVALUATION OF DEVELOPMENT AND IMPLEMENTATION OF ITHQ

This chapter describes chronologically the important issues and the background and contextual factors that influenced the introduction and implementation of ITHQ in Lake Huron. While the subject of this research is the impacts of ITHQ, and not specifically the adoption nor the subsequent changes to the policy, this discussion is none the less essential for understanding the ITHQ policy. It is useful in understanding both the substance of the policy changes and the processes by which they came about. While the process by which ITHQ policy came about and the specific measures adopted do not directly explain the consequences in the fishery of those policies, they do have an indirect influence. For example, in the Lake Huron case, it may be that some of the consequences of ITHQ in the fishery are the result of deficiencies in implementation, and that these deficiencies, in turn, stem from the process by which the policies were chosen and implemented.

Reference to "the industry" indicates a range of commercial fishery participants including: fishers, processors and wholesalers.

4.1 Development of Quota Regulation

In response to concerns about overfishing and declining fish stocks in the Great Lakes, fisheries managers are seeking to control or reduce pressure on fish stocks. In the past, the most frequently employed methods have been indirect controls on seasons, gear and areas to limit the fishing effort of commercial fishers, and achieve the management goal of protecting fish stocks. Indirect controls have proved unwieldy, expensive to enforce and obey, and have been evaded on occasion. In some instances, legislation has been inconsistent and ineffective. For example, in the early 1980s, regulations requiring 6.55 cm mesh size for perch nets was intended to limit the size of harvested fish to 20 cm. Dockside, at least one half of the perch harvested with these

nets were under 20 cm. The Ontario Ministry of Natural Resources (OMNR) lost several legal cases regarding measurement of the fish, which although measuring 20 cm when first caught, shrank below the legal limit after several hours out of the water.

In the Canadian portion of the Lake Huron fishery, fishers and managers anticipated individual transferable harvest quotas in 1982, and expected legislation in 1983, and first came into effect in the 1984 season. Quota regulation is part of a provincial fisheries modernization program initiated to safeguard the continued viability of commercial and sport fish stocks. The quotas are attached to specific fishing licenses, and can be sold or leased subject to the area, gear and season conditions listed on the license. Since 1985, ITHQ appear as conditions of the commercial fishing licence.

In the history of Great Lakes fisheries, there have been times when too many pounds of fish were taken from the fishery too quickly (Whillans and Berkes 1986). Looking back as far as the 1790s, Whillans and Berkes outline several boom-and-bust cycles in Great Lakes fisheries, including intense harvest of specific species and the collapse of lake trout and lake whitefish stocks in the upper Great Lakes. In the period leading up to the implementation of ITHQ, the potential for over-harvest existed in the Lake Huron commercial fishery, in the form of gear and vessel capacity. For fisheries managers, the challenge was one of determining a sustainable level of resource harvesting, equitably allocating it, and monitoring compliance with the management system.

In order to assess the usefulness of quota regulation in managing the fishery, managers and fishers need to know its impact on how fishers run their operations, the changes in the amount and value of the commercial harvest, as well as its advantages and disadvantages. While it is still too soon to assess definitively the impact of quota regulation on the fish community, the process of allocating and administrating individual transferable harvest quotas has already had important effects on the commercial fishery.

4.2 Trends in Lake Huron's Commercial Fish Stocks

The fishery resource is important to the province of Ontario. In 1984 there were close to 1,000 commercial fish licensees, who directly employed over 2,000 persons annually. These fishers harvest approximately 60 million[27] pounds of fish a year, with a landed value of nearly 30 million dollars (Pope 1984). Lake Huron is the second largest of the Great Lakes and the fifth largest lake in the world. The lake has supported a commercial fishery since the late 1800s and ranks third among the Great Lakes in commercial fish landings. The major species in the commercial harvest are primarily whitefish (Coregonus culpeaformis; also termed lake whitefish), chub (Coregonus spp.); and secondarily, yellow perch (Perca flavescens; also termed perch) and yellow pickerel (Stizostedion vitreum vitreum; also termed walleye). In 1980, for example, the harvest of these species alone totalled just over 2,000,000 lb., with a landed value of approximately $2,300,000 (OMNR n.d.).

4.2.1 Historical trends in the Lake Huron commercial harvest

According to Berst and Spangler (1973), the Lake Huron commercial harvest was nearly constant from the early 1900s until the mid-1930s, when lamprey (Petromyzon marinus) predation affected whitefish, lake trout (Salvelinus namaycush) and sucker (Moxostoma spp. and Catostomus commersoni; also termed white or common sucker) landings. They cite an almost steady decline in total production continuing through 1966, accompanied by an increase in the proportion of (then) lower valued species[28] (e.g. chub and perch) (Smith 1968). The most dramatic decline was in the lake trout and chub

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[27] All weights are cited in imperial units (1 kg. = 2.2 lb.).

[28] Marketed smoked, chub are now a valued commercial species, and yellow perch, marketed to the "finger food" industry for battering, have commanded a good price since 1977.

populations, but other species (e.g. whitefish, sucker, sauger [Stizostedion canadense], walleye) also declined in the 1940 to 1966 period.

After the mid-1930s, Berst and Spangler (1973) describe an overall trend of decline in commercial fish stocks in Lake Huron, and attribute this principally to early over-exploitation (of sturgeon [Acipenser fulvenscens; also termed lake sturgeon] and whitefish in the U.S. fishery, following the 1928 introduction of the deep-water trap net[29]) and sea lamprey predation (of lake trout, burbot [Lota lota; also termed ling], chub, whitefish, and suckers). The impact of lamprey predation was significant because in removing high level carnivores such as lake trout and burbot, the lamprey triggered a dramatic succession of changes in the populations of other species (Smith 1968). Forage species, too small to fall prey to lampreys (e.g. smelt [Osmerus mordax; also termed American smelt], alewives [Alosa pseudoharengus] and chub) and other large species which share a relatively early sexual maturity (e.g. rainbow trout [Salmo gairdneri], whitefish, white suckers and burbot) have persisted.

Although comprehensive records do not exist, fluctuations in the whitefish population have been attributed principally to exceptionally strong year classes (e.g. 1943 and 1981), rather than to precipitous declines (Berst and Spangler 1973; OMNR n.d.). (Berst and Spangler also describe the sudden decline in the 1942 whitefish catch in the U.S. fishery, and attribute it to the continuing intensive fishery for lake trout which exploited whitefish as an incidental species.) In contrast, chub declined rapidly after 1961, and appeared to be on the verge of collapse in the early 1970s (Smith 1970). The historic yield of this species from 1911 to 1940 was over 11.4 million lb. (OMNR 1979).

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[29] The deep-water trap net was outlawed several years after its introduction (H.A. Regier, pers. comm. 1992).

4.2.2 Recent trends in the Lake Huron commercial harvest

In retrospect, it is apparent that ITHQ was implemented during a period of relative stock abundance in the Lake Huron commercial fishery. The 1984 commercial harvest in the Canadian waters of Lake Huron was 6.1 million lb., and it has since been estimated that the future annual sustainable fish yield for the lake could be 11.4-12.1 million lb. (OMNR 1988c). Further:

> The reported harvest [of whitefish] from Ontario waters of the Lake Huron basin in 1985 was 2.284 million lbs., up 4.7% from 1984, and second only to 1983's record production. Since 1977, harvests have all exceeded one million lbs., a level not previously reached during this century. (GLFC 1986)

In the Georgian Bay basin, also, the implementation of quota regulation is operating in the context of increased biological production. For 1985, the same report cites an 80% increase in total reported harvest of whitefish in the Georgian Bay basin over the previous year. Similarly, although the North Channel whitefish harvest in 1985 dropped 5.7%, the overall production 1982-1985 has been well above the harvest reported at any other time since 1922.

The GLFC report further states that in the Lake Huron basin, total chub harvest reported in 1985 was down from that of 1984, and well below the quota total of 1,286,000 lb. In the Georgian Bay basin, however, the chub harvest increased to the highest level reported since the 1971-1976 period.

The perch harvest totals in the whole of the Lake Huron fishery declined and were all below the quota limits.

The optimistic pronouncements in the Lake Huron Committee Meeting report (GLFC 1986) are followed by the assertion[30]:

> Although now regulated by quotas, the commercial fishery is evidently not seriously constrained as reported harvests in all quota areas were again below the amounts allocated.

ITHQ implementation occurred at the beginning of a time period of seemingly booming stocks in several of the commercial species under quota allocation. This presents a situation in which allocations have been calculated on the basis of lesser stocks and therefore outdated or imprecise information.

The provincial government's 1988 management plan for Lake Huron described the lake and the fishery in generally optimistic terms: "Lake Huron is still oligotrophic and can support all species native to the lake." (OMNR 1988c). Nevertheless, the plan does sound a cautionary note in regard to the stresses generated through activities which impact the resource both indirectly:

> . . . inshore environmental impacts include agricultural runoff, localized habitat alteration, water flow regulation in tributary streams and the St. Mary's river, and airborne contamination, and may be limiting in some areas.

and directly:

> Important changes to the fish community include the near extinction of the lake trout, reduced stocks of walleye, and the partial replacement of native lake herring and chub by the introduced non-native species, alewife and smelt. These changes, the result of overfishing, sea lamprey predation, and competition, have considerably reduced the combined sport and commercial harvest from historical levels.

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[30] It could be argued that the abundance explained why there was no reduction in the harvest; i.e. that had the stock been less abundant, allocations would have been lower and would have effected a reduction in harvest. In addition, the problem of overharvest, which ITHQ is designed in part to remedy was not an on-going problem in Lake Huron.

4.2.3 Conclusions and implications on stock management

As the history of the fishery attests, since the late 1800's, various factors including commercial fishing activities in Lake Huron have been significant in managing the fishery. Despite management efforts, fish stocks have been subject to great fluctuations, and managers can expect continuing unpredictable variation in stocks. This variability is an important factor in interpreting the efficacy of ITHQ in the fishery. Managers' abilities to adapt ITHQ to this variability will affect fishers' perceptions of the reliability of the scientific basis for allocations. These perceptions will affect fishers' support for ITHQ and ultimately the amount of effort required for monitoring and enforcement.

4.3 Development and Implementation of ITHQ

This section describes the process by which provincial ITHQ was developed and implemented in the Lake Huron commercial fishery.

4.3.1 Policy objectives for Ontario's commercial fisheries

The ideal research situation would involve a policy that represents a dramatically different approach from prior practice, embodies clearly specified goals, and where predicted impacts would be measurable with sound techniques (Cingranelli, et al. 1981). The situation in the Lake Huron fishery did not meet these lofty ideals. In fact, policy goals for ITHQ were only vaguely specified and only a small sub-set of the impacts (predicted and unpredicted) are readily measurable.

Implementation of ITHQ was a component of a comprehensive management initiative aimed at "modernizing" Ontario's commercial fisheries. There is a single, seminal, document in the public domain which states the objectives of modernization, viz., Report of the Committee on Modernizing Ontario's Commercial Fishery (OMNR

and OCCF 1982) (also known as the "Blue Book"). In this document, the only statement of policy objectives for modernization (and by inference, for ITHQ) is specifically referred to as an explication of "major areas of concern." These "concerns" were: (1) development of a rationale for the industry; (2) enhanced resource prediction capabilities; (3) harvest regulation; and (4) licensing (i.e. limiting entry) (OMNR and OCCF 1982).

While this statement of policy objectives does not provide an ideal basis from which to begin an evaluation, it is the only one available. Because there is no other official documentation of a statement of policy objectives, more explicit definition of what managers expected to achieve (i.e. their policy objectives) must be inferred from other sources. These sources include additional documentation such as, speeches, Hansard, internal communications (e.g. committee meeting minutes, standing committee reports), papers delivered at conferences by the managers involved, academic publications, etc., as well as information obtained through key actor interviews. Not surprisingly, this results in variation in phrasing, emphasis and definition as the policy (or, as sometimes specified, the program) objectives are reiterated in a number of different contexts. The following paragraph presents a statement of OMNR's policy objectives for ITHQ that was abstracted from a review of the information sources listed above.

According to a speech delivered by the Minister, "the primary goal of the modernization program must be 'conservation of fish species,'"[31] and the most evident result of modernization is the establishment of ITHQ (Pope 1984). In Lake Huron, the individual transferable harvest quotas were instituted with the gene al goals of controlling commercial harvest and managing fish stocks. This was meant to be a change from Ontario's reliance on more indirect methods to manage the fish harvest (e.g. closed

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[31] This phrase, which occurs nowhere else in the policy documentation of ITHQ, is taken to mean "control of harvest amounts and species." In the context of the Minister's preceding remarks, it is likely that he was referring to sport fish species of value to both sport and commercial interests.

fishing seasons, closed fishing areas, size limits on catch, restrictions on the type of gear used, etc.) (Pope 1984). In synthesis, the specific objectives of ITHQ can be stated as:

(1) control the amount of fish harvested;

(2) control the species of fish harvested;

(3) reduce harvest capacity;

(4) simplify fishery regulation and thereby enforcement; and

(5) facilitate selective spatial distribution of commercial fishing in order to ameliorate user group conflicts.

4.3.2 Why ITHQ Was Implemented and the Role of the Committee on Modernizing the Commercial Fishery in Ontario

This section describes how ITHQ was developed and implemented in the Lake Huron commercial fishery.

In December 1980 the Deputy Minister of OMNR appointed a committee to assess the administrative system of the province's commercial fishing industry. This was in response to the urging of fisheries managers and commercial fishers, many of whom felt that the existing system of regulation was out-moded and ineffective. The Committee on Modernizing the Commercial Fishery in Ontario was charged with the task of considering "the major issues of concern and recommending an administrative system that would recognize contemporary societal and industry expectations in as simple, rational and direct a fashion as possible" (OMNR and OCCF 1982). The involvement of both government and industry representatives was an integral part of the committee's charge. The Ontario Council of Commercial Fishermen (OCCF, now the Ontario Fish Producers' Association) the only province-wide association of fish producers, was asked to nominate members to the committee, with representation from all the Great Lakes, northwestern Ontario and Lake Nipigon.

The committee recognized four major areas of concern:

i) a rationale for the industry;
ii) resource prediction;
iii) harvest regulation;
iv) licensing. (OMNR and OCCF 1982)

This succinct list of concerns encompassed questions on the fundamental right of the commercial industry to exist and the future viability of the province's fisheries, as well as the basic issues of allocating harvests and limiting entry to the fishery. These issues are strategically linked. It is important to define the purpose of industry activities and the extent of the available resource base, in order to make decisions about who may have access to the resource and how much of the resource they may utilize. The expectations of those who already share the resource must also be taken into account by fisheries managers.

As a basis for negotiation, the industry required the government's commitment to a continuing, viable commercial fishing industry. In recent years there had been vociferous lobbying for the elimination of commercial fishing on the part of sport fishing interests. The provincial government has responded with high profile stocking programs (see Table 4.1) and the 1987 institution of a resident sport fishing licence (OFPA 1987b). Under increasing political pressure generated by the sport fishers' lobby, the commercial fishing industry needs explicit recognition of the industry's right to a share of the resource. (See chapter five for a discussion of allocation between sport and commercial fishing interests.) Reliable resource prediction and political affirmation are essential to fair resource allocation, as is a comprehensive information base. Once this foundation is established, regulatory reform can follow.

In 1980, when plans for the Committee on Modernizing the Commercial Fishery in Ontario were first initiated, the publicity garnered by promotion of this idea, together with some serious setbacks owing to fluctuations in fish stocks and the repercussions of the banning of consumption of some important commercial species in the Lake Huron fishery (owing to contamination with chlorinated hydrocarbons), had lent an embattled

TABLE 4.1 : Sport fish planted in Lake Huron, 1980-1987

Year	Number of Fish
1987	1,493,000
1986	1,451,000
1985	1,258,000
1984	1,131,000
1983	977,000
1982	1,110,000
1981	811,000
1980	751,000

N.B. Species include: lake trout, splake/lake trout backcross, walleye and small mouth bass.

Source: OMNR

atmosphere to the committee's deliberations. The Lake Erie fishery was in the most critical state, with serious problems of overexploitation of smelt and perch populations. It was the situation on Lake Erie which really provided the impetus for the formation of the committee and the development and implementation of ITHQ as a provincial policy. In Lake Huron, there were some disturbing fluctuations in the whitefish stocks, but the major problems were related to market gluts and subsequent low prices. Although the potential for overharvest existed in the Lake Huron commercial fishery (in the form of overcapacity), as demonstrated by the harvest data presented in section 4.2.2, overharvest was not a problem in the Lake Huron commercial fishery at the time ITHQ was developed and implemented. There were also some contaminant problems in the (southern) Lake Huron basin fishery (i.e. excluding Georgian Bay and the North Channel). During the 1970-1977 period, for example, walleye were unfit for human consumption owing to high levels of mercury. Following pollution abatement, commercial harvest resumed, and 1977 was an excellent year for this commercial species (471,689 lb.). In contrast, the following year landings were poor lake wide (190,910 lb.) (OMNR n.d.).

In reviewing the modernization report, industry representatives themselves expressed reservations about the final recommendations. The most prominent of these recommendations included suggestions that: (1) the rationale as stated in OMNR and OCCF (1982) (quoted on previous page) be adopted; (2) deficiencies in assessment of fish stocks be remedied; (3) transferable harvest quotas, to be determined by local joint industry-OMNR committees, be introduced for each licensee; and (4) no more licenses be issued (although new licenses could be issued for new sorts of fisheries if these were to develop). To these recommendations, industry representatives added the following caveats to their support for the committee's final report:

- The structure of the ministry's management system must be revised with central control at Queen's Park.[32]

[32] OMNR head office, located at Queen's Park.

- Present fish stock assessment capability is not adequate. There must be upgrading.

- There must be enhanced enforcement in order to assure proper quota control. (OMNR and OCCF 1982)

Although the principles of enhanced assessment and enforcement were supported by all committee members, the industry's last minute inclusion of the condition for central control in effect nullified their support of the program. At that time, decentralized management was integral to OMNR's management strategy. Ministry programs and policies are routinely administrated through the ministry's 48 district offices, and exceptions are not made for any single program.

Released in April 1982, the committee's report was a rallying cry for the industry. It declared that the commercial fishery "does make a substantial contribution [to the provincial economy] and when viewed in some local and regional contexts, it has a very significant impact" (OMNR and OCCF 1982). In particular, the commercial fishery was cited for its: (1) provision of access for the general public to Ontario's food fish; (2) contribution to local economies; (3) role in stock assessment; and (4) enhancement of fish-community stability through balanced harvesting. These important themes emerge repeatedly in building an understanding of how individual transferable harvest quotas impact the Lake Huron fishery. These themes emphasize the view of itself that the industry seeks to promote: that it is a leader in husbandry of the resource, in partnership with the ministry. This description suggests some of the elements of co-management. In these terms, it is easy to see that the commercial fishers' exclusion from the development of allocation formulae, and the subsequent imposition of these formulae without adequate consultation would cause some problems in acceptance of ITHQ.

4.3.3 Determination of spatial distribution of implementation of ITHQ

The first step in allocating the Lake Huron commercial fishery was to divide the fishery into "quota areas." (See Figure 4.1.) These geographical divisions were then assigned an area quota, or allowable biological catch (ABC) for each species designated under quota regulation. Officially, the quota areas were determined in reference to:

(1) the three-basin morphology of the lake;

(2) existing statistical and assessment divisions;

(3) lines of latitude and longitude on a five minute grid;

(4) existing administrative units;

(5) fish stocks and habitat; and

(6) the traditional areas that commercial fishers were licensed to fish.

In 1982, OMNR put forward proposed quota areas for discussion with the commercial fishers in the form of a short report, distributed from the district offices. These proposals were discussed, some adjustments were made, and the boundaries finalized in 1982. The quota areas which resulted from this process reflected both the boundaries of the traditional fishing areas and those of a pre-existing grid system the ministry had been using as a basis for its stock assessment program. This territorial division created one of the first problems in the implementation of individual transferable harvest quotas. Although the boundaries of the traditional fishing areas were considered in delineation of quota areas, some fishers were significantly displaced from their traditional areas. Problems owing to these displacements were one of the unanticipated side effects of the manner of ITHQ implementation.

The ABC was determined on the basis of the ministry's fisheries assessment information. This information base is developed from three sources: (1) the monthly reports filed by commercial fishers detailing their harvest; (2) a sampling program of the commercial catch; and (3) index netting. (For a more detailed discussion of the ministry's assessment program, see OMNR 1984.) The monthly reports supplied information on the total pounds of fish of each species harvested under each commercial

FIGURE 4.1 : Quota Areas in Lake Huron

SOURCE : O.M.N.R.

fishing licence. With the cooperation of individual fishers, the ministry also runs an onboard program of sampling the commercial catch, to gather more detailed information on the size, age and feeding preferences of the fish. The purpose of the index netting program is to provide trend-through-time information on the fishery. The methodology of this latter program requires the setting of standardized nets at the same locations, depths and times each year. The index netting program provides information that gives a relatively accurate picture of fish stock population dynamics over a longer (e.g. 10 year) time period, and the program is not meant to provide absolutely accurate information on the abundance of fish stocks. Taken together, in this descending order of utility, interpretations of these three sources of information were the bases for assignment of a species-specific ABC to each of the quota areas in the Lake Huron commercial fishery. Discretionary judgments were also important in assessing the relative strengths and weaknesses of fish stocks in the fishery. For example, as chub stocks were judged to be weakened and just beginning a recovery, the allocations of these species were purposely kept low.

4.3.4 The allocation process

The next phase in developing individual transferable harvest quotas was the determination of the criteria and method for allocating the commercial fishery resource. In the Lake Huron fishery, the ministry's primary means of consultation were: (1) discussions with the members of the Committee on Modernizing the Commercial Fishery in Ontario, both before and after (but not during) designation of allocation formulae; and (2) negotiations with OFPA local associations. Organized throughout the province on a lake-by-lake basis, these local meetings were to be a one-time activity, with any adjustments in quota allocation to be implemented independently. The purpose of this consultation initiative was to determine the basis upon which individual quotas were to be set.

The prominence given to the commercial fishing industry's contributions to fisheries management in the modernization report emphasized the necessity of meaningful consultation with industry representatives in revamping fisheries administration. The OFPA is the only association of fish producers claiming provincial representation, and as such plays a significant part in OMNR's consultation initiatives. An association of 19 member groups throughout the province, the OFPA also promotes the production and marketing of Ontario's freshwater fish products. Effective advocacy and representation of the industry with government and other groups is one of the association's primary goals. Supporters and critics alike have noted that the association's claim to representation is sometimes hampered by a small budget, poor communications and lack of consensus within the organization itself.

In participating in the quota development meetings that followed the release of the modernization report, for example, the OFPA representatives on the committee did not always have the resources to consult effectively with their constituency members. This hindered communications within the organization, and presented difficulties for members who were not making a special effort to keep up with developments to voice their views as fully as they otherwise might. This situation was further confounded by some degree of confusion and inconsistency on the ministry's part in assembling assessment data and developing the criteria for allocating individual transferable harvest quotas to individual licensees. As a result, fishers were not notified of their quota allocations until spring of 1984. At this time ITHQ had already been in effect since January of that year.

Berkes and Pocock (1987) quote as follows from an OCCF (OFPA) brief to the Minister, dated August 1985:

> During the spring and summer of 1983 the Ministry was warned [by the OCCF] that they were trying to move too fast without proper consultation with the industry. During the summer of 1983 a series of disastrous meetings with fishermen were held. The fishermen were told the quotas had been approved by the OCCF -- without reference to the three provisos we insisted must be included with the report. The industry view is that

> those meetings did not represent an honest effort at consultation, and quotas were presented as a fait accompli. (OCCF 1985)

Some fishers were surprised and disappointed by their quota allocations. Many felt that their allocations did not accurately reflect (or account for mitigating factors in) either their past harvests or the potential of their operations or the fishery. More importantly, some fishers, principally those with smaller or part-time operations, feared that inadequate allocations might force them out of business; they might not be able to harvest enough fish to keep their businesses profitable.

If allocations were based on a fisher's past performance (i.e. the amounts of fish of various species harvested over representative previous years), why would the resultant quota allocation not support "business as usual?" One commonly offered explanation is that the fishers in this position had been under-reporting their catch in years used for calculation of the individual transferable harvest quotas. Independence and lack of regimentation are often mentioned as characteristic advantages of commercial fishing as an occupation (Beddington and Rettig 1984). It was common knowledge that some fishers, on some occasions had under-reported their catch. There is no way to prove or disprove this explanation, but neither can it be totally discounted in interpreting the impacts of quota allocation. Poor past performance was also attributed to chance factors such as illness and weak market incentives for some species.[33]

Determination of time of implementation

The timing of ITHQ implementation also influenced allocation amounts. In the Lake Huron fishery, uncertainty was increased by the politically dictated timing of ITHQ implementation. The provincial government had been working inconclusively on a general set of species-specific formulae as a basis for fishery allocation throughout the

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[33] For example, chub markets were very poor in 1981, one of the years used in calculating past harvest totals. This is discussed in more detail in chapter five.

Great Lakes. At this point, the Hon. Alan Pope, then Minister of Natural Resources, directed that allocations be calculated separately for each of the Great Lakes, and implemented on an accelerated schedule. This decision was taken against the advice of senior fisheries managers. The minister decided to adopt ITHQ in Lake Huron, where there was no immediate problems with overharvest, in part as a matter of policy consistency, not as a requirement to prevent over-exploitation. In the Lake Huron instance, this politically dictated need for immediate implementation forced hasty preparation of allocations based on inadequate assessment information. This had an indirect influence on ITHQ impacts, in that there was little time for adequate stock assessment or consultation and ITHQ became more closely associated with sport fishing interests.

The timing of ITHQ implementation was a matter of political expediency.[34] The Minister represented a northern Ontario riding in which tourism and recreation is an important economic sector. Sport fishing is an important contributor to the tourism industry in Ontario's north, with tourist lodge operators, charter boat operators and recreational fishers, alone, contributing over half a billion dollars to the provincial economy annually (Pope 1984). These user groups were demanding measures to ensure a stable sport fishery resource, in order to facilitate long term business decision making and planning for recreational pursuits. Pope (1984) states specifically that it was in response to pressure from these groups that the Ontario government instituted ITHQ with such urgency.

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[34] Up to this point, consultation on quota regulation was limited to the OCCF/OMNR joint committee (which recommended quota regulation in principal, but did not review any policy details such as allocation methods or timing). Additional consultation initiatives (e.g. Lake Huron Quota Review Committee, consultation on the subject of ITHQ in the Lake Huron Management Committee, etc.) were primarily reactive in nature, dealing with problems associated with the initial implementation of ITHQ.

Determination of the amount of allocation

In theory, the formulae used in allocating the Lake Huron fishery gave to each fisher a percentage of the harvest based on past harvest totals (i.e. past performance). For example, if the fisher traditionally caught 15% of the whitefish harvested within a certain quota area, the new allocation would be 15% of the whitefish ABC. This percentage was to be set, and unchangeable, as it was intended to be used to allocate future increases and reductions in quota amounts. For example, if there were to be a 5% reduction in the ABC for whitefish, in a particular quota area, the individual described above would lose 5% of the previously assigned allocation.

In practice, individual transferable harvest quota allocations have been adjusted via two mechanisms: (1) direct appeal to the Lake Huron Quota Review Committee (in the past); or (2) through the OMNR district offices, by assignment of additional quota on a pro rata basis, in response either to changes in the calculation of the weight of fish, or to perceived increases in fish stock abundance.

Another form of allocation is achieved through "buyouts," in which OMNR makes a cash purchase of an individual fisher's vessel, gear and licence, thereby retiring the operation, and by default, reallocating the "retired" quota to the sport fishery. While some commercial fishers unreservedly welcome the opportunity to cash in their operations, others would like to remain active in the industry. There is also some industry support for reallocation of the government-purchased quota within the commercial fishing industry. Still others feel that the buyout program in general is a threat to a viable commercial fishing industry. ITHQ facilitates the use of "buyouts" as a management option by placing a specific value on the harvest potential of an operation. This, in turn, indirectly affects how ITHQ impacts the fishery. In the Lake Huron fishery, the greatest number of buyouts have been in the Georgian Bay area. This popular tourist area has been plagued by conflicts between commercial and sport fishers. Georgian Bay is periodically stocked with sport fish species, and this makes it difficult for some commercial fishers to avoid substantial incidental harvest of non-target species.

In this fashion, ITHQ are perceived by some to be linked more closely to the sport fishers' goals than to the maintenance of a viable commercial fishing industry.

The role of the Lake Huron Quota Review Committee

The short-lived Lake Huron Quota Review Committee was established in direct response to the fishers' protestations about their quota allocations. The committee was set to provide an informed and balanced settlement of disputes relating to individual transferable harvest quotas, and all recommendations were made through the chairman, F.E. Fry, an independent fisheries scientist. The other two committee members, R. Christie, a senior OMNR manager and W. MacKenzie, an industry representative put forward by the OFPA, acted as resource persons. Appointed by the Minister of Natural Resources, the committee was adjunct to the line administration of the ministry. This three person committee heard their first cases in June of 1984 and in the Lake Huron fishery, their deliberations were completed by September of the same year. A commercial fisher wanting to meet with the committee could make an appointment through an OMNR district office. The proceedings of the committee were held in private. Recommendations on each case were communicated by letter, directly to the Minister. Any implementation of recommendations was through the district offices, at the behest of the Minister. The committee members confirmed[35] that they did not receive any formal notification of the fate of their recommendations. If any official guidelines or terms of reference were set for decisions on the committee's recommendations, they were not communicated to the public or to the committee members.

In rendering decisions on adjustments in the amounts, species and area assignments of allocated quota, the committee's deliberations and rationales were absolutely confidential. Not even the fishers concerned were advised of the reasoning

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[35] F. E. Fry, pers. comm., June 28, 1988; R. Christie, pers. comm., March 21, 1988; W. MacKenzie, pers. comm., August 6, 1987.

leading to the decision on their own cases. One rationale for this strict confidentiality was the personal and confidential nature of the information that some of the fishers brought to the committee. In some instances, financial and other highly sensitive records (e.g. possibly the implied under-reporting) were presented in support of requests for a change in allocated quota. Although the need for a certain degree of confidentiality is generally recognized, some fishers who regarded the ministry's decision to be unfair would like to know more about the thinking that led to the government's decision in their cases. This secrecy contributed to the divisive atmosphere of mistrust and competitiveness that was one of the impacts of ITHQ implementation.

At about the same time as this committee was concluding its work, a group of fishers from Lake Erie took OMNR to court, challenging the provincial government's right to regulate through the use of quotas in a federal jurisdiction. Berkes and Pocock (1987) neatly summarize the issue.

> In October, the Ontario Supreme Court ruled that quotas were technically not valid. However, the MNR obtained permission to allow quotas to remain in effect until their appeal was heard. A week later, MNR officers seized catches from two boats belonging to one of the proponents, charging that the catches were over the quotas. However, the appeal court upheld the earlier decision that the provincial quotas were unconstitutional and that Ontario was enforcing fish quotas "without lawful authority."
>
> The de facto lifting of quotas placed the majority of fishermen in a difficult position because they regarded a "free-for-all" as a threat to both the market and fish stocks. In late October, several fishermen and local associations announced they would voluntarily honour the quotas.[36] At the same time, the MNR adopted emergency measures to protect the stocks by prohibiting all commercial fishing for two of the species, under Section 6 of the Ontario Fishery Regulations, under the

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[36] This point highlights an important aspect of the Lake Erie situation: the fishers who brought suit were recent entries to the Great Lakes and had not accepted the evolving traditions predominant in the fishery. These newcomers flouted not only government regulations but also existing fishery conventions.

> federal Fisheries Act.[37] This created an additional strain on relations between MNR and the fishermen. Shortly thereafter, quotas were reimposed by the federal Department of Fisheries and Oceans by an order-in-council. One consequence of the federal involvement was the publication of [Lake Erie] quotas in the Canada Gazette, thus ending the secrecy.

Berkes and Pocock conclude the saga:

> In February 1985, the Ontario Court of Appeal ruled in favour of the MNR, stating that quotas were legal and that the authority to impose them had been properly delegated from the federal to the provincial government, thus ending the minor constitutional crisis precipitated by fish quotas.

Determination of changes in ITHQ amount

In 1985, OMNR supplemented the existing Lake Huron Management Committee, with a Liaison Committee, directed specifically to meeting what the ministry's senior management recognized as a continuing need for dialogue. The membership of the Liaison Committee was set by the Lake Committee chairman, and the fisheries managers and commercial fishers (put forward by the OFPA as industry representatives) on the committee were to anticipate potential management problems and use their meetings as a forum for discussion and communication between the ministry and the industry. In this way, it was hoped that some of the worst problems of the past might be avoided. Administration of individual transferable harvest quotas has been a topic of continuing discussions for the Liaison Committee.

Quota adjustments are also administrated through the OMNR district offices. In 1987, for example, whitefish quotas in the Lake Huron basin were temporarily increased 7% (approximately 250,000 lb.) in response to commercial fishers' reports of booming populations. This increase was rescinded at the end of the year. Additionally, there

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[37] An error in the original source has been corrected with the permission of the authors.

have been further incremental percentage adjustments to specific quota allocations, owing to changes in the conversion factors used to calculate the differences between dressed and round weights for whitefish and lake trout.[38]

There have also been some significant decreases in quota allocations. The 1989 chub allocation, for example, was decreased by 15%. It was felt that the initial allocations had been calculated on the basis of unusually high harvest levels, and this decrease was seen to bring the chub allocation back in line with the ABC. There was also a 15% decrease in perch allocations in the south end of Lake Huron. The allocation for this species had been increased by 30% in 1986, and it was felt that the stocks could not support the continued high harvest rates.

In 1988, negotiations between the ministry and representatives of the Lake Huron commercial fishers resulted in a proposed procedure for adjusting quotas for the 1989 season. Under this proposal allocations for quota areas would be increased or decreased, in usual circumstances, a maximum of 10% from the previous years' level, based on population trends (not absolute numbers) in the ministry's analysis of assessment data. Under exceptional circumstances, quotas may be adjusted by a larger percentage.

Negotiation of issues of importance to interest groups also played a significant part in ITHQ development. Over the generations, individual commercial fishers developed specific temporal and spatial harvest patterns particularly suited to their vessels, gear and the geography of their area. In some instances, new quota areas and ITHQ allocations and concomitant shifts in areas where sport fish species were planted, were inconsistent with these traditional patterns. Where the trade-off value of certain rights and traditions was not readily quantifiable, negotiated solutions were reached. For

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[38] The ministry calculated quota allocations on round weight. Those fishermen who traditionally reported their whitefish and lake trout harvest in dressed weight sought an adjustment in their quotas to reflect the discrepancy in their assigned harvest quota.

example, OMNR planted sport fish species in a traditional commercial fishing area, displacing commercial harvest activities, but offered an ITHQ allocation in an alternative area. In another example, commercial fishers made voluntary changes in the timing of their harvest activities in exchange for modified allocations.

In practice, the ITHQ allocations are the result of compromise. Neither of the two interest groups was able to achieve fully its ultimate goals, nor were fisheries managers. Commercial fishers no longer predominate in some traditional areas, and continue to negotiate on the issue of incidental catch. There will no doubt be perpetual bargaining for modifications to allocations. Sport fishers have not managed to have gill netting banned, and must share some species and areas with commercial fishers. Fisheries managers cannot make allocation decisions in isolation and must accommodate the social and economic concerns of importance to these resource user interest groups.

4.3.5 Incidental catch and government stocking programs

Resource use conflicts affect many user groups, as well as fishery managers in their efforts to allocate the resource. In 1985, approximately 20% of adult resident sport fishers were members of a national or provincial wildlife organization or other local membership club (OMNR 1988a). In some cases, sport fishing interest groups such as Ontario Federation of Anglers and Hunters (OFAH) have experienced a degree of success in wielding political pressures to support their demands for exclusive access to fishery resources and/or their attempts to make commercial fishing so inefficient that it is no longer profitable. The recent successes of sport fishing groups are due in part to a sustained public relations effort supported by numerous sports writers and publications (notably, John Power's Outdoors column in the Toronto Star, Ontario's largest circulation paper). (The commercial fishers have not developed a program of similar breadth and profile.)

For example, there is conflict over the advisability of continuing the Lake Huron commercial fishery. Some particularly vocal members of the sport fishers' fraternity have publicized the idea that the operations of the commercial fishing industry seriously interfere with sport fishing businesses and recreational pursuits. The following declaration from an OFAH Position Paper on Commercial Fishing in Ontario (OFAH 1987a) is a typical example of the views and attitude of this organization in regard to the commercial fishing industry.

> The government of Ontario must take immediate action to ban the use of gill nets for commercial fishing (with the possible exception of sets for whitefishes [sic.] over 250 feet deep);
>
> The M.N.R. should continue the policy of buying out commercial fishermen where there are conflicts with other resource users, or where stocks are threatened by such fishing. Such buy-outs should be at fair market value, with licenses being terminated and total area quotas being reduced appropriately;
>
> The M.N.R. should designate additional locations where commercial fishing should be disallowed, especially where such fishing endangers stocks of sport fish or unduly interferes with other resource users;
>
> The manufacture of gill nets in Ontario and the importation of gill nets into Ontario should be banned. Gill nets acquired by the M.N.R. through seizure or buy-out must not be sold to commercial fishermen.

There is a longstanding competition between commercial and sport fishers for access to the fishery resource. This competition is most acute in certain areas (e.g. Georgian Bay) and where it involves the salmonid species especially sought after by sport fishers. To some extent, individual transferable harvest quotas were thought to address this problem by explicitly allocating a portion of the fishery to the commercial fishing industry and specifying the number of pounds of each species that may be sold commercially.

Only since ITHQ implementation have efforts been made to define the scope of the incidental catch problem on Lake Huron, and quantify the amount of fish involved.

The Ontario Ministry of Natural Resource's (OMNR) report on incidental catch on Lake Huron finds that through placement of nets at depths and in locations where knowledge and experience indicate the target commercial species is likely to be concentrated, commercial fishers can be very successful in avoiding sizeable incidental catches (OMNR 1988b). The average weight of non-commercial salmonids caught in gill nets is estimated to be only 1.8% of all commercial landings in Lake Huron, principally from the main basin of Lake Huron and in Georgian Bay.[39] While this small percentage supports claims for the specificity of gill nets, it also demonstrates that at least a minimal incidental catch is unavoidable.

The ministry has undertaken stocking programs in certain areas. There are also significant stocking programs in U.S. waters. For example, OMNR reports that over a recent five year period, annual plantings in Lake Huron by the State of Michigan averaged 3.0 million chinook, 0.46 million coho, 0.51 million brown trout and 1.26 million lake trout (OMNR 1988b). Over the same time span, Ontario planted annually approximately one million lake trout backcross and lake trout (see Table 4.1). Where these artificially stocked areas overlap licensed commercial fishing areas, commercial fishers confirm that it can be difficult or impossible to set nets for whitefish without catching lake trout (including backcross) or to target chub and at the same time avoid a sizeable harvest of splake. It is the incidental catch of these planted game fish (largely unsaleable, owing to harvest quotas) which fuels conflict between these two important user groups. The commercial fishers say that they would like quota allocations which match the amount of their incidental catch, so that they can sell the fish. OFAH documentation states that sport fishers would like gill netting banned, and mandatory live release of all incidental catch from impoundment gear (OFAH 1987b).

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[39] The report does not address the significance of this percentage in relation to the sport fish harvest, and so no conclusions can be drawn on this point.

Ontario's fishery regulations were extensively revised as of 1989. Although the resulting regulatory regime may well appear to be simplified, this in itself does not necessarily indicate a reduction in restrictions on commercial fishing. For example, since the 1989 reforms took effect, some restrictions that used to be embodied in regulations, are not in the revised Act, but the same restrictions appear as conditions on commercial fishing licenses. While such administrative action does reduce the actual number of regulations, it in no way reduces the degree of regulation.

In explicitly quantifying the portion of the fishery allocated to commercial harvest, ITHQ became part of the incidental catch issue. The distribution of benefits between the sport and commercial fishers, and among the commercial fishers was made more explicit. Sport and commercial fishers could cite specific amounts of harvest that may have been granted to one or another fisher or interest sector, although there was no reliable stock assessment by which to evaluate the fairness of the allocations. In effect, this explicit allocation increased administrative complexity by adding a new layer of organization. In addition, this new layer of organization required closer monitoring and stricter enforcement of the commercial harvest. A pilot project replacing monthly with daily reporting of harvest was implemented in 1985, bringing with it a need for increased frequency of monitoring and enforcement. Clearly, problems with incidental catch have seriously affected ITHQ implementation.

4.4 Analysis of the Policy Process

4.4.1 The impact of incremental decision making

The incremental model of public policy making is well suited to assist in understanding the process of developing and implementing ITHQ. While the bioeconomic model helps to identify underlying environmental and economic forces affecting the Lake Huron fishery, aspects of the process by which fisheries management decisions are reached appear to conform to an incremental pattern, rather than a rational

model. Many important management decisions have been conservative, fragmented and political. Implementation of ITHQ can be characterized as conservative and incremental on the basis of managers' calculating allocations from available information about past harvest amounts. (Formulae for species-specific allocations are based on fishers' previous harvest amounts.) Under usual circumstances, active consideration of allocations is limited to changes to the previous year's amount, and only a small percentage (up to 10%) of increase or decrease is considered. (Both initial allocation and the methods of changing allocations are discussed in sections 4.3.4 and 5.2.1.) ITHQ is also seen to be conservative in that it accepts and builds upon much of the existing regulatory framework of season and area limitations concerned with protection of reproduction and safeguarding of sport fishers' interests. Allocations are not reviewed as a whole every year, in the sense of reconsidering the value of existing base allocations. (Although in some cases, allocations for a specific species may be comprehensively reviewed.) Managers are seldom required to defend allocations that exceed those current, but reduced allocations may require extensive documentation.
The incremental model of the policy process illustrates how moderate changes are suggested by foregoing policy and can be more easily implemented. In facilitating buyouts, ITHQ may be an example of this, as it is consistent with the pre-existing buyout policy.

The allocations are also somewhat fragmented in that decision making is limited to quantitative allocations of specific commercial species. This may be because these limitations have administrative advantages for managers. First, discussion is limited to the realm of fisheries science, where managers feel most comfortable. Second, it is much easier to agree on a small addition or decrease to a single species allocation than it is to analyze the broad impacts of ITHQ implementation, some of which may be outside of the administrative areas of the decision-making agency. Third, it institutes a system of compromise; individual fishers who may realize a net benefit from one particular set of allocation decisions may hesitate to protest the unfairness of another set of allocation decisions by which they are not directly affected.

ITHQ implementation is very political. In the absence of reliable stock assessment information, effective implementation of ITHQ may be a matter of special interest groups and their representatives granting their political acceptance of ITHQ allocations.

4.4.2 The influence of special interests

ITHQ deeply affects specific interests. For example, aside from its obvious impact on commercial fishing interests, by making an explicit allocation to the commercial fishing sector, ITHQ makes an implicit allocation to the sport fishery. Implementation of ITHQ in Lake Huron also further empowered another interest group, fisheries managers, by providing a regulatory instrument by which to shift commercial fishing effort among and within species in a specific areal pattern. Interest group theory provides an instructive lens for examination of ITHQ. The significant effects of interest group activities on resource management policy development, implementation and assessment are not accounted for in the rational model. In describing the process of implementing ITHQ in the Lake Huron commercial fishery, chapter four shows how this process was influenced by two major interest groups, the commercial and sport fishers, as well as the fisheries scientists.[40] In its emphasis on the roles of power and influence in the policy process, the interest group model lends insight into how these interests were able to affect the decision process. Bargaining, negotiating and compromise were prominent aspects of decision making. Implementation of ITHQ involved bargaining because managers did not have adequate assessment and resource use data to support allocation decisions. Some initial amounts and areal limits of allocations were subsequently modified on the basis of bargains struck with commercial fishers.

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[40] Chapter three includes a discussion of the role of sport fishers in determining the timing of ITHQ implementation and the need for creation of the Lake Quota Review Committee to accommodate commercial fishers needs.

The sport fishers' lobby, as represented by the OFAH, surpasses the Ontario Fish Producers' Association in terms of the effectiveness criteria identified by Dye (1972), viz.: (the OFAH) (1) has a larger membership; (2) with a cohesive set of goals and values regarding sport fishing; (3) has resources for extensive membership consultation and public communications; (4) has a high profile leadership with excellent media connections; and at least over the time period immediately preceding the implementation of ITHQ, (5) superior access to and influence on policy makers, in particular the Minister of Natural Resources (OMNR 1988a; Toronto Star 1988; DFO 1987). The OFAH has 73,000 members and represents 429 fish and game conservation groups. OFAH has a laudable record of involvement in conservation projects and has been an effective lobby to various government agencies (O.C. 1376/89).

4.5 Summary and Conclusion

ITHQ were instituted as part of a provincial fisheries modernization program. At that time, there was thought to be the potential for overharvest in the Lake Huron commercial fishery, in the form of excess capacity. Program objectives included control of the amount and species of fish harvested, reduction in harvest capacity, simplified regulation and capacity to ameliorate user group conflicts. Some of the consequences of ITHQ are the result of deficiencies in the implementation of ITHQ, and these deficiencies, in turn, stem from the process by which the policy was chosen and implemented.

ITHQ allocations were based on a fisher's past performance. Development and implementation of ITHQ was significantly influenced by:

(1) inadequate consultation on policy development;

(2) lack of consensus among commercial fishers;

(3) uncertainties in assessment information;

(4) administrative changes in the boundaries of licensed fishing areas;

(5) hasty implementation; and

(6) secrecy and lack of routinization in post-implementation allocation adjustments.

In explicitly quantifying the portion of the fishery allocated to commercial harvest, and defining the distribution of benefits between the sport and commercial fishers and among the commercial fishers, ITHQ has become entangled in the incidental catch issue. Problems with incidental catch have seriously affected ITHQ implementation.

Clearly, the manner of development and implementation has a significant influence on the effectiveness and impacts of ITHQ. This research finds the development and implementation of ITHQ in Lake Huron to be the result of the interaction of rational, incremental and interest group decision-making processes. This "mixed model" approach to policy development and implementation is consistent with the conclusions of Allison (1971). Further, this policy development is seen to take place in the context of complex social and environmental conditions that impact on decision making.

The process of ITHQ development and implementation emphasized the significance of communications, consultation and compromise. Available information was imperfect, political circumstances dictated the need for immediate measures, and resource user interest groups were pressing for achievement of conflicting goals.

5.0 RESULTS OF ANALYSIS OF QUANTITATIVE AND QUALITATIVE DATA

This chapter presents the results of analysis of both the quantitative and qualitative data sets.

5.1 Results of the Analysis of Quantitative Data

This section presents an analysis and interpretation of the major relationships among the quantitative variables. Interpretation of the results is cautious owing to the relatively short time series. Where possible (i.e. harvest and value data) the data base has been supplemented with information for additional years.[41] Though the data remain limited, this analysis provides important information on the initial stages of ITHQ implementation that cannot be obtained anywhere else.[42]

If ITHQ works as fisheries' theory predicts, harvest would be controlled within a predetermined amount, prompting changes in resource users' behaviour, such that capacity would be reduced and therefore the remaining capacity would be utilized more efficiently (Grima and Berkes 1989). Simply put, does the data set support a conclusion that ITHQ constrains two principal problems in the general management of many fisheries: overharvest and overcapacity?

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[41] As detailed in section 3.1.1, OMNR has continued to collect data on the commercial fishery, utilizing since 1986, a modified instrument. For this and other reasons, the quantitative data set compiled for this research is not perfectly compatible with the post-1985 OMNR Commercial Fish Harvest Statistics data base. Nevertheless, the 1986-1989 harvest amounts and value of harvest from this data base are depicted graphically in this section in order to give some indication of changes in these data since the conclusion of the study period. The "Source" annotation for each graphic identifies the depicted data base.

[42] Dollar values are presented as 'current.' Owing to the relatively low rate of inflation over the study period, transposition to 'constant dollars' would not have significant impact on the analysis or conclusions.

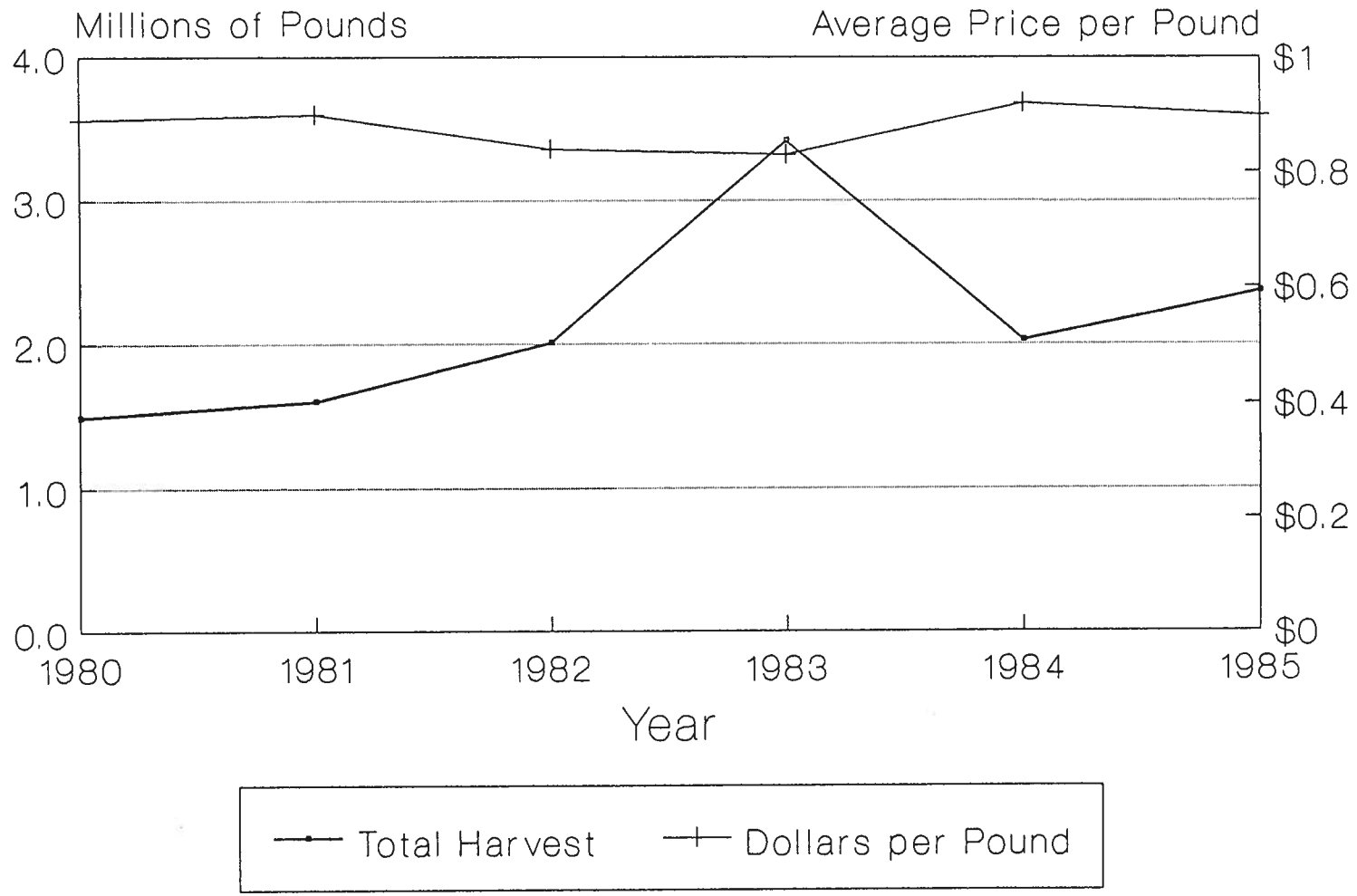
5.1.1 Overharvest and the price of fish

One of the theoretically expected outcomes of ITHQ is control of harvest within a predetermined amount. Although there is no evidence of overharvest, analysis of changes in total harvest of the principal commercial species in the Lake Huron commercial fishery should give some indication of whether ITHQ controlled the amount of fish harvested. Thus, tracing fluctuations in the amount of harvest and selling price of the two major commercial species in the fishery, and interpreting these changes in the context of other limiting factors, would give some indication of the impact of ITHQ on the total harvest and the income obtained from this harvest.

Whitefish is the major commercial species in the Lake Huron fishery. With the exception of the large harvest in 1983, the post-quota harvests of this species have been slightly greater than those of the preceding four years (see Figure 5.1). Over this same time period (again excepting 1983), the total value of the harvest has stayed in relatively the same proportion to the total harvest (see Figure 5.2); the price per pound has varied only slightly (see Figure 5.1). Additional data on whitefish harvests from 1986-1989 show a consistent trend; total harvest and total value of the harvest are relatively evenly proportioned (see Figure 5.3). These harvests also are greater than those in the years immediately preceding ITHQ implementation.

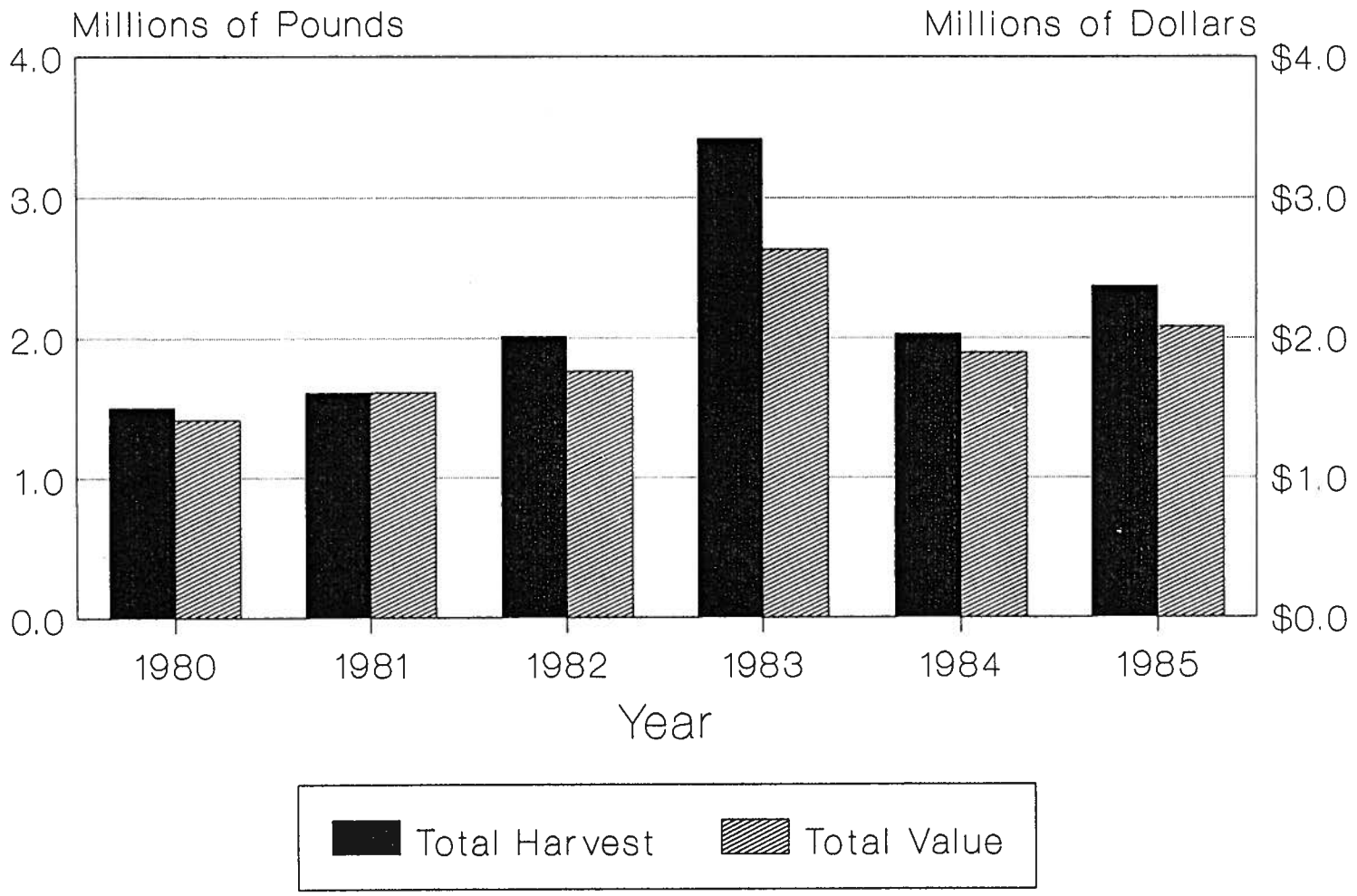
Harvest amounts and harvest/price relationships change little either before or following the implementation of quota regulation. The harvest amount differed from the allocation: aggregate harvest amounts remained below the levels set by managers both before ITHQ (when there was a lakewide harvest quota) and after ITHQ implementation. Therefore, the fact that harvest levels remain below ITHQ levels is not necessarily

FIGURE 5.1
Average Price per Pound and Total Harvest of Whitefish, 1980 - 1985



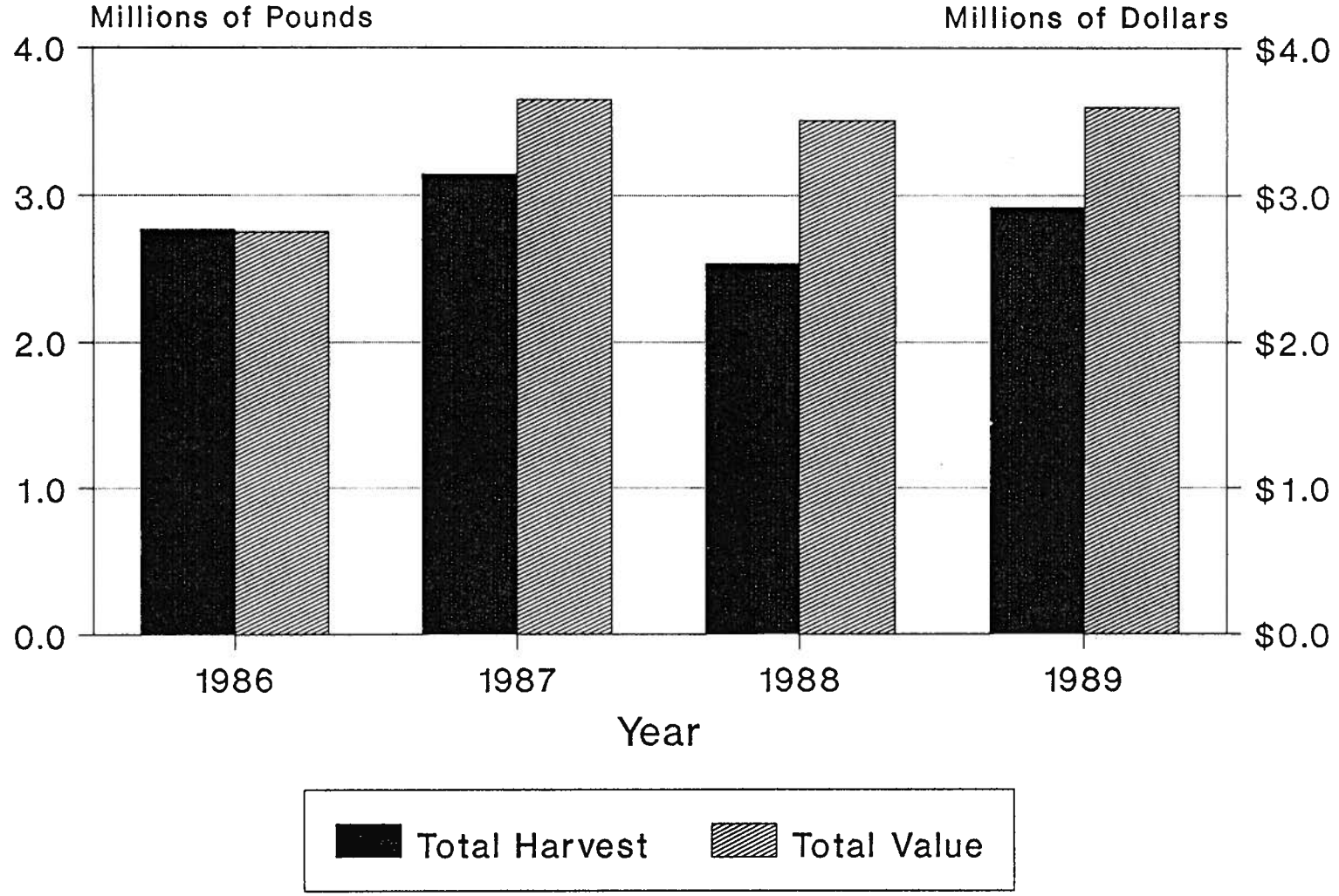
Source: OMNR CF.8A

FIGURE 5.2
Total Harvest and Total Value of Whitefish, 1980 - 1985



Source: OMNR CF.8A

FIGURE 5.3
Total Harvest and Total Value of Whitefish, 1986 - 1989



Source: OMNR Commercial Fish Harvest Statistics

evidence that ITHQ alone, has effected lakewide control of the harvest or affected the selling price of whitefish, in the Lake Huron commercial fishery.[43]

Chub is the second most important commercial species. In contrast to the mostly modest increases in harvest of whitefish, harvest of chub has increased dramatically over the study period (see Figure 5.4). (Fear of mercury contamination, particularly in the Georgian Bay area, may partially account for the low harvest levels in the early 1980s). The sharpest increase was from the 1980-1982 period to 1983. Harvest levels peaked in 1984, the first year of quota regulation, and although slightly reduced from the previous year, 1985 harvest levels continued to top those of all of the pre-quota years under study. Chub prices and total value of the harvest were highest in 1984, the peak harvest year (see Figures 5.4 and 5.5). Additional data on chub harvests from 1986-1989 continue this two year "trend;" total harvest and total value of the harvest are greater than those in the years immediately preceding ITHQ implementation (see Figure 5.6).

The sale price of this species has varied little since ITHQ, despite the greater harvest levels. This suggests that the demand for this species may have increased also. Again, quota regulation may be doing no more than previous regulatory regimes to control harvest levels.

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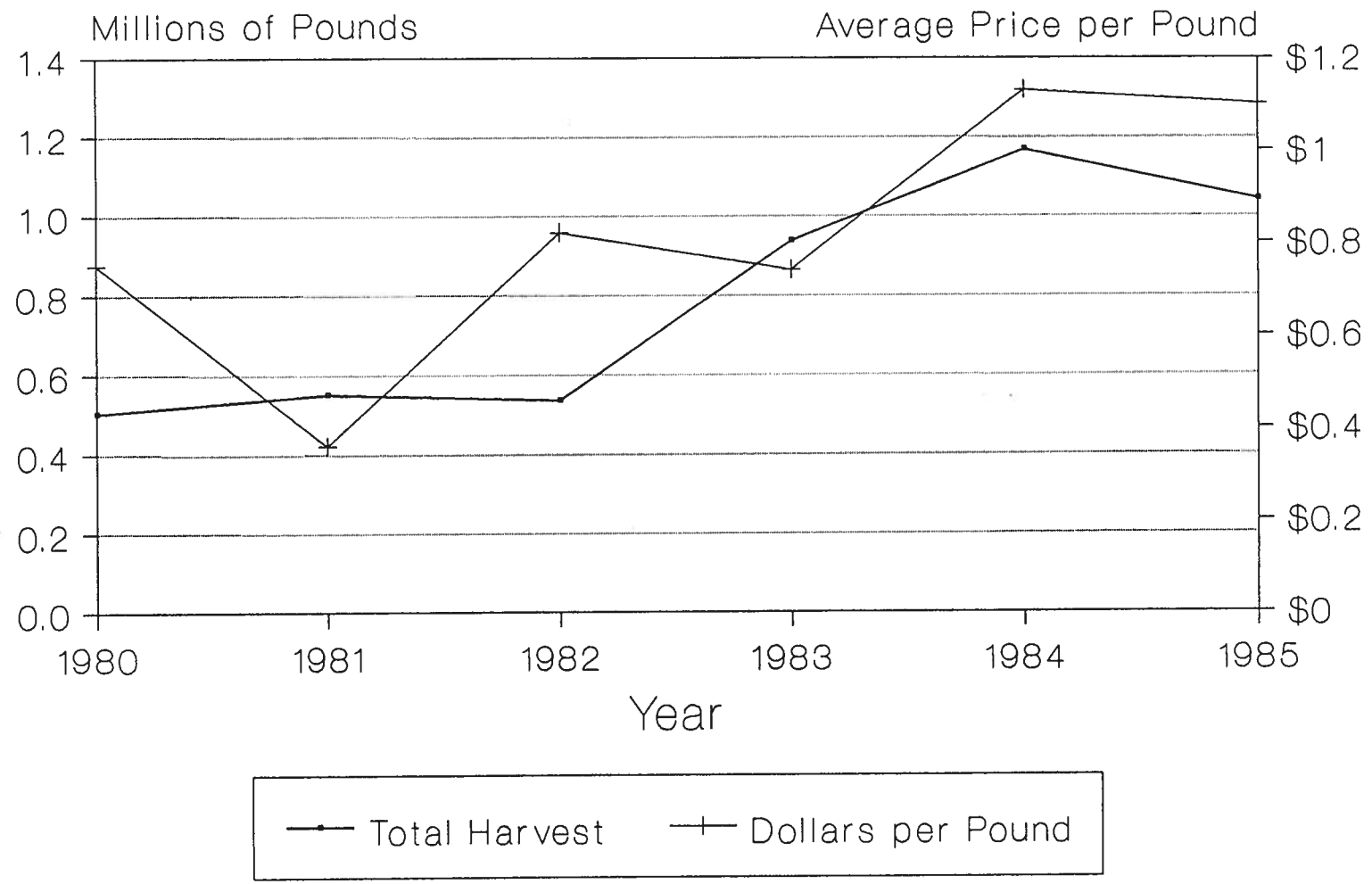
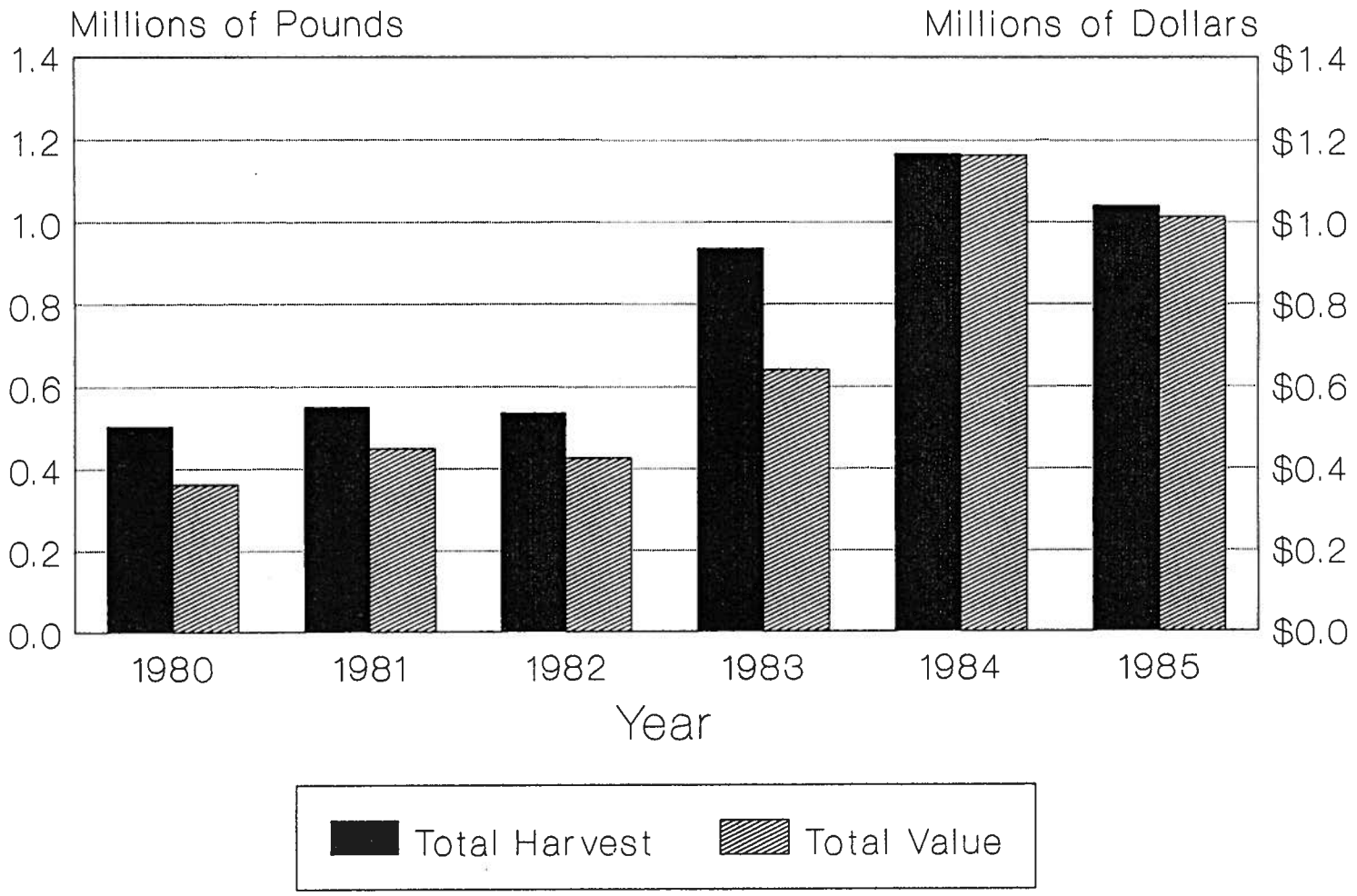
[43] It is possible, however, that some individuals were constrained by ITHQ. Over time, any such individuals can try to increase their allocations through purchase or lease of additional quota. If this redistribution were to take place, the expectation would be that the lakewide allocation would be met.

FIGURE 5.4
Average Price per Pound and Total Harvest of Chub, 1980 - 1985



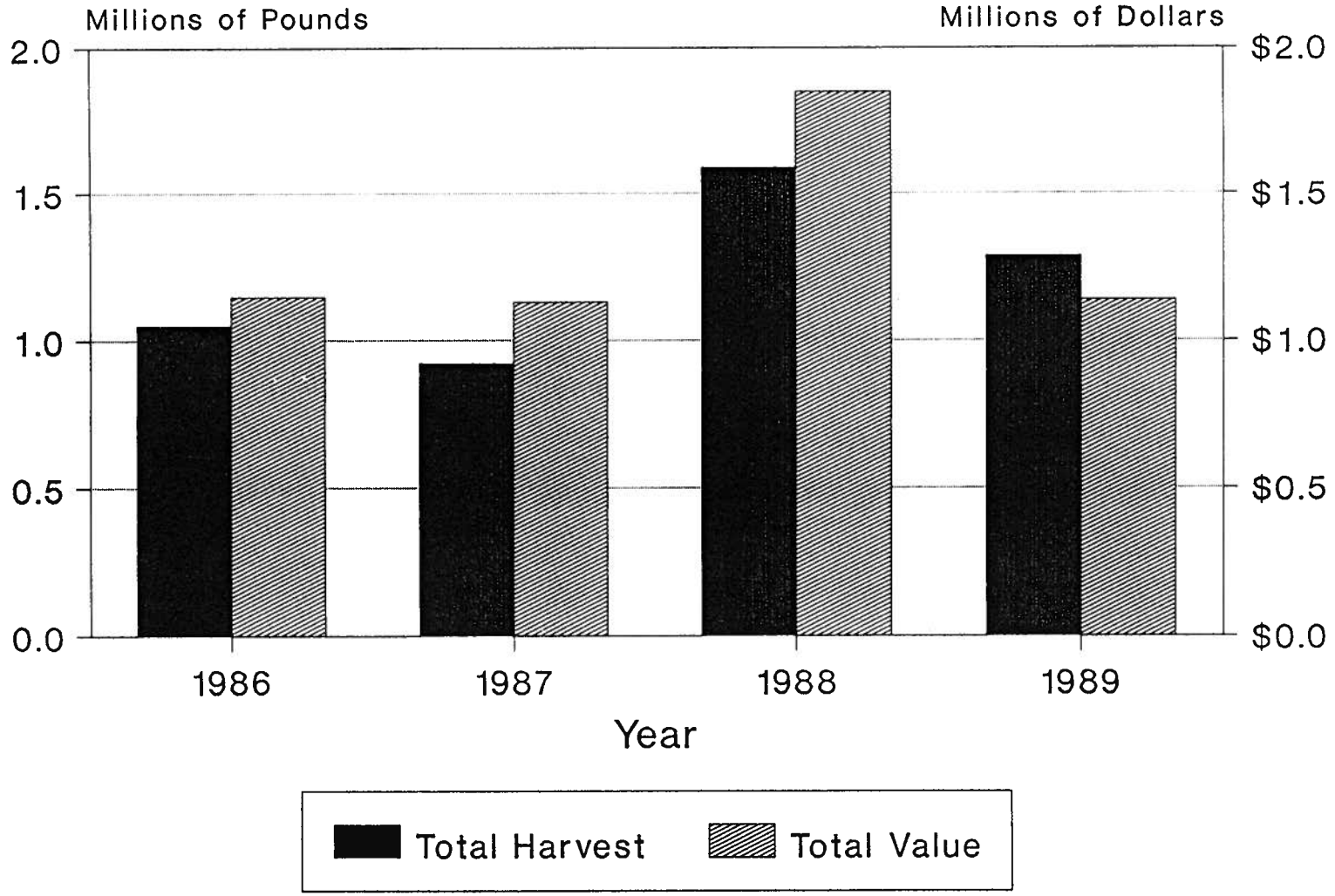
Source: OMNR CF.8A

FIGURE 5.5
Total Harvest and Total Value of Chub, 1980 - 1985



Source: OMNR CF.8A

FIGURE 5.6
Total Harvest and Total Value of Chub, 1986 - 1989



rce: OMNR Commercial Fish Harvest Statistics

5.1.2 Overcapacity and organization of the industry

Another of the theoretically predicted outcomes of ITHQ is a reduction in overcapacity, such that remaining capacity would be utilized more efficiently. One of the principal objectives of ITHQ is to control harvest capacity in the commercial fishery.[44] Individual investment in vessels and gear is a measure of harvest capacity. The shifts in such investments and changes in the number of commercial fishing operations in the fishery over the study period may attest to the effectiveness of ITHQ in reducing harvest capacity.

The bioeconomic model links these shifts to returns received for fishing effort, specifically, to the relationship between total revenue (harvest x price) and total cost (cost per unit of fishing effort). Information on individual investment and the value of individual harvests as measures of economic benefit are analyzed to show how harvest capacity and the returns to fishing effort have shifted since the introduction of ITHQ. Given the relationships specified in the bioeconomic model, a theoretically predicted outcome of ITHQ implementation would be an egress of inefficient, non-viable operations, accompanied by a concomitant concentration of capital linked to high value harvests. The fishing operations with the greatest level of investment and harvest value would most likely also have harvested the greatest number of pounds of the two major commercial species.

Number of commercial fishing operations

The number of commercial fishing operations in the Lake Huron commercial fishery dropped from over 86 in 1980 to less than 60 in 1984, the first year after the

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[44] The objective of reducing harvest capacity in the commercial fishery is a province wide policy objective. Problems of excess capacity were most acute in the Lake Erie commercial fishery. As discussed in section 5.2, reported harvests in all quota areas in Lake Huron were below the amounts allocated in both 1984 and 1985, owing to factors unrelated to capacity (e.g. environmental, social, economic). It is still instructive, however, to examine shifts in the amount and distribution of harvest capacity within the Lake Huron commercial fishery.

implementation of ITHQ, and slightly in the next year (see Figure 5.7). The overall reduction in the number of operations is consistent with theoretically predicted outcomes regarding reductions in harvest capacity and concentration in the industry. A logical inference is that some harvest capacity is being retired, and remaining capacity is being more fully utilized.

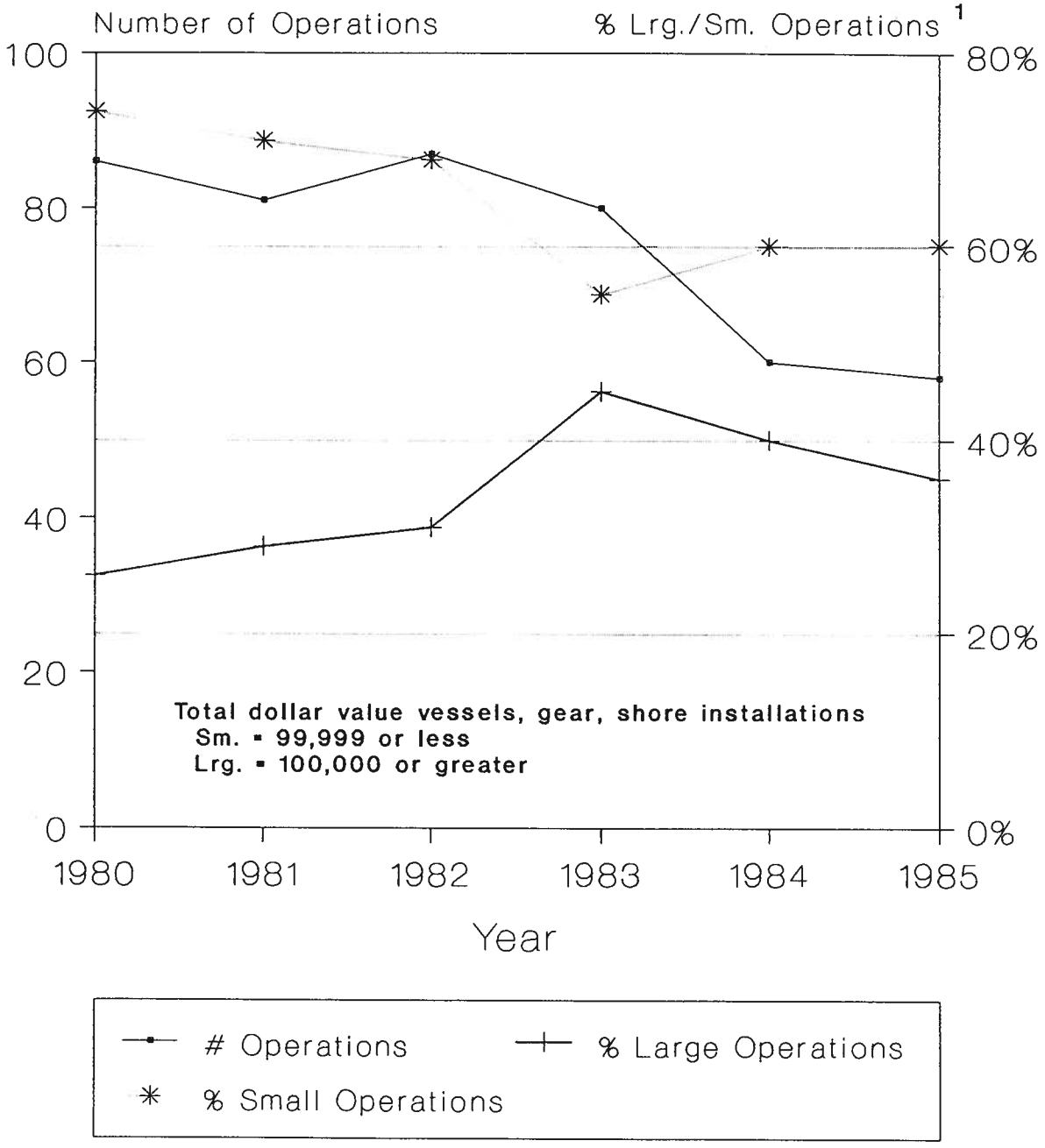
Changes in the number of operations relative to their harvest and investment amounts

Since the implementation of quota regulation, an increasing percentage of those operations reporting the greatest harvests also report the greatest investment in vessels and gear (not including monies spent on quota lease or purchase for which data are unavailable) (by 1985, only 6% of operations in the 'low' harvest category reported investments over $100,000, as compared to 1980, when the comparable figure was 13%, see Figure 5.8). Over the study period the percentage of operations with reported investment under $100,000 and in the 'low' harvest category has decreased from 53% in 1980 to 30% in 1985. The percentage of operations with reported investment of less than $100,000 in the 'medium' or 'high' harvest categories has grown (from 17% in 1980 to 20% in 1985). (This may be an indication of more efficient use of fishing capacity, and from a theoretical point of view, considered to be a positive outcome of ITHQ.) Looking at all investment levels, there was a general movement out of the 'low' harvest category (66% in 1980, compared to 46% in 1985), consistent with a division of the harvest among fewer fishers.

Over the study period, there has been a growing percentage of operations with reported investments over $100,000 (29% in 1980, and 32% in 1985). Operations in these investment categories are also increasingly evident in the two highest harvest categories (16% in 1980 and 36% in 1985).

Although assessing impacts of ITHQ from a somewhat different perspective, related results in Berkes and Pocock's (1990) study of diversity of commercial fisheries

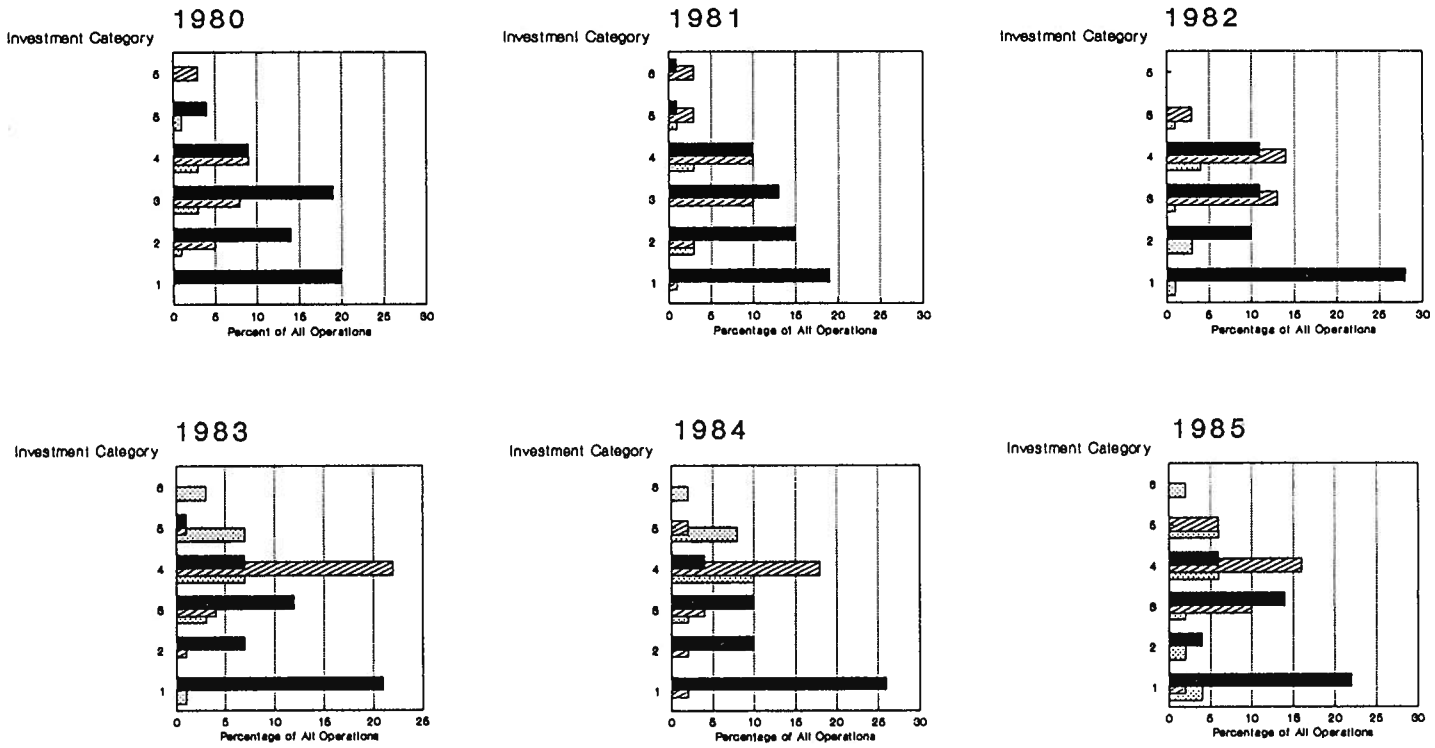
FIGURE 5.7
Total Number and Percentage Small and Large Commercial Fishing Operations on Lake Huron, 1980 - 1985



1 May exclude 0-5 operations for which data were unavailable.

Source: OMNR CF.8A

FIGURE 5.8
Percentage Change in Numbers of Operations by Investment and Harvest Category, 1980 - 1985



Investment (total $ value vessels, gear, shore install.)		Harvest (total pounds of whitefish & chub)
1 = 24,999 or less	4 = 100,000 - 249,999	*Low = 19,999 or less*
2 = 25,000 - 49,000	5 = 250,000 - 499,999	Med. = 20,000 - 99,999
3 = 50,000 - 99,999	6 = 500,000 or greater	High = 100,000 or greater

Source: OMNR CF.8A

in Lakes Erie and Ontario indicate that ITHQ has encouraged larger-scale operations to the detriment of "small-scale operations [that] were more efficient in their use of energy and capital and created more employment [per unit of investment] than larger-scale operations."

Total investment

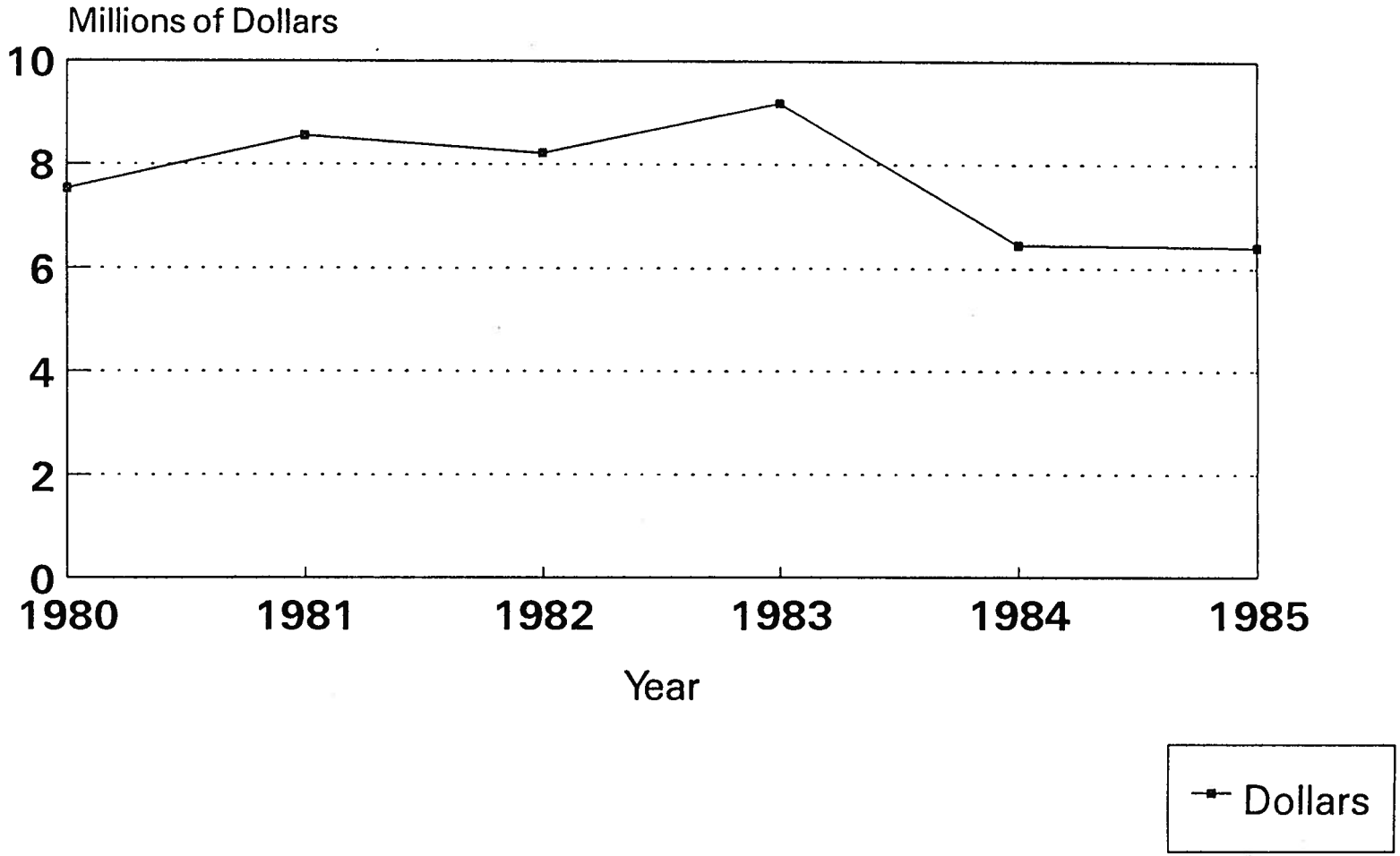
The general trend in the changes in total investment over the study period shows a high point in 1983, some decline to 1984 and relative stability through to 1985 (see Figure 5.9). This pattern is similar to those in the total number of operations (Figure 5.7) and the total harvest and total value of whitefish (Figure 5.2). The post-ITHQ, 1984 and 1985 levels of total investment are less than those of the previous years in the study period. It is unclear, however, how much of this reduction can be attributed to ITHQ. ITHQ was legislated in 1983, for certain implementation in 1984. In spite of this, 1983 was the peak investment year in the study period. It is likely, for example, that the bountiful whitefish harvest of 1983 spurred some of that year's increased investment through providing available cash for upgrades that may have been postponed over the previous few years. The post-1983 decrease in total investment is consistent with the reduction in the number of commercial fishing operations on the Lake.

5.1.3 Employment

Change in employment is another measure of how ITHQ may achieve the theoretically predicted outcome of reducing overcapacity, such that remaining capacity would be utilized more efficiently. In some respects, employment in the fishery is a measure of "capacity," and as such, would be expected to decline with the advent of ITHQ. Although the number of persons employed in each operation is reported in the annual report (Form CF.8A), reliance on this sole source of information can be misleading. Owing to the nature of commercial fishing, it is often a family concern, involving thousands of hours of unattributed labour (e.g. telephone calls to market the catch; cleaning and mending nets; initial processing of the harvest; etc.).

FIGURE 5.9

Total Investment[1] in Commercial Fishing Operations on Lake Huron 1980 - 1985



1 Excluding O-5 operations for which data were unavailable.
Source: OMNR CF.8A

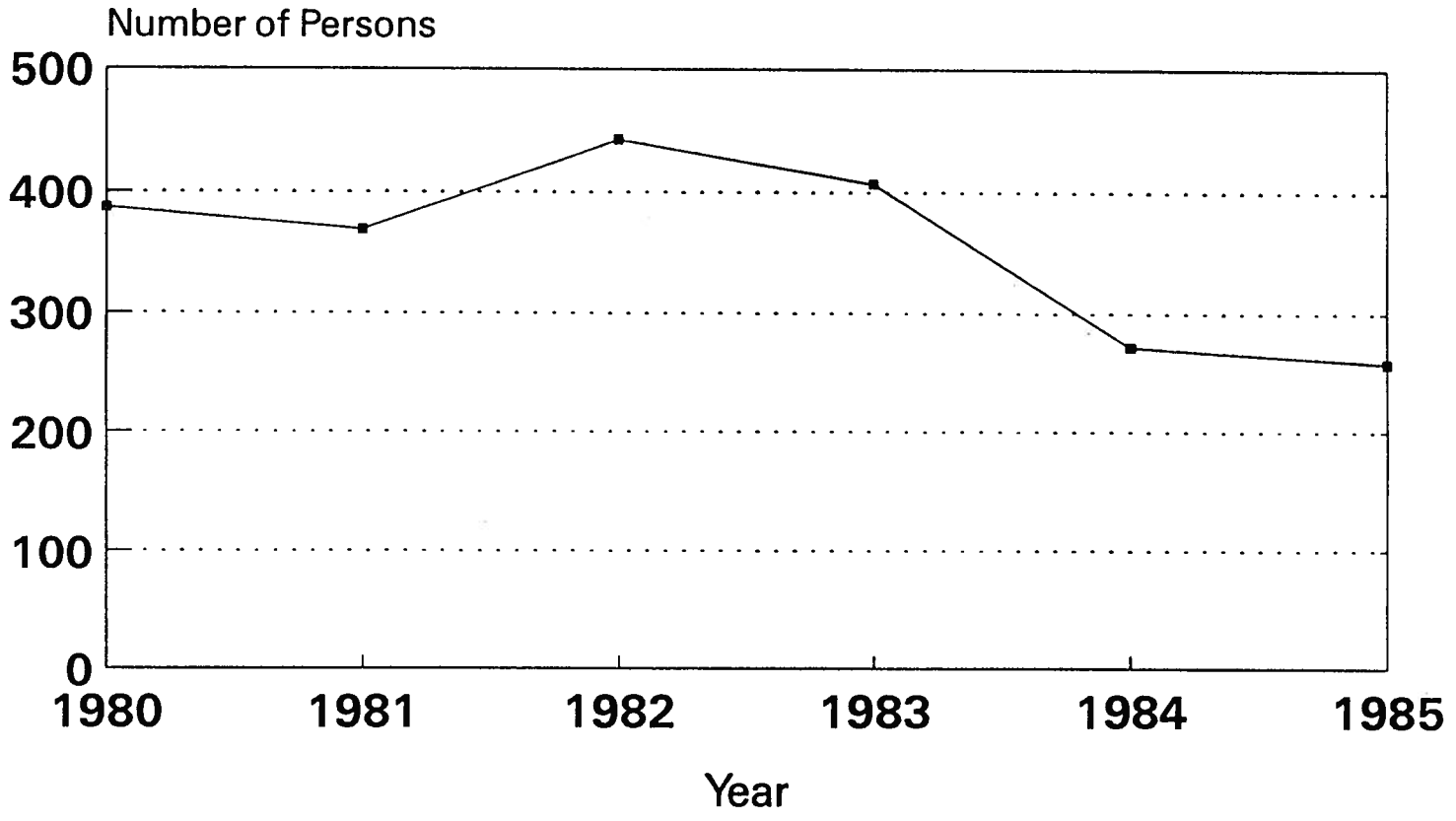
Over the study period, 1982 was the year of peak employment, with almost 450 persons employed in the Lake Huron commercial fishing industry (see Figure 5.10). The decline from this peak is most steep in the year immediately following ITHQ implementation. This decline contrasts with the increases in the harvest amounts and value of the two principal commercial species over the same time period (see Figures 5.1, 5.2, 5.4, 5.5). Over this period, there was a reduction in the percentage of operations with substantial investments in vessels and gear, but relatively low harvest totals (i.e. the very inefficient firms where total cost and total revenue relationships were not favourable). Assuming a relatively stable family labour contribution, these two sets of changes support the contention that existing employment and investment are being used more efficiently to achieve an increasing harvest and harvest value. Given that these relationships were observable at least two years before the implementation of ITHQ, however, no conclusions can be drawn as to what extent the new regulatory regime has contributed to these changes.

Little has been written on empirical observations of the relationship between employment and ITHQ in the Great Lakes. In reference to Lakes Ontario and Erie, Berkes and Pocock (1990) note that small-scale operations created more employment per unit of investment than the larger-scale operations that are encouraged by ITHQ. Consistent with the findings of this research, a 22% reduction of the labour force in the Lake Erie fishery in 1984 is attributed to a reduction in the number of crew employed and to the elimination of entire crews, as boats were drydocked to facilitate consolidation of ITHQ to one boat (Berkes and Pocock 1987).

The preceding analysis highlights some of the emerging trends in selected quantitative aspects of the post-ITHQ Lake Huron commercial fishery. The following section, details the methodology and analysis of the qualitative data base.

FIGURE 5.10 [1]

Number of Persons Employed in Lake Huron Fishing Industry 1980 - 1985



1 Including licence holder, may exclude 1 operation for which data are unavailable.

Source: OMNR CF.8A

5.2 Results of Analysis of Qualitative Data

This section presents a descriptive and interpretive analysis of the major themes and issues emerging from the qualitative data.[45] As discussed in section 4.3.1, ITHQ was intended to affect selected aspects of commercial harvest activities. ITHQ took effect in a complex context, however, and the new regulatory regime affected a broad spectrum of activities and factors associated with the commercial harvest. Various regulatory, social and cultural aspects of the fishery reflected impacts owing to the implementation of ITHQ. This section examines some of the impacts not predicted on the basis of interpretation of the relationships modeled in the biological and economic models.

Analysis of the qualitative data examines a thesis suggested by the co-management critique of resource managers' efforts to maximize resource rents: that theoretically feasible solutions can encounter transitional problems when applied in the real world.

5.2.1 Changing quota allocations

Theorists often cite "administrative ease" as a benefit of ITHQ. Hard information on the government's and the fishers' administrative costs was unavailable for this study. In lieu of such financial information, two qualitative indicators of administrative ease were identified: (1) consistency in administration of ITHQ; and (2) ease and rapidity of response to resource users' and managers' requirements. The following analysis of interview respondents' comments on their dealings with ITHQ defines problems and also ways to improve the administration of ITHQ.

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[45] Where anonymous quotes are used, they were taken from interviews conducted by the author, not for attribution.

Sometimes the managers' and fishers' contrasting objectives and perceptions create misunderstandings in the implementation of ITHQ. The questions in areas one and two of the interview schedule examined the level of awareness of, and perceived reliability of, the causal relationships defined in the biological and bioeconomic models. Biological models of stock status do not produce exact figures of fish abundance, but they are useful to indicate trends. Different models give varying results for the same fish populations, and all models have errors associated with the numbers they produce. Fisheries managers rely on such models to predict trends in fish stocks.[46] From time to time, OMNR assessment information indicates certain conditions unfavourable to the commercial fishery pertain in the fishery, such as a small year class of a certain species or an absence of a particular size of whitefish. If this happens, and then there is a serendipitous commercial harvest of a plentitude of the supposedly absent year class, or size of fish, contradicting the prediction, this news will soon travel through the region. Such informal communication contributes to the belief that OMNR's assessments are erroneous (most commonly in underestimating the fish populations). Analysis of interview data indicates that all fisheries managers can be uncomfortable in increasing quotas because an increase on the basis of a short time series of data may result in putting too much harvest pressure on the stock. This statement of managers' views is further substantiated by OMNR Fisheries Branch representatives presentations and contributions to discussions at the 1989 OFPA Annual Meeting. Similarly, at the same meeting, most fishers substantiated the conclusion drawn from analysis of interview responses: that they are equally ill at ease with decreases because a significant decrease could substantially reduce their income and they might not readily be able to return to the former, larger quota. During the period of a field visit to a prosperous southern

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[46] During the period immediately preceding the implementation of ITHQ and during the field work portion of this research, the OMNR did not have a working data base for the Lake Huron fishery. (A senior fisheries manager confirmed, "Quotas were based on hurried calculations based on formulae from the Minister. Our own records were in some disarray.") This situation is now rectified and stock assessment models are routinely utilized for prediction of trends in stock fluctuations in Lake Huron.

Lake Huron commercial fishing/processing operation, for example, OMNR assessment officials were widely quoted by commercial fishers as reporting an absence of "jumbo" whitefish. In the same week, the author observed that this processor was marketing live "jumbos." In the spring of 1988, when OMNR refused to adjust whitefish quotas upward, whitefish were reportedly so plentiful in Lake Huron that one Southampton fisher reported unintentionally netting whitefish when just washing nets in the lake. Apocryphal incidents such as these are thought to be commonplace, and have contributed to a lack of confidence in the scientific assessment data on which quota adjustments are based. The commercial fishers interviewed usually ask for increases in their quota allocations on the basis of an observed abundance of fish. When this is in contrast to official assessment information, an increase from OMNR is unlikely.

The contrast of the specific limits set by ITHQ with the uncertainties of perceived and/or inadequate stock assessment tends to emphasize an ongoing fisheries management problem. Management is complicated by the necessity for managers to derive species allocations from uncertain historical assessment data, months in advance of their implementation. Along with a reluctance on the part of managers to make mid-season adjustments to quota allocations, these implementation problems have complicated policy-making and hindered the effectiveness of ITHQ. Explained one fisheries manager with lakewide responsibilities,

> "There is more management now, it is more difficult and more time is spent. Before [ITHQ] management was keeping track of the number of yards [of net] on a license and there was less day to day work. Enforcement was minimal. Besides, commercial fishing reports are not fully accurate as to the area of catch, so the data base suffers."

Thus management cannot be said to be more consistent or less burdensome administratively. At the time of this research, contrary to theoretical predictions, ITHQ had not eased administration. An additional factor is the weaknesses of the necessary scientific foundation, as the allocations were at least partly arbitrary, and this has heightened the politics associated with ITHQ.

5.2.2 Uncertainty and quota transfer

Area three of the interview schedule looks at the factors affecting the perception of quotas as a management tool. Uncertainty about how allocations might be changed by government fiat has led to a number of interrelated unanticipated impacts. Four of the individuals interviewed (coincidentally, all licensed to fish in the northern area of the lake), reported that prior to ITHQ implementation, they had fished only sporadically (owing to poor health, personal inclination, poor markets, poor stocks, etc.) and so received small quotas. Understandably, respondents in this position voiced dismay at seeing this portion of their life's work reduced to the relatively little they could realize from the sale or lease of their quota. An additional three of the fishers interviewed specifically said that they would like to "cash in" their fishery. Having observed or heard about other fishers negotiating increases in their quota, or benefiting from stock assessment-based increases, however, they are holding on to their allocations, in the hopes that they will realize a higher "cash in" value. For example, one prosperous Port Elgin fisher/processor confirmed that his aggressive efforts to purchase perch ITHQ in 1986 were prompted by that year's 30% increase in overall perch quotas. (In turn, the OMNR decision to make a 30% reduction the following year may have caused some disappointment on the part of the new owners of the reduced quota.) Alternatively, as reported by a frustrated willing purchaser in the Parry Sound area, in some instances, significant quota may be being held (but not fished), and the allocation is not being harvested. In particular, this individual complained that "the majority of quota should go to the most active fishermen" if there were to be any increases. Opportunity costs are the only penalties an individual would sustain in retaining an unused quota allocation. As a secondary impact, this is constraining the more active fishers in the area. They might like to expand their operations, but cannot purchase or lease the unused quota in their area. From the point of view of the government, there is no biological (i.e. scientific) basis for assigning any additional allocation to the fishery. This stymies the individual fisher, and confounds fisheries management in the affected areas. And the resultant harvest does not reflect the potential of the fishery. From the fishers' point of

view, necessary government decisions greatly complicate "ownership" and "economic" calculations. This situation is analogous to "owning" (and selling/buying) a piece of property, the size of which is/can be changed by government (and is changed regularly and without warning).

Although most of the fishers interviewed did not want to sell or lease their own quota, those with larger harvesting or harvesting/processing operations reported obtaining additional quota by these methods. In general, both managers and fishers interviewed saw this practice to be beneficial for both the biological and economic management of the commercial fishery. Fishers support for the sale of quota was limited to those transfers that allowed the allocation to remain active within the commercial fishery. None of the fishers interviewed supported the "retirement" or government buyback of quota without replacing the equivalent allocation in another area. "Buyback is no good," noted a Southampton fisher, "licenses are lost, the commercial fishery becomes weaker and the sport fishery will become the focus of the bureaucracy."

At one point in the formulation of ITHQ there was some discussion of how to deal with unutilized quota allocations. A commercial fisher representative on the joint OMNR/OCCF committee said that the committee tabled the suggestion that if allocations were not used or were under-used for a period of time, and without just cause, the quota would be reallocated to other fishers. The representative explained that doubts regarding the exact terms of the provision (what would constitute under-utilization, for how long) and how such a rule might affect fishing effort, resulted in the proposal being shelved. The currency of this idea, however, does seem to have some effect on fishers' behaviour. A dissatisfied Southampton area fisher claimed that he was "fishing more now than before, because I don't want to lose any quota. I was doing OK before, but now I have to meet the quota figure."

Berkes and Pocock (1987) relate that in 1984, fears that a fisher would lose the unused portion of a quota contributed to market flooding in the volatile Lake Erie

fishery, and led to the near bankruptcy of several processors in the winter of 1984-1985. Dewees (1989) also found problems with quota transfer, and recommended that such transfer be facilitated, so that the industry can efficiently manage quota holdings.

Under the conditions present in the Lake Huron fishery at the time of ITHQ implementation, quota regulation brought into being a wholly new management problem that would not exist without the creation of ITHQ. The regulation introduced an element of uncertainty for fishers about their fishing rights. Additionally, the possibility of reallocating ITHQ has opened up a new area of decision making about the distribution of benefits from the fishery. Again, administrative details can have a confounding effect on how well ITHQ works to achieve maximum resource rents and to reduce overcapacity.

5.2.3 Spatial distribution

Any analysis of the distribution of fishing effort is confounded by inconsistent management actions (e.g. planting of sport fish species in various and variable areas) and changes in the geographical definition of management units coincident with the implementation of ITHQ. It is nevertheless worthwhile to discuss how interview respondents see redefinition of the geographical areas in which they are licensed has affected their operations. Area four of the interview schedule deals with perceptions of the scope of change introduced by ITHQ and the management of this change.

Over the years, commercial fishers had developed traditional areal fishing patterns within their licensed areas. With the introduction of quota regulation, quotas were assigned to area divisions as re-determined by OMNR. As reported by interview respondents, one of the results of this spatial reorganization of the fishery was that allocations assigned to some of the newly designated quota areas (see Figure 3.1) were inconsistent with traditional fishing patterns, leaving some fishers with only a very small quota allocation (based on past performance) for areas in which they had in the past

expended very little effort, and excluding them from fishing in areas in which they had had years of substantial harvests. Initially, the fishers' past performance in these newly-excluded areas was not used in the calculation of their quota allocation. This situation was crucial for a number of North Channel area fishers, who reported that they had "left off fishing [in a local near-shore area] to keep out of the way of the tourists [i.e. sport fishers] and to give the [chub] stocks a break. And now we don't have any quota in that area, even though we fished there for eighty years." Some fishers who took the one-time opportunity of applying to the Lake Huron Quota Review Board to remedy situations similar to this one reported that they received additional quota allocations and/or adjusted licensed areas. These increases were based on the fishers' overall past performance and not on any biological assessment of the new areas. The objective of these adjustments was to allow the fishers to maintain their level of business. Analysis of interview responses indicates that fishers disadvantaged by the area reorganization, who did not apply for an adjustment or who did not receive the adjustment they sought, remain disgruntled.

In practice, some fishers throughout the lake reported that the grid limitations were just too restrictive. A Manitoulin Island fisher/processor said that "Some areas are twice as productive [as others], but I can't fish there and I have to stay in less productive waters." A Georgian Bay area fisher expressed a more cynical approach: "I report my catch the way they want to hear it," implying a certain liberty in his reporting. "Area restrictions are not enforced up here. I catch where there are the most fish, regardless. Area restrictions are wrong; you should take fish where they are most plentiful" said a Bruce Peninsula fisher. In the southern part of the lake, a fisher/processor tackled the problem by "fishing fifteen separate fisheries [licences] as one business."

Contrary to the expected provision of increased security for fishers about their fishing rights, changes in fishers' usual licensed fishing areas brought an element of uncertainty to those fishers who were displaced from their traditional fishing areas. This situation was particularly acute where fishers were assigned allocations in areas that were

unsuitable for commercial harvest activities owing to planting of sport fish species and the fisher did not have additional ITHQ in an alternative area. Little has been written on either the theoretical or applied spatial aspects of the distribution of allocations, but clearly there are cases when traditional harvest patterns are important considerations in operationalizing ITHQ. This problem highlights one weakness of one assumption inherent in the bioeconomic model -- the assumption that fisheries stocks are homogeneously distributed in spatial terms. (They are not.)

5.2.4 Problems in calculating allocations

ITHQ is an "information hungry" method of regulation. In order to work as theoretically predicted, allocations must be based on adequate assessment information. Unfortunately, in the Lake Huron fishery, the information available at the time allocations were calculated was incomplete. As well as pointing out the need for revised methods of monitoring and enforcement, this problem has implications for the distribution of benefits among the commercial fishers. The final questions in area four of the interview schedule focused on the level of awareness and perceptions about the method of calculation of allocations.

A North Channel fisher recounted that "Thirty years ago, one tourist operator had the Bayfield Sound area restricted and it's still out of bounds today, even though the lodge doesn't even exist any more and there's lots of whitefish there. The government never did any assessment there, so it has no past and therefore no future." Archaic administrative conditions such as this one would unnecessarily limit both the areas for which stock assessment information is available and, in areas where significant commercial stocks exist, the amount available for ITHQ allocation to the commercial fishery. "Pope [former Minister of Natural Resources] put the cart before the horse." declared a Manitoulin Island fisher/processor. "You should have the assessment first, and then the quota." This individual went on to cite specific weaknesses in assessment procedures. "MNR did not sample in March, April, November or December," he said.

"Their data doesn't represent the fishery. There were changes in personnel, and this introduced biases in the sampling program and in interpretation." The ITHQ management option would be perceived to be working more fairly and effectively if adequate assessment and administrative review occurred before ITHQ was implemented.

Based on interview analyses, it is clear that in some instances commercial fishers harbour suspicions of the stated reasons for collection of information on the amounts and sale prices of past harvests. Aware of this scepticism of government "prying," interview respondents contend that some fishers have under-reported their harvests. Naturally, if deflated figures were used as a basis for calculation of individual transferable harvest quotas, the resultant allocations could not truly reflect the past harvests. While there can be little sympathy for individuals who may have chosen to lie, it is unfortunate that by underreporting harvest, they may have diminished the size of quota for honest fishers too. Underreporting of harvest would, of course, result in a reduction of the historical, lakewide totals utilized in the allocation formulae.

Co-management theorists point out that management systems depending more fully on community regulation have the potential of internalizing some of the high information and transaction costs (Grima and Berkes 1989). These costs would be internalized by dependence on traditional information about the biological limits of the resource which have been learnt by experience, and use of the requisite social coercive mechanisms, such as peer pressure and adherence to tradition, to force compliance with expected harvests (Grima and Berkes 1989).

5.2.5 Incidental catch[47]

Questions in area five of the interview schedule sought information on respondents' perceptions of the consultation activities associated with ITHQ development and implementation. In the context of this discussion, consultation activities refer to the ability of actors to participate in decision making and the political ramifications of these activities in an interest group context.

Like many natural resources, the fishery has been subject to pressures of utilization. The three areas where conflicts between sport and commercial fishing activities are most clearly manifest are: (1) numbers; (2) timing; and (3) spatial distribution. In regard to the numbers of sport fishers wanting to use the resource, sport fishing in Ontario is a major recreational activity. Anglers fished a total of about 34.4 million days in 1985 (OMNR 1988a).

> Temporal distribution of sport fishing effort is another source of pressure:
>
> Most fishing (85%) occurred during the period April through September. During that time 83% of resident and 96% of nonresident effort was expended. More than half of all effort (54%) occurred during July, August, and September. (OMNR 1988a)

As is the spatial distribution: the southern, central and southwestern (including the study area) regions of the province were the most heavily fished for sport (OMNR 1988a). In particular, picturesque Georgian Bay offers a wider variety of popular sport fishing opportunities than can be found in Lakes Ontario and Erie, for example, (including the chance to angle for lake trout, rainbow trout and salmon) and is immensely popular with sport fishers. The Georgian Bay fishery has also attracted a powerful sport

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[47] Section 4.3.5 discusses a 1988 provincial government study of incidental catch in Lake Huron.

fisher lobby and the Georgian Bay area is home to Ontario Fisherman, a popular bi-monthly publication targeted to sport fishers.

This situation has led to growing conflicts between sport and commercial users of the fishery resource. Interview responses substantiate this view. Several respondents reported making modifications in their harvest patterns (timing and area) in order to accommodate pressures from sport fishers. "I don't fish in-shore at all in July," a Port Elgin area fisher explained, "just to keep out of their [sport fishers] way. If they see even one commercial fishing boat, and they're having a bad day, they think [its because] you've caught all the fish." Similarly, four North Channel/Manitoulin Island area fishers reported that they voluntarily avoid popular sport fishing areas during the tourist season. An OMNR fisheries manager with lakewide responsibilities described sport fishers' perceptions that "the commercial fishermen are purposely fishing salmon. This is inaccurate. For example, in Sauble Beach, the whitefish fishery is confused with the salmon fishery. Anglers think the nets are blocking the fish runways, then they get their expensive gear caught in the nets and object to them."

Some commercial fishers believe the implementation of ITHQ has exacerbated friction with the sport fishery. One of the long standing challenges for commercial fishers has been to target specific species of commercial value while at the same time, avoiding "incidental" catch of an unwanted or unsalable species. (This type of targeting is possible because fish species have a specific vertical distribution in the lake waters.) However, a portion of almost every "set" is discarded, given away or, if there is a market, sold for a few cents a pound as animal feed. Interview respondents report that for the most part, the incidental catch is considered to be a great nuisance, requiring time and labour to cull from the saleable harvest. "The anglers are claiming that commercial fishermen are purposely catching [planted] salmon. This isn't true. They are oily and smell bad, strictly a trophy fish. And they have big teeth that do a lot of damage to the nets." complained one Parry Sound area fisher. At other times, however, respondents concur that a portion of the incidental catch may be game fish that are sought after by

sport fishers and which, if there were not quota restrictions, would be saleable by the commercial fishers. A North Channel fisher described how "in trying to keep away from pickerel I can't fish as freely for [target species] perch. Once I reach the limit [of incidental catch allocation] I have to keep a running tab, including the conversion[48] to avoid going over. I have to keep some quota for any incidental catch of quota fish, even when I'm fishing for another kind of fish." It is this 'truly' incidental catch that is the source of conflict.

The implementation of ITHQ has interacted with this problem in a complex way. For example, often commercial fishers fish very specific grounds within their licensed area. In areas of favoured whitefish or chub grounds which are also popular for sport fishing for (planted) salmonid stocks, the stage is set for conflict. Under these circumstances, the commercial fishers interviewed contend that they cannot harvest the allocation of quota species without risking a substantial harvest of non-quota, sport fish species. The government has made some effort to mitigate the conflict through allocation of very small quotas of the sport fish species, thus making saleable at least a portion of any incidental catch. Some commercial fishers would like to be able to sell all of their incidental catch. "What's the point in wasting it?" is an accurate paraphrase of many respondents' comments. Commercial fishers from areas where sport stock were planted reported that they have voluntarily stopped fishing certain of their traditional areas in order to avoid substantial incidental catch of non-quota sport fish. It is not economic for the commercial fisher to expend effort and resources if a significant part of the harvest is not saleable. In turning to alternative fishing grounds, however, the commercial fisher may bear additional risks and costs, including more dispersed stocks, greater travelling distance and an increased exposure to possible inclement weather. A Georgian Bay fisher, caught in a "catch 22" position described area restrictions that limited him "to fishing off-shore for chub. This is less efficient than what I was doing before, catching

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[48] Quota is allocated in round weight, this fisher markets much of his harvest dressed.

whitefish and splake in-shore. Off-shore, there is less schooling, and I have to use more gasoline and four times as much gear to produce the same amount of money." In this particular case, OMNR planted splake in the in-shore area where this individual traditionally harvested whitefish and chub, and to avoid substantial incidental catch, he had to relocate. This case was examined but unresolved by the 1984 Lake Huron Quota Review Committee and the fisher was seeking redress (i.e. "concessions with respect to territory and splake quotas") through the courts at the time of the interview.

Dewees (1989) cites problems with discarding of non-quota fish, but in this category, he includes not only sport species, but commercial species culled from the harvest in order to ensure that only the highest priced portion of a fisher's catch was landed. Additional conflicts between commercial and sport fishers include illegal sale of fish by sport fishers, competition for the allocation of fish, and the effects of recreational fishing on the resource (Dewees 1989). Berkes and Pocock (1990) refer to "the presence of a powerful sport fishing lobby resulting in the elimination of commercial fisheries from some areas and marginalization in other areas [of the Great Lakes]." In an earlier discussion of "people problems" in implementation of ITHQ in the Lake Erie commercial fishery, Berkes and Pocock (1987) identify sport fishers as "important, but subordinate parties in the quota development process."

Sport fishers remain influential in policy developments affecting the commercial fishing industry. Some respondents feel that it was promised that the implementation of ITHQ would reduce the need for those gear restrictions that are unrelated to conservation, but this has not been the case. Commercial fishery policy must operate in a complex social milieu. For example, in response to continued lobbying efforts on the part of the sport fishers' fraternity, OMNR imposed an additional mesh-depth restriction[49] on perch nets in the Lake Huron fishery (OMNR 1988b). This regulation is unrelated to conservation and is solely aimed at reducing the incidental catch of

[49] Phased in over a three year period, to correspond with the lifespan of gill nets.

salmonids (OMNR 1988b). Clearly, ITHQ, alone, was thought to be insufficient regulation, and thus ITHQ have not done away with other regulations.

5.2.6 Limits on fishers' decision-making

Areas six, seven and eight in the interview schedule examined details of the response to the way ITHQ was developed and implemented. To ascertain how adaptable ITHQ has been to real world conditions such as changes in technology, costs, prices and availability, interview respondents were asked about their risk management decisions related to enforcement, allocation and ITHQ administration. Perceived ease in reallocation and transfer is taken as a measure of ITHQ adaptability because it can be linked to acquisition of specific gear and vessel types, costs, prices and availability. In overview, the extent to which fishers' can make business decisions that include ITHQ as a manageable variable reflects the extent to which the policy has become a part of the industry.

The fact of quota allocation affects the commercial fishers' decision-making environment in three distinct ways. First, in contrast to the traditional independence associated with commercial fishing, fishers are accountable to fisheries managers for each pound of fish they harvest and market. Coupled with uncertainties about losing even temporarily unutilized quota, fishers no longer feel free to alter their harvest efforts. Second, in defining harvest limits, ITHQ specifically defines the resale value of a commercial fishing operation. Third, fishers ability to switch their efforts to alternative species are constrained. These issues are discussed below.

An individual transferable harvest quota may be too small to support a business. Aside from the reasons mentioned above, respondents cited additional explanations as to why this is so. In some instances, there are specific reasons why the past performance harvests were below the usual harvests or less than could be supported by the fish stocks. The reasons vary, but a common pattern would be poor health or temporary alternative

employment on the part of the licence holder, leading to reduced or no reported harvest in the years used for calculation of past performance figures. Poor markets or a health advisory on certain commercial species could also lead to a lesser harvest of a particular species in a defined time period. The legacy of such situations is especially troublesome in instances where a younger member of the family wishes to assume greater participation in the family's commercial fishing business, but is constrained by a small quota allocated on the basis of an older person's previous part-time efforts. According to one North Channel fisher, "My son bought a licence, gear and a boat off a retiring fisherman, but there was only a very small quota as the licence was not used much. My brother and me sold him some of our quota, otherwise he would not have survived." Some retiring fishers who may have chosen to fish only part-time in recent years, and who wish to sell their operations find the value limited by the amount of their individual transferable harvest quota.

Dewees (1989) also reported concerns that cutbacks in fishers' potential harvest under ITHQ make their business uneconomical. Some of the fishers he interviewed previously fished full-time, but subsequently changed their operations to part-time because their quotas were less than their harvest capacity.

With the implementation of ITHQ, fishers became accountable to fisheries managers on a pound by pound, species by species basis for their harvest. Quota regulation suddenly introduced an element of accountability that was not previously present, and in so doing, some respondents feel it has impinged on an important element of the commercial fisher's traditional independence. This independence allowed fishers to lay off fishing in order to take advantage of short-term, profitable, non-fishing employment opportunities, or for any other reason. Conversely, they could make a short-term increase in their effort (and harvest) if they so desired. Before quota regulation, the individual fisher was free to harvest more or less of any given species (within the ABC) from one year to the next, with only the short-term consequence of varying income. With the advent of quota regulation, variations in the amounts and

species harvested can have more long-term ramifications for a fisher's livelihood. "Quota regulates our income," said a North Channel fisher. "There's no way to work harder and make more money."

ITHQ has impacted the traditional method of evaluating an operation (i.e. estimation of the potential of an operation as represented by licensed area and vessel and gear capacity and its resale value). Since the implementation of ITHQ, the quota reflecting past performance has come to be the most significant measure of the value of a commercial fishing operation.

Fishers' decision making is also limited because quotas apply to particular species. With quota regulation in place, a fisher holding substantial quota allocation in a single species, and only a small allocation of other species, has lost flexibility in decision making. If harvest or sale of the major quota species is poor, the shortfall cannot easily be made up through increased harvest of alternative species. A Bruce Peninsula fisher specializing in chub elaborated, "The problem is that quota puts a ceiling on how much I can catch, and I can't make up for a bad year by catching more the next year. Sometimes the amount of fish is set by schooling [of fish], not by the number of fish in the lake. And with the quota I have now, I can't switch species and so I'm more vulnerable to a health scare."[50] Should either situation occur, a fisher is risking a substantial reduction in earnings for the length of time the harvest or market remains poor. A second fisher from the same area substantiated this view: "I need flexibility in case there is a problem with chub. Right now I don't have enough whitefish quota to even pay my winter expenses. It's so small that it's not worth buying gear to switch."

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[50] This is a problem owing to water pollution, which is not an uncommon problem along the highly industrialized shores of the Great Lakes. Lake Huron is at risk not only by virtue of the Sarnia-area petrochemical industrial complex, but from the many mining and forest products industries located along the northern shores. Market perception is also very important: the fish need not be contaminated, only perceived to be at risk, for sales to be affected in one area or another.

The option of purchasing or leasing quota in another species may be impractical (e.g. if a specific type of gear or vessel is required; if the capital outlay is too great) or impossible (e.g. if none is available). The option of receiving a temporary re-allocation from OMNR was not seen to be an adequate one. "MNR is too slow." the first Bruce Peninsula fisher noted. "It takes them a year to respond to any request." It is likely that this lost flexibility may limit, not enhance, efficiency for the commercial fisher. Although the principle of ITHQ is intended to maximize efficiency, the practical effect is, in some respects, to reduce it.

Berkes' and Pocock's (1990) research demonstrates that in the Lake Ontario fishery, in particular, where fishers typically use five distinct techniques and obtain eleven species of fish, ability to switch vessels, gear and target species is the predominant strategy to reduce expenses and optimize operations. They see this strategy to be less critical in the Lake Erie fishery, where fishers utilize one technique or gear predominantly and rely mainly on one of two species (i.e. yellow perch or smelt). Dewees' (1989) interview subjects cited the high price of quota as being a barrier to adapting fishing practices to maximize prices received for fish.

Aside from these practical aspects of freedom in decision making, research by Beddington and Rettig (1984) confirms the psychological importance of autonomy for the commercial fisher.

> For example, fishermen often complain that their individual occupational objectives are inadequately considered when regulations are set. Many fishermen chose their way of life because they wished to be independent while living an outdoor life full of challenge, with a lack of regimentation, full of a sense of identity, and proud of their occupation (Thompson 1984). Further, many of them argue that their heritage does not allow any other self-image. They also want a great deal of flexibility in choosing target species, size and type of vessel to operate, gear to use, what time of year (week, day, and time of day) to fish, and the area in which they will fish. Such flexibility implies to them both ease of entry and exit from a specific fishery.

Autonomy was mentioned as a factor in the Lake Huron commercial fishery. Although he said that he still harvested the same amount of fish, he viewed restrictions and government control over the amount, type and location of harvest as "too much interference." This Georgian Bay area fisher declared himself to be "so depressed by the whole situation that I'm thinking of getting out."

5.2.7 Marketing quota value

Questions in area seven of the interview schedule examined how fishing activities may have changed in response to ITHQ.

Dewees (1989) identified development of innovative on-board handling methods and harvest of marketable non-quota species as two changes consistent with the theoretically predicted behaviours associated with ITHQ. These predictions are also substantiated in examination of the post-ITHQ behaviours in the Lake Huron fishery. ITHQ has spurred some changes in fishing technology, processing and marketing. Fishers detailed several innovative activities in their descriptions of how they were adapting their operations to the constraints and opportunities created by the implementation of ITHQ. These activities included development of retail operations selling cooked fish, icing fish immediately to preserve freshness, and experiments with trap netting and sale of live fish. A Manitoulin Island fisher/processor, for example, described how he "raised these [farmed] trout to match the size of the plates in the restaurant that buys them." The same individual said: "I use my freezers to control supply and keep the fish in better condition." In another example of innovative marketing, indicating the converted schoolbus on his dock (conveniently located near the high-traffic liquor store and adjacent to a provincial park that attracts many tourists) a Killarney area fisher/processor related that he "started this fish and chip business because my quota was too low to stay in business. I put cisco [not considered to be a commercial or sport species, and not subject to quota restrictions] through the chip wagon and sell them as 'round whitefish'." A North Channel fisher reported on his experiments in trap-

netting: "I had to do a lot of paperwork, but I finally got a crew of American Indians over here to catch my quota with their own trap nets. I got the same amount of fish, but they were more valuable [i.e. could be sold at a higher price] because they're not damaged." And marketing of non-quota species: "I found a market for mullet in Montreal and New York, where they make it into fish product. But I need to be able to produce one tonne per day to make it worthwhile, and I can't do that yet." Consistent with, but somewhat tangential to a strict interpretation of the theoretical predictions of "increased efficiency," ITHQ has been concurrent with the development of harvest, processing and marketing techniques which add value to the harvest and/or exploit the fishery resource more fully (e.g. development of markets for previously non-commercial, non-sport species).

Recent advances in the marketing of the commercial harvest have brought a new dimension to the valuation of quota that has received little attention in the literature. Fish harvesters and processors reported that they are doing more to increase the market value of their fish (e.g. icing when caught, dressing, offering uniform size, marketing to local stores and restaurants, developing new products, etc.). The potential "processed" value is implicit, regardless of whether the fish are processed by the harvester, and thus becomes part of the value of the quota. This means that quota may then be transferred on the basis of the processed (not the harvest) value of the fish.

Aside from tracking the sale price of whitefish and chub, the quantitative data available for this research do not address the effect of quota regulation on the market for the commercial harvest. Fisheries managers expected ITHQ to have a stabilizing effect on the overall market for Great Lakes fish. On the basis of interview data, however, it seems that the Lake Huron market is developing more clearly distinguishable parts. Respondents reported many small, detailed adjustments and investigations undertaken to develop new market niches and add value to their limited harvest (e.g. innovative processing and marketing for the wholesale and retail sale of non-quota species to the fast-food market). In the meantime, as indicated by Figures 5.1 and 5.3, in the short

time over which ITHQ effects are studied here, prices for whitefish have varied little from those in the immediately previous period. (As discussed earlier, increases in the prices for chub can be attributed to recovery of market confidence lost owing to contamination from water pollution and errors in packaging leading to spoilage.) Certainly the market innovations associated with implementation of ITHQ cannot be categorized as "problems;" however, given that the Lake Huron commercial fishery was not immediately previously an open access fishery, incentive to maintain quality and develop quality-based markets existed, and these initiatives could have been developed in the absence of ITHQ.

5.2.8 Seasonal patterns of harvest

One of the theoretically predicted beneficial effects of ITHQ is that by assuring each fisher a share of the harvest, the incentive to harvest large amounts of fish early in the season would be removed, thereby creating opportunity for a steady harvest of fish throughout the season. Questions in area seven of the interview schedule address this issue. In the Lake Huron fishery, however, most interview respondents reported little change in their customary temporal fishing patterns. Individual predilections aside, they said that these patterns are largely determined by: (1) safety considerations in regard to weather conditions; (2) the higher prices available during certain religious holidays; (3) avoidance of conflict with sport fishers; and (4) biological considerations relating to fish behaviour (e.g. fish do not school in June, when there is no thermocline). Fisher after fisher confirmed this. "There are no big changes, I use the same amount of twine, conditions haven't really changed. I catch the same amount," a North Channel fisher reported. From a Georgian Bay fisher: "I put out the same effort or maybe a bit more [to meet the quota amount]. Sometimes I have a shorter season and I would have continued if I didn't have the quota." And in the south basin: "I fish to the market, not to a certain volume. My volumes and costs balance, so it is the same." Similar remarks can be attributed to a representative Bruce Peninsula fisher: "Everything is the same,

same time, same amount of people [employed] and same amount of fish." Various versions of "It really depends on the weather." was the most ubiquitous comment.

Dewees' (1989) research identified concerns about the increased capitalization required to obtain an adequate quota and to change fishing practices to maximize prices received for fish (in some cases, increased prices were required to compensate for an otherwise uneconomical allocation).

According to Lake Huron commercial fishers, ITHQ has not had any impact on the timing of fishing effort. Seasonal patterns persist. For example, every whitefish fisher interviewed identified the Rosh Hashanah holiday period as a continuing important market target.

5.3 Summary and Conclusion

The following summarizes the principal findings of the analysis of the quantitative data base.

(1) Aggregate harvest amounts and harvest/price relationships changed little either before or following the implementation of quota regulation. (Harvest amounts did differ from the quota. Harvest amounts have been less than both the previous, lakewide quota, and the subsequent ITHQ allocations.) Therefore, the fact that aggregate harvest levels remain below ITHQ levels is not necessarily evidence that ITHQ has effected lakewide control of the harvest or affected the selling price of whitefish. Analysis of chub harvest is also inconclusive on this point.

(2) There have been reductions in the numbers of commercial fishing operations and in harvest capacity. At the same time, there has been a shift of harvest share from the lower to higher investment categories and a modest growth in the percentage of low investment operations in the

medium and high harvest share categories. These findings may be an indication of more efficient use of harvest capacity.

(3) Total investment has declined in a pattern consistent with the reduction in the number of commercial fishing operations.

(4) Employment has declined, possibly indicating that existing employment and investment are being used more efficiently.

Analysis of the qualitative data base identified the following impacts associated with ITHQ.

(1) Since ITHQ define allowable harvest per fisher by species and amount, incidental catch is no longer legally saleable and this has been a concern.

(2) ITHQ has not had any impact on the timing of fishing effort.

(3) There are administrative problems in adjusting allocations to reflect stock availability. This points to a need for revised methods of monitoring and enforcement.

(4) Allocations assigned to some of the newly designated quota areas were inconsistent with traditional fishing patterns.

(5) Details of quota transfer are uncertain, and this uncertainty is affecting fishery operations.

(6) The need for increased monitoring and the specific quantification of harvest for specific species can infringe on fishers' traditional freedoms by creating barriers to: (a) diversification of the variety of species harvested; (b) ready variation of fishing effort; and (c) opportunities for growth.

(7) ITHQ has spurred some development in fishing technology, processing and marketing, including development of retail operations selling cooked fish, icing fish immediately, and experiments with trap netting and sale of live fish.

Although the quantitative analysis may seem inconclusive, the data do indicate some important characteristics about the Lake Huron commercial fishery and ITHQ impacts. In particular, ITHQ's most important effects seem to have been on the organization of labour and capital in the fishery. Harvest amounts, species and prices have remained relatively stable.

Overharvest was not a lakewide problem either before or after ITHQ. Although market conditions were not specifically studied in this research, the market for any particular species or fish product is understood to be one of the many contextual factors (e.g. weather, religious holidays, competition from other user groups, etc.) that determine the environment within which the commercial fisher must operate.

Qualitative interview data, however, suggest several conclusive findings with respect to the process of ITHQ development and implementation and its effectiveness. Most importantly, weakness associated with a lack of: (1) recognized, adequate stock assessments to support allocation adjustments; (2) early and continuing consultation that is fair and effective in influencing decision making and recognizes the benefits of pre-existing and potential co-management efforts; and (3) efforts to anticipate and ameliorate social impacts that resource users find undesirable. The accumulation of problems in development and implementation of ITHQ ultimately contributes to an atmosphere in which the policy's effectiveness and level of acceptance is compromised.

6.0 ITHQ IMPACTS AND MODELS OF PUBLIC POLICY

Application of ITHQ in the Lake Huron commercial fishery revealed a range of impacts. These impacts can be classified as follows: (1) predicted impacts, as anticipated and explained by the introduction of ITHQ; and (2) unpredicted impacts. This analysis utilizes these two impact categories to link research observations with relevant theoretical constructs from the bioeconomic and co-management models of resource management and the rational, incremental and interest group models of public policy.

6.1 Predicted Impacts

Table 6.1 lists the predicted outcomes and theorized explanations that follow from the bioeconomic model.

Prediction under ITHQ of more even temporal distribution of fishing effort is based on the reasoning that with an assured share of the catch, fishers will not need to race to secure a share of an overall harvest. Because fishing would be spread over the full length of the season, market saturation (and the concomitant price response) at season inception would be avoided. ITHQ should also reduce the incentive to accumulate the excess capacity related purely to competitive pressure. The principal motivation for this type of change would be economic efficiency; the same harvest could be taken by a smaller boat, with less gear and fewer crew if the effort could be spread over a longer time. Similarly, avoidance of market saturation would be expected to secure more stable unit prices for the harvest.

One assumption underlying the use of ITHQ to reduce fishing capacity is that the earlier excess capacity is related primarily to the need to compete for harvest and <u>not</u> to any economies of scale that may derive from increased investment. Under this

TABLE 6.1:

PREDICTED IMPACTS

DESCRIPTION	EXPLANATION
1. more even temporal distribution of fishing effort possibly reducing fluctuations in supply and thus permitting more stable prices	▪ assured share of harvest eliminates need for intensive harvesting at the beginning of the season ▪ no market saturation
2. control of amount of harvest of quota species	▪ quota allocation specifies and limits legal harvest of quota species
3. rationalization of industry	▪ operations will leave the fishery because they cannot produce adequate revenue to cover debt and operating costs ▪ remaining operations will buy additional quota up to the limit of their capabilities

assumption, the logical response of the individual or operation to ITHQ is to reduce capacity and consume more time in the accumulation of harvest.

The Lake Huron data indicate that pre-existing seasonal harvest patterns have not changed with the implementation of ITHQ. Religious holidays and weather were reported to be the most important determinants in the timing of harvest activities. Religious holidays precipitate the year's best prices for whitefish, and so fishers target their efforts to this time period. In most parts of Lake Huron, winter weather is too severe to permit commercial harvest activities. In some areas of the lake, the lack of a thermocline (usually in June) discourages schooling and so commercial harvest activities are suspended during this period. In both of these circumstances, exogenous variables (i.e. cultural factors and weather) affect the behaviour of fishers in a manner beyond the scope of the causal relationships defined in rationality-based models (i.e. bioeconomic model).

Examination of the price data on an annual basis evidenced substantial stability (see section 5.1.1). However, it is likely that this level of aggregation masks seasonal variability due to cultural and natural environmental factors.

ITHQ limits the harvest of designated species. It is illegal to sell extra-quota harvest. In this way, ITHQ is thought to remove any economic benefit from harvest overcapacity accumulated solely to facilitate rapid harvest early in the season. The evidence does not suggest ITHQ has controlled overall harvest. In achieving the goal of controlling harvest, much depends on the precision with which quotas are set and the confidence that fishers have in the reliability of scientific evidence that supports quota allocation. Quantitative evidence on harvest amounts shows that, for the two principal commercial species, lakewide harvest amounts are less than the allocated amounts and have changed little from those prior to implementation of ITHQ.

Rationalization of overall fleet capacity to a level consistent with the MEY equilibrium position is an expected outcome of ITHQ.[51] The relationships modeled in the bioeconomic model suggest that, given stable prices, operations with more substantial vessels and gear than necessary to harvest their allocation should begin to adjust their individual cost functions to the new equilibrium positions dictated by their assigned allocation and unit price received.

Reducing overcapacity means reduction of cost per unit of fishing effort. The underlying assumption is that the costs involved in commercial fishing can be readily adjusted in small increments. Although this may be true for some aspects (e.g. it may be possible to purchase or lease relatively small amounts of quota), in general, cost adjustments must be made in substantial increments (e.g. one less vessel, crew member, etc.). Analysis of investment in vessels and gear shows that a larger number of small operations left the fishery with the continued application of ITHQ. Berkes and Pocock's (1990) found a similar response in the Lakes Ontario and Erie fisheries. ITHQ, by creating exclusive property rights in the fishery, seems to encourage fishers to tend towards the MEY point (i.e. where marginal revenues equal marginal costs). As long as economic rent persists in the fishery, some excess capacity is consistent with this equilibrium position.[52] This is particularly true among the larger operations.

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[51] MEY represents the point of maximum profit. Thus, assuming that the lakewide allocation functions to prevent the level of exploitation of the fishery moving towards BE, where rent is dissipated, the theoretical equilibrium position should tend to MEY.

[52] Monopolistically competitive industries tend to be overcrowded with firms, each of which is underutilized (McConnell and Pope 1987). The assumption in this thesis is that the fishery is more representative of a monopolistic competitive situation than one of pure competition.

6.2 Alternative Explaination of Impacts

There may be other explanations for some of the impacts cited in Table 6.2.

Policy derived from assumptions and hypotheses on which ITHQ is based requires good information, rational behaviour, mobility of resources and the capacity to make marginal adjustments in resource inputs. The evidence presented in the Lake Huron fishery suggests that these preconditions are not always met. The fact that ITHQ is superimposed on a range of preexisting regulatory and social conditions argues for a closer examination and better understanding of the context in which ITHQ was developed and implemented.

The narrow focus of the incremental policy process does not take illegal harvest into account. An alternative explanation for harvest not meeting allocation is that stocks of some species may have remained stable in some years, thus not providing easy opportunity for larger harvests. This factor would be largely determined by environmental and ecological forces. ITHQ policy's focus on the remediation of overharvest and overcapacity does not readily accommodate opportunities to maximize the benefit from a stock boom.

A number of the impacts associated with the development and implementation of ITHQ can be explained by looking at the policy process. Based on the discussion presented in chapter three, it is evident that there were serious information gaps, particularly in reference to stock assessment. In the absence of new information, the policy process relied on "old" information, the fishers' past performance. Reliance on previous experience is a feature of an incremental policy-making process. It is also evident that social and environmental factors play a significant role in determining the price received. Marketing error, pollution problems and the actions of a middleman, for example, were particularly important to the chub market. These features are related to exogenous social and environmental factors, including self-regulation.

TABLE 6.2:

UNPREDICTED IMPACTS

DESCRIPTION		EXPLANATION
1.	harvest is less than allocation	▪ poor stocks ▪ poor markets ▪ area restrictions ▪ non–reporting of harvest ▪ uneconomic allocations held, but not utilized
2.	harvest of quota species increases over previous levels	▪ improved stocks ▪ improved markets ▪ species specialization ▪ previous non–reporting
3.	non–economic operations remain	▪ unrecorded value is added to legal harvest ▪ anticipate better prices for vessel & gear ▪ anticipate increase in allocation ▪ general uncertainty ▪ obtain adequate income from lease ▪ traditional occupation ▪ continuing part time ▪ temporary poor health prevents greater harvest ▪ supplementary alternative employment
4.	seemingly economically viable operations drop out of the fishing	▪ area conflict with sport fishers ▪ emotional impacts of loss of decision–making power
5.	additional gear regulation	▪ sport fishers' lobbying
6.	increased administrative tasks	▪ data requirements for ITHQ administration ▪ data requirements for political defense of ITHQ allocations
7.	formerly viable operations receive non–sustaining allocations	▪ exceptionally poor harvest in years used to derive allocation ▪ previous non–reporting
8.	persistence of seasonal harvest patterns	▪ off–season (winter) harvest conditions can be dangerous ▪ fish do not school when there is no thermocline (summer) ▪ religious holiday creates seasonal market ▪ early season harvest captures better prices, non–quota species can be harvested later ▪ avoidance of conflict with seasonal sport fishers ▪ assured, limited, abbreviated, early harvest allows shorter "year" and additional non–fishing occupations ▪ preference for traditional harvest pattern

An ITHQ-based policy assumes that allocations can be set mechanically and fairly. Initially, individual quota allocations were influenced by: (1) past performance; and (2) incomplete assessment information. Negotiated adjustment came into play later. Use of past performance and other assessment information is consistent with an incremental policy-making process, in which policy changes little from that previous. Negotiated adjustment, such as through the temporary Lake Huron Quota Review Committee, was a component of the ministry's efforts to manage interest group pressures. In this case, accommodation of sport fishers' urgent requests for limits on the commercial industry (as detailed in section 4.3.4), and commercial fishers' appeals for economically viable allocations were negotiated.

Annual harvests of the two principal commercial species in the Lake Huron commercial fishery are and have been less than the allocated amounts. Given the perception of overcapacity in this fishery, and the assumption that maximum harvest would improve the profitability and efficiency of any operation, the expectation would be that full allocations would be harvested. The qualitative analysis provided a number of reasons why the harvest might be less than the allocation. Poor stocks (i.e. fewer fish) limit fishers likelihood of successful harvests. Poor markets remove the incentive to fish, as harvest activities are uneconomical if markets are poor. In some instances, changes in areal distribution of allocations restricted fishers from their traditional harvest areas, and they did not want to fish in the new area, so they did not fish as heavily as usual, or were less successful. If harvest was not reported, it would not be counted in evaluating harvest activities. In some instances, fishers felt that their allocations were too small to support harvest activities, but at the same time, they did not want to sell or lease them.

For some fishers, harvest of quota species has increased over previous levels (while remaining under the aggregate quota allocation), even though a theoretical goal of ITHQ is to limit harvest. On occasion, allocations have been increased temporarily in response to stock booms. Fishers' decisions to specialize in a single species could also

contribute to an increase in the harvest of that species. Finally, if harvests were previously under-reported, complete reporting would increase the harvest totals of those species.

There are still some operations remaining in the fishery which seem to be operating in an uneconomic manner (for example, those operations categorized as having high investments, but remaining in the lower harvest categories). This outcome is not expected with ITHQ because interpretation of the relationships represented in the bioeconomic model suggests that such operations would either cease operations or purchase more quota, in order to move to a more economically efficient position. It is possible that some operations that seem uneconomical on the basis of harvest totals alone, are actually earning revenue from the addition of unrecorded value to their harvest. Further, given the number of operations leaving the fishery and the management history of the fishery, anticipation of improved selling prices for vessels and gear (and need for more quota) or an increase in allocation may contribute to some fishers' reluctance to move quickly out of the fishery. General uncertainty as to what the government might do is another explanation. In some cases, fishers may be content to receive income from lease of their allocation. There are also a number of factors relating to employment, that may explain why these operations persist: wanting to maintain an attachment to a traditional occupation, continuing fishing as a part time occupation, temporary poor health preventing full time fishing and temporary alternative employment.

In contrast, there are also instances of reportedly[53] economically viable operations selling out and leaving the fishery. This would not be an expected outcome of ITHQ, as there seems no economic reason for these operations to leave the fishery. However, causal relationships underlying the bioeconomic model address aggregate, rather than individual behaviour. Some interview respondents in this situation reported

[53] Judged to be economically viable by the operation owners.

that area conflicts with sport fishers and the loss of decision-making power in their business were so discouraging that they no longer wanted to continue fishing.

The ITHQ literature identifies less regulation of fisheries as one of the benefits of utilizing direct, rather than indirect methods of regulation. The continued imposition of additional gear regulations in the Lake Huron commercial fishery, therefore, would not be expected to accompany implementation of ITHQ. The imposition of this regulation is a result of interest group lobbying efforts on the part of sport fishers.

Expectations of less administration by government is one of the advantages of ITHQ that receives much attention in the literature. In practice, however, the stock assessment and harvest data necessary to maintain a responsive ITHQ system does require extensive administration. For example, in some jurisdictions harvests are reported on a daily basis, instead of monthly, as formerly. It is also necessary to have up-to-date assessment information in order to adjust overall quotas[54] and to explain management actions to the two major interest groups involved. Incidental catch was a historical issue in the Lake Huron fishery, but the implementation of ITHQ complicated dealing with it, due in part to pressure from sport fishers.

Some operations received allocations too small to support viable operations. Given the use of past performance in formulation of allocations, this would not be an anticipated outcome of ITHQ. Possible explanations include exceptionally poor harvests

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[54] ITHQ can be more effective if allocations can be readily adjusted. Ease of adjustment can go some distance toward ameliorating problems caused by imperfect information on fish stocks. Management interventions derived from interpretation of a "rationally" based resource management model that depends on an extensive information base in order to accurately represent a particular resource use system, can encounter problems in application in rapidly changing or uncertain environments.

in the years used to calculate past performance and possible previous non-reporting of harvest.

Although designation of exclusive property rights to an assured share of the fishery, as represented by ITHQ would be expected to reduce the need for early season competition for the harvest. As noted in section 5.2.8, seasonal harvest patterns persist in the Lake Huron commercial fishery. In reality, there are a number of other social and environmental factors that have an overriding influence on the timing of fishing activities in the Lake Huron commercial fishery. Harsh weather conditions restrict winter harvest activities, and fish availability is reduced during parts of the summer. Occurrence of religious holidays that create an increased demand for whitefish determine the season of greatest demand for this species. Some fishers curtail their activities in the summer months, simply in order to avoid conflict with sport fishers. Some fishers, knowing in advance the limits of their harvest, will fish hard and early and take an additional job for the rest of the year, to increase or sustain income. Finally, some fishers just prefer to continue operations as they have always done.

6.3 Summary and Conclusion

Implementation of ITHQ depended on inadequate assessment and past performance information, and managers' narrow focus on harvest allocations characterized the incremental aspects of the policy process that resulted in ITHQ. This narrowness was detrimental because managers then failed to recognize and incorporate persistent features of established resource use patterns that would reinforce ITHQ objectives and foster its acceptance and support in the industry (e.g. mobility within traditional fishing areas, adherence to seasonal patterns; rapid response to changes in fish stocks, etc.). In addition, the political activities of special interest groups also affected the acceptance of ITHQ. For example, imposition of additional gear regulations resulting from sport fishers' lobbying efforts was contrary to the lessened gear regulation

commercial fishers expected with ITHQ implementation. This contributed to an undermining of the policy's support base in the commercial fishing industry.

As the analytical focus narrows, and behaviours become more determined by idiosyncratic factors, the applicability of theoretical models can be expected to decline. A primary basis for modelling in the economic literature is the general assumption of economically rational behaviour. Although understanding of the responses to market controlled variables is enhanced by economic analysis, this study reveals that economic rationality is constrained by environmental, social and individual factors. These constraints are most visible in the development and implementation of the policies like ITHQ, that contribute to the context within which the market must function. The co-management model represents a system of relationships incorporating many of the social and environmental forces that can frustrate ITHQ effectiveness. It provides a strong contribution to our understanding of the basis for explaining the community of resource users because the relationships it incorporates overtly address decision-making processes related to the adaptation of new ideas, distribution of resource rights and benefits, arbitration of power relationships, and the rate, timing and extent of change. Owing to the relatively short time period of this research, caution should be taken in generalizing findings to other situations.

7.0 DISCUSSION AND CONCLUSIONS

Fisheries management has significant impacts on important aspects of social, cultural and family life as well as on the economic and biological aspects of the fishery, but the fisheries management regime in the Lake Huron commercial fishery has been oriented toward achieving predominantly biological and economic objectives. Because the ITHQ approach to resource management does not accommodate (or accommodates poorly or inequitably), many important social, political and cultural considerations that impact the fishery, instruments such as ITHQ are unlikely to work entirely as theoretically anticipated. These factors contribute to a complex and volatile decision-making environment in which interest group activity, incremental decision-making, and attempts to follow "rational" decision processes, all play important roles in forging adaptations of ITHQ and other policies.

This thesis discussed an array of impacts associated with the implementation of ITHQ, and the social, environmental and economic factors that may influence these impacts. The broad range and sometimes contradictory nature of these impacts, and the possible explanations for them, suggest assumptions of ITHQ are narrow and unrealistic. We need to recognize these limitations and build flexibility into policy development and implementation processes to accommodate anticipated and unforseen impacts.

The co-management model of resource use describes a set of relationships in the resource use community that can reinforce ITHQ regulation, and internalize substantial enforcement, administrative and assessment costs. Evidence for this conclusion is found in existing practices such as the on-board assessment program, experiments with daily reporting of harvest, and discussions in the joint OMNR-OFPA Lake Huron Liaison Committee. Effective self-management is also seen to be a feature of established resource use systems, such as exist in the Lake Huron commercial fishery. Managers can best avail themselves of the advantages of these systems through effective

consultation and inclusion of co-management in policy development and implementation.

Co-management theorists suggest an approach that builds on the strength, energy and interests inherent in the social, political and cultural context. Because it is cooperative and participatory, a greater use of the co-management approach has helped resolve some of the "problems" affecting ITHQ implementation in Lake Huron. In their struggle to make ITHQ work effectively, Lake Huron fisheries managers have initiated a number of changes, including recasting of management decision-making processes, to more closely resemble a "weak" co-management process (e.g. more participatory decision making, self-regulation, consideration of individual needs and contributions, etc.). Without these changes (and the potential for more comprehensive co-management embodied in them), the social, political and cultural issues exacerbated by the development and implementation of ITHQ might have been so severe as to delay or prevent effective ITHQ implementation.

It has been apparent for some time that biological interventions alone (e.g. conservation-oriented measures to protect spawning) are an inadequate management tactic, and that effective fisheries management practices must encompass economic and societal as well as biological aspects of management. In working to maintain a healthy fishery, managers are seeking regulatory solutions which take account of socially embedded contributing factors, not biological ones alone.

Early experience with fisheries management led managers to focus on issues of conservation and protection of reproduction. This, in turn, led to promulgation of "indirect" regulations which employed areal and seasonal limits to protect the fishery. The effect of these regulations was to limit the efficiency of harvesting operations. In response, fishers made efforts to increase their short-term harvesting capacity, for example, through use of larger, faster vessels with increased holding capacity, improved gear, high technology fish finding equipment, etc.

This experience led to an expansion of this body of regulation to include limits on additional aspects of fishing effort, such as vessels, gear, size of fish, etc. (Whillans and Berkes 1986). These regulations were intended to control harvest by limiting efficiency. In response, fishers again devised ways to circumvent this type of regulation. Thus developed a situation of point-counterpoint, as managers and fishers matched wits in continuing rounds of regulation/response.

7.1 Research Objectives and ITHQ Objectives

Derived from interpretation of the biological and economic relationships represented in the bioeconomic model of resource use, ITHQ can be characterized as a "rationally-based" strategy for dealing with fisheries management problems. As formulated in application to the Lake Huron commercial fishery, the strategy of ITHQ was to discourage overcapacity and limit harvest to sustainable levels and increase efficiency by allocating an individual share of the harvest to each commercial fishing operation. Heavy reliance was placed on OMNR district offices for policy implementation and enforcement. Fisheries problems were viewed as a product of overcapacity, and it was reasoned that only a coercive strategy would prevent overfishing and overinvestment (i.e. a reduced "economic rent"). Yet this strategy (in Lake Huron and elsewhere) has produced many unintended consequences, and has not succeeded in meeting fully its management goals.

The objectives of this study were:

(1) to identify and understand the impacts of ITHQ itself;

(2) to detail the linkages between these impacts and the application of fisheries management interventions derived from the bioeconomic model (which is the theoretical origin of ITHQ); and

(3) to further our understanding of the process of ITHQ development and implementation and the impacts of this process of development and

implementation, by utilizing theoretical perspectives in the co-management theory of resource management and in three policy process models.

ITHQ is a "direct" method of limiting harvest effort. Total harvest would be limited by assigning a share of the harvest to individual operations, with the expectation that this would encourage efficiency in the industry (i.e. through some operations leaving the fishery and therefore more efficient use of the remaining capacity).

7.2 Principle Findings of Quantitative and Qualitative Analysis

The results of this preliminary evaluation of ITHQ impacts in the Lake Huron commercial fishery suggest that while ITHQ effectiveness in limiting overall harvest is uncertain, there is a trend towards a reduction of capacity in the fishery. The quantitative data indicate that ITHQ's major economic effects have been on the organization of labour and capital in the fishery. Commercial fishing activities will not likely generate major instabilities; it is the ecological phenomena that most affect harvest amounts, species and values. Other policy impacts, however, are complex and difficult to identify and analyze. Future administrative costs are not easy to estimate; the social impacts from changes in the structure of the industry are intricate; and some aspects of policy implementation may be too inflexible.

One of the advantages cited in the ITHQ literature is that the regulatory regime would be simplified, as many of the previous "indirect" regulatory controls would no longer be necessary. In fact, changes to the relevant regulations often involved merely repositioning some formerly regulatory restrictions as "conditions of licence." There have also been additional area and gear restrictions since ITHQ implementation.

7.3 Principle Findings of Policy Process Analysis of ITHQ Development and Implementation

Policy process models are relevant to analysis of the consequences of ITHQ in that they help explain not only the decision to adopt ITHQ, but, more importantly, why implementation of ITHQ occurred as it did, and thus, how "deficiencies" in implementation have affected the fishery. By drawing on an array of conceptual policy process models, it is possible to analyze the decision making and impacts associated with the development and implementation of ITHQ. In so far as the policy process models examined in this thesis help to explain how ITHQ came to be developed and implemented in the way that it was, the analysis provides an explanatory link between the theoretical expectations of ITHQ and the observed consequences of its application, as illustrated in this case study.

ITHQ reflect some of the operative assumptions of rationality as represented in Allison's (1971) classical rational actor model. Various weaknesses of the rational model's assumptions also apply to ITHQ and the bioeconomic model from which it is derived.[55] Assumptions regarding the calculation of costs and benefits, for example, are limited and unrealistic. A failure to distinguish between "open access" and "communal" systems, and the assumption of open access underlying the bioeconomic model, weakens application of ITHQ to the Lake Huron commercial fishery. The Lake Huron fishery, before and after the introduction of ITHQ, had restricted entry, and thus

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[55] Ostrom's (1990) comments on the use of specific models (i.e. tragedy of the commons, the prisoner's dilemma, logic of collective action) also apply to ITHQ and the bioeconomic model:

> What makes these models so interesting and so powerful is that they capture important aspects of many different problems that occur in diverse settings in all parts of the world. What makes these models so dangerous -- when they are used metaphorically as the foundation for policy -- is that the constraints that are assumed to be fixed for the purpose of analysis are taken on faith as being fixed in empirical settings, unless external authorities change them.

was not the sort of commons (i.e. open access) system envisaged by Hardin (1968) and assumed by the bioeconomic model. It was therefore less susceptible to over-fishing than a genuinely "open access" system. In addition, the basic assumption of the policy maker as a rational decision maker also overlooks the substantial influence of community social context and interest group politics (discussed in detail in section 2.5).

ITHQ was applied to the Lake Huron despite the recognized absence of over-exploitation and market saturation problems sometimes associated with seasonal harvest patterns.[56] A resource management policy based on economic criteria was later modified in response to social criteria. If these modifications had not occurred, the policy would not have been workable.

Interest group activity was, in fact, an important determinant in the implementation of ITHQ, significantly influencing its timing and the spatial distribution of the allocation of commercial fishing quotas and buy-outs. Initial policy development was undertaken in cooperation with commercial fishery representatives, and there have been continuing efforts to work with this interest group in refinement and modifications of ITHQ.

Sport fishers also influenced aspects of commercial fishery regulation, particularly in terms of area closures, buy-outs and gear restrictions. In some areas popular with sport fishers, difficulties in providing adequate allocations to commercial fishers within a reasonable distance of traditional fishing grounds can be attributed to a specific conflict between the two groups, rather than to implications of ITHQ in general. To some degree the geographical distribution, species and quantity of ITHQ allocations are the result of political compromises among sport fishers, commercial fishers and fishery managers.

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[56] As detailed in section 4.3.2, the decision to adopt ITHQ in Lake Huron (where over-fishing was not a pressing problem), was taken in the interests of policy consistency (i.e. ITHQ was in place in other Great Lakes' commercial fisheries) and in response to intensive pressure from the sport fish lobby.

The incremental nature of the policy process has also been an important influence on ITHQ impacts. The constraints introduced by the dependence on previous practice and the narrow focus on allocation amounts adversely affected acceptance and support of ITHQ and contributed to ITHQ implementation becoming associated with preexisting contentious issues. Problems with incidental catch and spatial separation of sport and commercial fishing activities were two such issues that complicated ITHQ implementation.

7.4 Principle Conclusions from Co-management Theory Analysis

The co-management model of resource use describes a cooperative decision-making process based on collective (but exclusive of those not belonging to the collectivity) property rights. The operative assumptions of the co-management model differ from those of the bioeconomic model principally in the latter's assumption that competition for a common resource will be destructive (as exemplified in the "tragedy of the commons"). Co-management theorists submit managers' acknowledgement and utilization of strengths in community relationships can avoid or address some of the difficult problems typically encountered in development and implementation of theoretically feasible solutions to fisheries management problems, such as ITHQ. The co-management model suggests that incorporation of resource users' collective strengths and organization in an arrangement wherein regulatory interventions are developed and implemented cooperatively with resource users would lead to more efficient, effective and sustainable management regimes.

Transaction costs, for example, may be significantly reduced in a co-managed fishery where specified community characteristics exist (as detailed in section 2.4.2). These characteristics create a situation of "mutual vulnerability" in which information is shared, and resource users were readily mobilized to make decisions and rules and provide a measure of control over potential free-riders (Singleton and Taylor 1992). These same conditions could also contribute to reduction in monitoring and enforcement

costs by utilizing community interdependencies to develop informal arrangements with respect to distribution of resource rights among resource users. As several authors point out, exclusive government management weakens the linkage between the consequences of management decisions and those who depend most on the resource (Anderson and Hill 1988; Anderson 1987; Crutchfield 1979; Grima and Berkes 1989). By weakening this linkage, unnecessarily exclusive government intervention may contribute to simply shifting dissipation of resource rent from fishers' operations to the administrative arena.

The literature review in section 2.4.3 abstracted a number of features co-management theorists find to be typical or desirable to co-managed resource regimes. Although co-management was not identified as a management goal for the Lake Huron commercial fishery, managers and fishers turned to some of the methods of co-management in order to try to solve problems encountered in implementation of ITHQ. The following identifies the extent to which features typical of co-management are present in management of the Lake Huron commercial fishery.

(1) Reliance on cooperative (rather than competitive) approaches (Peters 1988). There is strong cooperation among kinship groups who share in harvesting and processing operations, particularly in the Georgian Bay and North Channel areas. Some additional, socially-oriented aspects of the industry, such as the chub market price-buffering[57], also exist. These

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[57] Specific to the chub fishery, interview data suggest an informal process of self-management. The chub market is relatively small and highly specialized. Almost all the chub harvest in the Lake Huron fishery is processed by a single operation. The management of this operation is committed to maintenance of a viable chub fishery in the lake. This operation buffers fishers from local price fluctuations by purchasing fish at a set price which is sometimes higher than current market prices, then holding the fish until the market recovers and they can be profitably sold. This provides fishers with assurance that they can sell their harvest and maintain cash flow. The processor also benefits by ensuring a steady supply of product and being able to "play the market." This manipulation of the timing of purchase and sales occurs within the context of the (continued...)

are examples of cooperative behaviour and not strictly co-management, as accommodations are made only between the fishers and processors, and there was little additional reported reciprocity among the fishers, nor involvement of managers. As noted in the following point (2), fishers do look to managers to provide a protective framework in the form of restricting access (i.e. limiting the number of commercial fishing licenses), and enforcing compliance with ITHQ allocations (i.e. enforcing harvest limits). In areas of the fishery where competitive behaviours are most evident, ITHQ has reinforced this mindset, by providing an additional way to quantify this competition. Fishers strive to assemble quota allocation or to circumvent some of the constraints imposed by ITHQ through changes in handling, processing and sale of non-quota species.

(2) Political independence (McKean 1992) and definition of property rights such as to limit access (Grima and Berkes 1989). The Lake Huron commercial fishers look increasingly to managers to protect the autonomy of the agreed-upon rules and regulations (e.g. pertaining to harvest amounts and areas) and to reinforce access-limiting provisions, in order to protect indigenous, cooperative arrangements where they exist. In modern times, the Lake Huron fishery has always been one of limited access (as discussed in section 4.2), an important criterion of co-management. In addition, resource users' reactions to managers' mistakes in their handling of ITHQ implementation have forced managers to acknowledge the need for an institutional infrastructure that is more conducive to co-management. Management problems associated directly

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[57](...continued)
existing regulatory regime, but is not due, as predicted, to behaviour changes on the part of fishers.

and indirectly with ITHQ implementation contributed to a resource users' backlash, and demands for closer involvement in decisions which affect them.

(3) Resource-users' input to the regulatory process (Buck 1989) and shared decision making (Pinkerton 1989b; Ostrom 1977; Ostrom and Ostrom 1977). Lake Huron fishery resource users have certainly provided comment, information and opinions to elected representatives and fishery managers (e.g. letters, court actions, participation on the Committee on Modernizing Ontario's Commercial Fishery, appearances before the Lake Huron Quota Review Committee, communications through the Commercial Fisheries Liaison Officer). The furor accompanying ITHQ implementation served to define more precisely the need for user input to the regulatory process, and managers' increased awareness of this need has contributed to redefining the mandate or terms of reference for any existing co-management-oriented infrastructure (e.g. Lake Huron Management Committee). Since ITHQ implementation, OMNR's plans and expectations indicate that commercial fishers may have more effective input, earlier in the decision-making process. Fishers' participation in shared decision making over the study period could be a first step toward "full" co-management. Although managers have always maintained control of how management problems are framed, which issues are available for discussion, as well as of the timing (i.e. frequency and duration) and intensity (e.g. degree of power sharing, range of representation of persons involved), the severity of the anticipated and unanticipated impacts on commercial fishers provided the fishers with a great degree of leverage. The process of dealing with ITHQ impacts has helped to create a permanent change in the relationship among managers, among the fishers and between the two groups, and has resulted in

creation of an institutional infrastructure more conducive to further development of fisheries co-management.

As described in section 4.3.4, lobbying and negotiation with regulatory bodies and resource managers can be a form of co-management (Acheson 1989). Lobbying and negotiation have been an influence on resource management policy and regulation in the Lake Huron commercial fishery. The most evident impacts on resource management attributable to lobbying and negotiation are the result of sport fishers' efforts in the political sphere. For the reasons detailed in section 4.3.4, commercial fishers have been much less successful in their lobbying efforts.

(4) Joint performance of management functions[58] (Pinkerton 1989b). Pinkerton (1989b) has proposed that joint performance by resource users and managers of a number of management functions can be assessed as a measure of co-management. McKean (1992) identified users' involvement in setting, monitoring and enforcing rules governing resource use as a criterion for successful management of a commons resource. There is evidence of joint performance of selected management functions in the Lake Huron commercial fishery. Fishers have long been involved in gathering essential data (this could be construed as a passive role in setting

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[58] Pinkerton (1989b) defines these management functions as:

> (1) data gathering and analysis . . .; (2) logistical harvesting decisions, such as licensing, . . . timing, . . . location, . . . and vessel or gear restrictions . . . ;(3) harvest allocation decisions . . . ;(4) protection from habitat or water quality damage by other water resource users . . .; (5) enforcement of regulations or practices guiding harvesting logistics . . . ;(6) enhancement and long-term planning . . . ; and (7) broad policy decision-making.

harvest limits) (see section 4.3.3), but have not participated proactively in analysis or interpretation. Recently, there has been involvement of commercial fishers in enforcement and monitoring (e.g. in the form of daily reporting), and to some extent previously, in broad policy decision making (e.g. Committee on Modernizing the Commercial Fishery in Ontario). Sport fishers have been involved in habitat management and have influenced important management decisions through successful lobbying.

There exist only the beginnings of what could be effective co-management with commercial fishers in the functions that managers traditionally hold most closely: logistical harvesting decision making; long-term planning; and harvest allocation decisions.[59] While the management practice to date of informing resource users of management decisions and the rationale behind them, could be construed as information sharing, these after-the-fact communications are not truly consultative and do not qualify as co-management.

Cooperation between the government and others and among scientists of different institutions and agencies and between scientists, fishers and managers in the form of shared decision making and responsibilities in managing the resource (McCay 1989). Such cooperation between managers and commercial fishers is evident in the Lake Huron commercial fishery. The establishment of the Lake Huron Management Committee, with the deliberate inclusion of commercial fishing industry representatives and ministry staff with both scientific,

[59] The one-time Quota Review Committee, was formed in reaction to problems encountered in ITHQ implementation that could not be resolved through existing management systems. Because the Committee's decision-making process and records were confidential, it cannot be seen as a shared management initiative.

management and enforcement responsibilities was an initial attempt, not necessarily to share decision making, but at least to bring a range of views forward for discussion. The act of establishing the committee and setting a consistent membership and meeting schedule, however, does provide the potential for development of more cooperative fishery management efforts. The role of fisheries managers in protecting the fishery from additional entrants (i.e. not issuing any more licenses), and in monitoring and enforcing ITHQ allocations is analogous to the "specialist" role advocated by Ostrom (1992).

(5) Varying systems of distribution[60] of rights and shares of the resource (McKean 1992). With the possible exception of adjustments made as a result of recommendations of the Lake Huron Quota Review Committee, ITHQ (i.e. entitlement to a share in the annual production of the resource) in the Lake Huron commercial fishery was initiated and implemented according to a neutral distribution rule, based solely on past performance (i.e. amount of harvest over a set time period). This allocation signified a balance between costs and benefits to resource users, in that those who benefited also bore more of the costs of maintaining larger vessels, more gear and additional labour and operating costs. This arrangement is consistent with McKean's (1992) description of features of successful systems of common property management.

With respect to eligibility for a share and participation in decision making in managing the commercial fishery, there is no formal hierarchy of rights (e.g. with senior or full rights reserved for one category of fisher and partial or half-rights being awarded to others). In practice, however, some fishers do assume aspects of nascent "seniority" by virtue of wealth,

[60] The bioeconomic model does not address distributional/rights problems such as quota allocation.

large ITHQ allocations, age, experience, familiarity with bureaucratic systems and/or their status as major processors in their area. Participation in decision making thus does become hierarchial -- another feature identified as typical of successful common property management.

Rights to capital stock in the fishery, as represented by proceeds of a transaction which removes a share from the common stock, accrue directly to the fisher involved. The "buy-out" process, in which the government retires ITHQ allocations, endangers the continuance of the commercial fishery in Lake Huron by permanently "removing" harvest shares for commercial species from the common pool. The "buy-out" process is thus antagonistic to co-management in the commercial fishery.

Although the management regime in the Lake Huron commercial fishery was not fully co-managed over the study period, it exhibits some aspects of co-management. It cannot be characterized as comprehensive co-management. Some co-management decision-making processes (e.g. negotiation, lobbying, data collection) and assumptions (e.g. limited access) are operative in the fishery, but the existing institutional infrastructure does not fully incorporate these characteristics into a coherent co-management system. Given the need for management of the social and cultural impacts of ITHQ, it is likely that co-management processes will become more important in the management of the Lake Huron commercial fishery.

7.5 Relation to Current Research

Many leading commons researchers have focused on questions pertaining to the successful management of common resources (e.g. McKean 1992; Ostrom 1992; Singleton and Taylor 1992). In surveying a range of commons systems throughout the world, these researchers have identified overlapping sets of criteria, features, attributes and processes by which to define and analyze common property management. These

include: (1) features typical to successful systems of common property management; (2) models suitable for analysis of commons management systems; and (3) necessary attributes of "community" (i.e. shared beliefs, stable membership, long-term interaction, direct and complex relations). The management system features cited by McKean (1992) as typical of such regimes are similar to those identified by Singleton and Taylor (1992): autonomy in decision making, limited/consistent membership and frequent and meaningful opportunities for interaction. McKean (1992) also identifies minimization of transaction costs as an important result of successful systems of common property management. The research presented here on the Lake Huron commercial fishery is to a large extent consistent with these findings. The community of Lake Huron commercial fishers, for example, has a relatively homogenous set of beliefs with respect to the commercial fishery, stable membership, with some kinship groups resident from the turn of the century, and these have many (but not exclusively) direct relations among themselves with respect to management of the fishery. In this the fishers' social organization approximates the definition of community that commons research suggests, and, to the extent that this is so, may be well situated to benefit more greatly from the lower transaction costs in solving management problems. Should the management regime in the Lake Huron commercial fishery move toward more fully realized co-management, decision makers may well take guidance from the several case studies of successful commons management.

With respect to methodological approaches, Ostrom (1990) argues that "one [model] cannot encompass (at least with current methods) th[e] degree of complexity" that must be addressed "when individuals in field settings attempt to fashion rules to improve their individual and joint outcomes." She views models in general as "highly particularized" and not as "universal theories." She also identifies scholars' presumption of positions of "omniscient observers able to comprehend the essentials of how complex, dynamic systems work by creating stylized descriptions of some aspects of those systems" as an "intellectual trap . . . relying entirely on models to provide the foundation for policy analysis." On this basis, she calls for further theoretical inquiry that is not

limited to model-building, but focuses on "theoretically informed empirical inquiries in both laboratory and field settings." This study is one such inquiry.

This case study emphasizes a number of significant aspects of policy development and implementation, and illustrates the importance of understanding and incorporating the complex forces that are brought to bear in the policy process. With respect to the important, needed contributions identified by leading theorists, this research is significant because it addresses analysis of common property problems through examining and utilizing the analytical powers derived from models dealing with biological, economic, and political relationships to examine a regulatory policy application in a field situation. Further, this work specifically examines the role of external authorities in impeding and/or facilitating capacity of individuals to manage shared resources, a problem also identified by Ostrom (1992):

> It is just as important to see how larger political regimes may facilitate the capacity of individuals to achieve agreements as it is to see the importance of community in facilitating solutions to these problems.

Continuing investigations in this area can make a useful contribution to resource management by focusing on processes of deriving and integrating management interventions with the support and involvement of the affected resource users. Owing to the relatively short time period of this research, caution should be taken in generalizing findings to other situations. The findings of this research do suggest, however, that contextual social issues of autonomy and equity and a broad basis of understanding are as important as those of economic efficiency, and that if not dealt with, these issues can significantly impact the efficacy of management interventions.

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APPENDIX 1: SAMPLE ANNUAL COMMERCIAL FISHING REPORT

ANNUAL COMMERCIAL FISHING REPORT

Do not include in this report any information shown on an Annual Commercial Fishing Report for another licence this year

TO Conservation Officer

FOR THE YEAR ENDING DECEMBER 31, 19 79

COMMERCIAL FISHING LICENCE NUMBER

NUMBER OF FISHERMEN ENGAGED IN FISHERY: (WHERE OWNER ASSISTS HE SHOULD BE INCLUDED BUT, DO NOT SHOW MEN ALREADY INCLUDED UNDER ANOTHER LICENCE) 1 (1) 2

NEW CAPITAL INVESTMENT
(PURCHASES DURING THE YEAR OF "NEW" EQUIPMENT NOT "USED" EQUIPMENT)

KIND	TOTAL COST $	
DIESEL AND GAS ENGINES, OUTBOARD MOTORS		00
TUGS, BOATS, CANOES, ETC.		00
GEAR: NETS, TWINE, ROPES, FLOATS, WINCHES, ETC.	2000	00
WHEELHOUSE EQUIPMENT: RADIOS, RADAR, ETC.		00

CHECK IF NO NEW EQUIPMENT PURCHASED DURING YEAR ☐

FISHING CRAFT OR BOATS (INCLUDING MOTOR)

DEPARTMENT OF TRANSPORT No. 371 444

LENGTH	NUMBER OF BOATS	TONNAGE (TONS)	VALUE $	
40 FEET AND OVER			35000	00
20 FEET TO 39 FEET	1		35000	00
UNDER 20 FEET	3		3500	00

FISHING GEAR
REPORT ALL GEAR ON HAND

KIND	NUMBER	LENGTH (YARDS)	VALUE $	
1. GILL-NET		55000	45000	00
2. POUND-NET				00
3. TRAP-NET				00
4. HOOP-NET (NO. OF POTS)				00
5. SEINES				00
6. NIGHT LINES (NO. OF HOOKS)				00
7. TROLLING LINES				00
8. DIP-NET				00
9. TRAWLS				00

SHORE INSTALLATIONS

KIND	NUMBER	VALUE $	
FREEZERS AND ICE HOUSES	1	7500	00
PIERS AND WHARVES	1	2000	00
NET SHEDS	1	3000	00

AN ANNUAL COMMERCIAL FISHING REPORT IS TO BE MADE BY EACH HOLDER, OF A COMMERCIAL FISHING LICENCE WITHIN 30 DAYS OF THE END OF THE YEAR REPORTED AS REQUIRED UNDER THE GAME AND FISH ACT, 1961-62.

FISH CAUGHT DURING THE YEAR

KIND	QUANTITY LBS.	PRICE PER POUND
1. BLUE PICKEREL		
2. BULLHEADS		
3. CARP	178	11c4
4. CATFISH	91	11c4
5. CHUBS & TULLIBEE		
6. EELS		
7. LAKE HERRING		
8. TROUT	31	1cc
9. LING		
10. NORTHERN PIKE		
11. PERCH		
12. MENOMINEE	283	30¢
13. SUCKERS OR MULLETS		
14. ROCK BASS & CRAPPIES		
15. SAUGERS		
16. SHEEPSHEAD		
17. SMELT		
18. STURGEON		
19. CAVIAR		
20. SUNFISH		
21. WHITE BASS		
22. WHITEFISH	23,589	70¢
23. YELLOW PICKEREL		

LOCALITY: Murphy Harbour L. Huron

DEPARTMENT USE ONLY 4 1 1 1 1

THIS RETURN CONTAINS A COMPLETE AND CORRECT STATEMENT OF FISHING OPERATIONS CARRIED ON BY ME DURING THE YEAR.

DATE Jan 9 1980

APPENDIX 2: INTERVIEW SCHEDULE

Introduction

The questions listed in this appendix make up the interview schedule for the key actor interviews. The questions are directed to provincial government fisheries scientists and managers and commercial fishers who have been involved in/affected by the development of ITHQ for the Lake Huron commercial fishery.

Procedure and Constraints

The interviews are in the form of an informal discussion, and all questions are implicitly open-ended, even those that seem to require only a "yes" or "no" answer. The interrogatories "How?" and "Why?" shadow each of the questions. In effect, each question represents a subject area for discussion, rather than a pointed inquiry with the expectation of answers from within a specific range of alternatives. This list of questions is primarily intended as a guide for the interviewer -- the questions represent the areas to be covered in the interview. Not all participants will comment on every question topic. Each meeting takes approximately 2 hours. In addition, time is spent talking on the telephone before the interview, or after, to clarify any points, or to seek the respondent's reaction to a statement or idea suggested at a later interview by someone else. In total, 35 people were formally interviewed, following the attached interview schedule.

Development of the Questions

The schedule is organized under eight governing areas of inquiry:

(1) ecological basis for the policy;
(2) policy instruments utilized;
(3) time-related factors of the policy;
(4) fundamental or incremental nature of the policy changes;
(5) breadth and purpose of consultation;
(6) distribution of the onus for action and distribution of benefits;
(7) distribution of risks; and
(8) territorial scale of the policy.

These governing areas of inquiry are adapted to research into ITHQ from Doern and Phidd's (1983) generic summary of the intellectual dimensions of public policy. These questions address the research problem in relation to concepts, structures and processes over the 1975-85 time period. In examining the impacts of policy changes, the current context is important. For this reason, the schedule includes questions directed at describing the present assumptions and organization of the commercial fishing industry.

Finally, attention is directed to how changes are occurring in the industry, as well as in what forms these impacts are expressed.

The questions under these eight areas of inquiry draw out the information needed to examine some of the ecological, organizational and management aspects of the individual transferable quota policy. The data base built from the Annual Reports contains the balance of the quantitative information required to describe the organization of the fishery.

A modified version of the Guttman mapping sentence technique was used in developing these questions. The questions are identified as to their affective (a), cognitive (c) and instrumental (i) orientation. For example, if the concept on which I wish to collect information can be posed as the question, Has quota management improved the way you fish? I would present three separate questions: Do you approve of quota management? (affective); Do you think quota management is a good method to manage fisheries? (cognitive); and Has the implementation of quota management caused you to change the way you fish? (instrumental). Each category of question plays a role in the hypothesis under study. The major purpose in using this technique was to clarify exactly which aspects of an issue each question was directed towards. In general, the technique forces more rigorous wording of the questions and reveals how well a topic is covered by the questions.

REFERENCES

Doern, G.B. and R.W. Phidd. 1983. Canadian Public Policy: Ideas, Structure, Process. Toronto: Methuen Publications.

Guttman, L. 1972. The Facet Approach to Theory Development. Jerusalem: Israel Institute of Applied Social Research. (Mimeo.)

INTERVIEW SCHEDULE

1. THE THEORY AND PRACTICE OF THE INDIVIDUAL TRANSFERABLE QUOTA POLICY. (N.B. It is unlikely that the commercial fishers will have much to say on this area of inquiry.)

1.1 What ideas would you say are the bases for the individual quota policy (eg., economic, ecological, mythological)? How have these changed over time, and which are the most significant? (c)

1.2 In general, do you believe/support these ideas? (a)

1.3 Do you think that these ideas are a valid basis for this policy? Why? (c)

1.4 Do individual quotas[1] help to implement these ideas? (a)

1.5 Do you think that individual quotas address, at least in part, some of the important problems facing fisheries management/the commercial fishing industry? (c)

1.6 What other actions should be taken? (i)

1.7 How have you changed your management/fishing activities since the implementation of individual quotas? (i)

2. WHAT POLICY INSTRUMENTS ARE BEING USED? IN WHAT SEQUENCE? WHAT PREFERRED INSTRUMENTS ARE BEING ADVOCATED AS THE PRIMARY BASIS OF REFORM BY THE GOVERNMENT? BY OTHER INTERESTED PARTIES? WHAT IDEAS ARE INVOLVED IN THESE PREFERENCES?

2.1 Right now, individual quota regulations are a major factor in how commercial fishing is managed in Lake Huron. Do you feel that the present system is better now than in the past when the gear and season regulations were the most significant regulations? Why? (a)

2.2 How is fisheries management/fishing different than before? (i)

2.3 Are these differences important? (a)

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[1]. Throughout, the term "individual quota(s)" refers to the individual transferable quotas presently in operation in the Lake Huron fishery.

2.4 The ministry has attempted to direct the fishing effort of the commercial fishing industry by "buying back" some of the commercial fishing quotas. Do you think this is effective in managing fish populations? (c)

2.5 Do you feel it is appropriate for the government to intervene by buying back quota or is it better to let the free market adjust to variations in supply? (a)

2.6 What alternatives to the buyback program would accomplish the same thing? (i)

2.7 What do you think about the idea of the government collecting royalties on harvest? (c)

3. WHAT ARE THE TIME-RELATED FACTORS? IS THE POLICY DIRECTED TO SHORT-TERM CONCERNS OR OTHER SYMBOLIC NEEDS?

3.1 Do you think the use of individual quotas is an effective method of managing fish stocks? (N.B. distinguish long run and short run effects) (c)

3.2 Do you see individual quotas as a long-term policy, rather than just a temporary measure? (c)

3.4 Do you think this is appropriate? (c)

3.5 With this in mind, are you planning any changes in how you manage/fish? (N.B. distinguish on-shore/on-water) (i)

4. ARE THE POLICY CHANGES FUNDAMENTAL OR INCREMENTAL?

4.1 Do you think the implementation of individual quotas is a major shift from how things were done in the past? (c)

4.2 What changes would you suggest for the present policy and its implementation? (i)

4.3 In calculation of individual quotas, commercial fishers received different amounts of quota. Do you know how this was done? Do you approve of this process? (a)

4.4 Do you think this process was fair? (c)

4.5 Quotas are calculated on a percentage of past performance basis. Does this process affect your management/fishing? (i)

4.6 Is your enterprise/do you think most enterprises are more or less profitable now that individual quotas are in place? (N.B. distinguish between large and small operations) (a)

4.7 Is this an improvement? (a)

4.8 Sometimes individual quotas are changed. How would you like to see additional quota distributed? How would you like to see reductions in quota distributed? (i)

5. WHAT SECTORS/INTERESTS ARE CONSULTED? WHAT IS THE PURPOSE OF THIS CONSULTATION?

5.1 What interests or groups do you think were involved in developing the individual quota policy? (N.B. for managers, refer to field staff) (c)

5.2 Why do you think these groups were involved in the process? (c)

5.3 Do you feel that this consultation process was adequate? Comprehensive? (a)

5.4 How did this consultation process, or the results of this consultation influence the development and implementation of the individual quota policy? (i)

6. IN IMPLEMENTING AND MODIFYING THE POLICY, TO WHAT EXTENT IS IMPLEMENTATION DEPENDENT ON PRIVATE BEHAVIOUR, AS OPPOSED TO WHAT OFFICIALS CAN DO? TO WHAT EXTENT CAN EVERYONE BE TREATED EQUALLY AND TO WHAT EXTENT DO DIFFERENT BENEFICIARIES HAVE TO BE TREATED DIFFERENTLY?

6.1 Do you think enforcement is feasible? Do you think commercial fishers can self-police the industry? Why? (c)

6.2 Do you feel enforcement/self-regulating behaviour is fair? (a)

6.3 What would be a better arrangement? (i)

7. WHAT RISKS OR UNCERTAINTIES ARE INVOLVED? HOW ARE THEY DISTRIBUTED?

7.1 Is management/fishing more predictable now that individual quotas are in place? (c)

7.2 Do you prefer this? (a)

7.3 How has this changed your management/fishing activities? (i)

8. WHAT ARE THE SPATIAL AND TERRITORIAL ASPECTS OF THE POLICY? LAKE-WIDE, LOCAL OR REGIONAL ISSUES? (N.B. centralized vs. decentralized decision making and implementation)

8.1 Individual quotas are administrated on a district-by-district basis. Do you think this is appropriate? Why? (c)

8.2 Is it significant that individual quotas are implemented on the district level? How do you think this affects the way that individual quotas are assigned and how the quotas are adjusted? (i)

8.3 Do you feel that district level management is fair? (a)

8.4 What would be an improvement/alternative? (i)

APPENDIX 3: INTERVIEW RESPONDENTS AND AFFILIATIONS

Commercial Fishers and Representatives

Carlson, E., Blind River.
Carlson, E., Blind River.
Deeg, J., Evansville.
Herbert, B., Killarney.
Jackson, W., Southampton.
Karwaski, W., Britt.
Lougheed, W., Southampton.
LaBalance, M., Port Elgin.
MacKenzie, W. M., member, Lake Huron Quota Review Committee and Ombudsman, Great Lakes Fish Producers.
McLay, J., Port Elgin.
McLay, R., Port Elgin.
Menary, M., Lion's Head.
Nyman, L., Blind River.
Parr, G., Parry Sound.
Perks, J., Midland.
Pilon, R., Southampton.
Purdy, M., Sarnia.
Purvis, G., Silverwater.
Raney, R., Tobermorey.
Waugh, J., Exec. Sec., OFPA.
Witty, W., Evansville.

Fisheries Managers and Scientists

Bedi, N., Fisheries Economist, OMNR.
Christie, R., member, Lake Huron Quota Review Committee, Lake Huron Manager, OMNR.
Fry, F., Chair., Lake Huron Quota Review Committee.
Holder, A., Dir., Central Region, OMNR.
Loftus, K., retired Director, Fisheries Branch, OMNR.
Miller, M., Fisheries Manager, OMNR.
Monroe, S., Lake Huron Fishery Co-ordinator, OMNR.
Payne, R., Lake Huron Fishery Assessment Unit, OMNR.
Potter, B., Fish Culture Assessment Bio., OMNR.
Samis, W., Fisheries Management Co-ordinator, OMNR.
Sheppard, J., Enforcement Co-ord., OMNR.
Tilt, J., Manager Commercial Fisheries, OMNR.
Townsend, D., Commercial Fisheries Liaison Officer, OMNR.
Whitney, G., Director, Fisheries Branch.