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AN EVALUATIVE SURVEY OF LAKE ONTARIO
COMMERCIAL FISHERMEN

by

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A Senior Honours Essay Submitted in
Partial Fulfilment of the Degree of
Bachelor of Environmental Studies
(Honours Geography)

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March, 1979

cc - Mr LORTUS
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1979-06-18

ABSTRACT

The Lake Ontario commercial fishery has deteriorated dramatically since the unsurpassed harvests of the 1920's, primarily due to the effects of overexploitation, environmental deterioration, and new species invasions. In attempts to counteract these effects, particularly overharvesting, government managers have reacted with a profusion of fish harvesting restrictions. This fragmented, crisis-oriented management approach has been ineffective due to the lack of explicit guidelines, and the inadequate consideration of resultant social and economic problems.

A questionnaire survey was developed and administered for the purpose of assessing the perceptions and attitudes of the Lake Ontario commercial fishermen, in the hopes that such information will be used to provide both socially and biologically acceptable management strategies. The survey results show that fishermen do not believe overexploitation to be a significant problem, but that government management, or mismanagement, is the major source of their present difficulties. Although, not all attitudes expressed are consistent, internally or throughout the fishery; nor are they always altruistically motivated, they do point out the urgent need for long-range, anticipatory management practices with increased user input during the decision-making process. The attitudes of fishermen towards the resource they exploit must also be significantly modified.

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CHAPTER I

INTRODUCTION

Serious depletion of fish resources has become commonplace throughout the world. The Lake Ontario fishery is no exception to this trend; the present fish community is a mere fraction of its social, economic, and biological potential. Decline of the Lake Ontario fishery is thought to be a product of 200 years of environmental deterioration resulting from development throughout the watershed and a long history of uncontrolled exploitation of fish stocks (LOFTPC, 1978, 3).

The decline in the Lake Ontario fishery has followed the classic sequence of events known as the "fishing-up" process (Loftus, 1976) which is characterized by a sequence of species declines and collapses. This sequential change in the fish community has resulted in a transition from large, late-maturing, high-value species to small, prolific, low-value fish (LOFTPC, 1978, 3). Continued competition for the high-value species combined with the continued economic growth within the watershed, and the resultant environmental degradation, have prevented major recovery of the premium fish stocks.

The decline in the Lake Ontario fishery reduced the effectiveness of the resource as a provider of food, income, employment, and recreational opportunities. The fishery is no longer capable of meeting the commercial and recreational demands of the people within the basin.

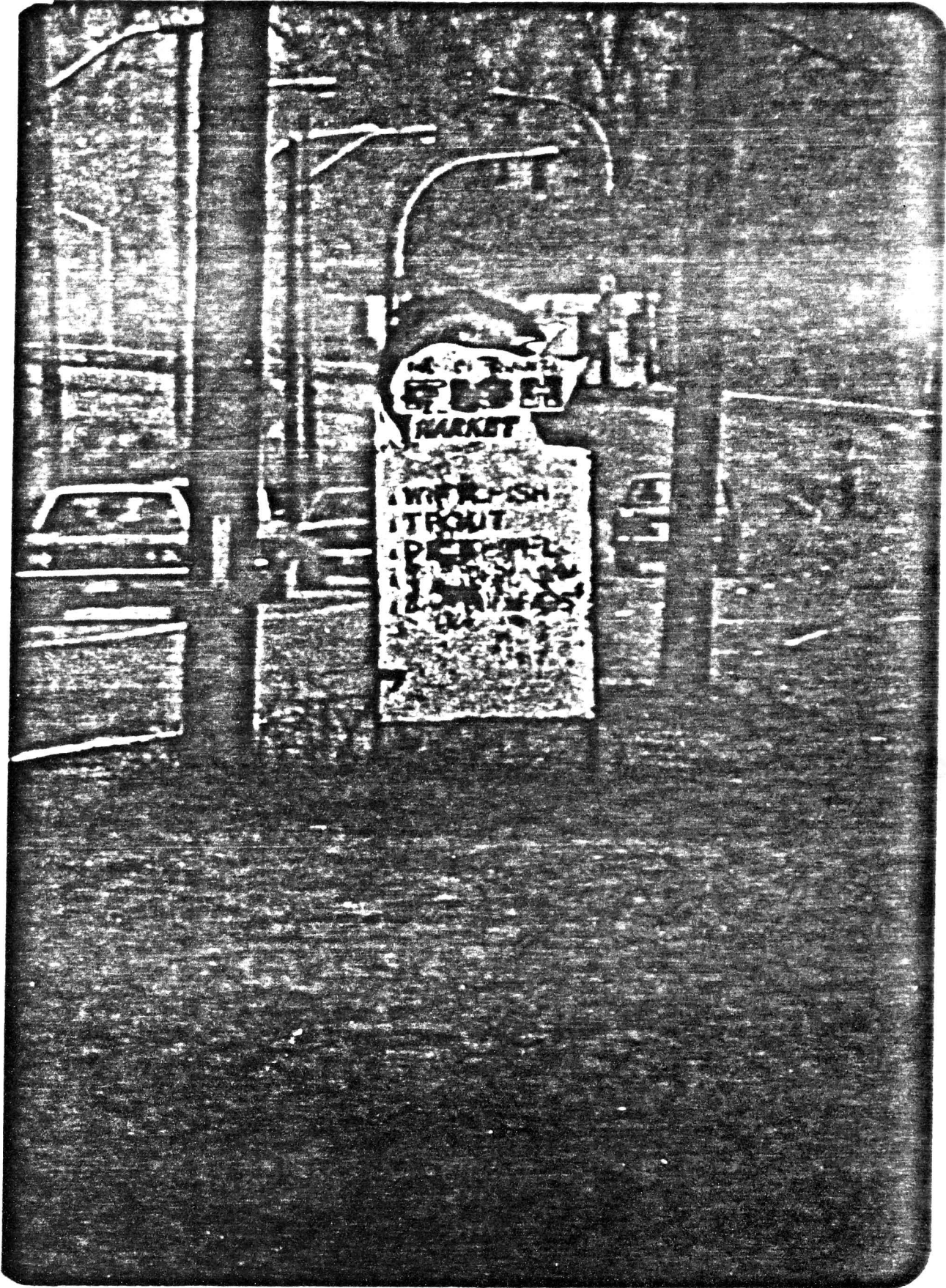


Figure 1: A SIGN OF THE TIMES

This weathered sign in front of a Belleville fish buyer's facilities reflects the decline in the Lake Ontario commercial fishery.

The Study

Management strategies developed to alleviate fisheries problems have, generally, been too little too late (F-PCOF, 1976, 8). They follow in what Kates (1967, 69) refers to as the

. . . long tradition of policy-by-crisis in resource management.

Also, in the past, fisheries management policy has been constructed mainly using biological guidelines with little regard for economic and social factors (F-PCOF, 1976, 8). This "paternalistic" system in which policies are formulated, with little public input, by a technical elite leaves much to be desired. As a result of their specialized training, these technical experts, such as biologists and engineers, have very narrow perceptions of problems and solutions (Sewell, 1971, 125). Resource managers rarely perceive the entire range of choice available to them in adjusting to a problem and, consequently, do not always choose the most acceptable alternative from the user's stand-point. Burton (1971), Whyte (1977), and Saarinen (1974, 268-9) give several examples of resource management problems which may have been avoided if public opinion had been ascertained prior to policy or project implementation.

The purpose of this study is to assess the attitudes of one specific user group of the Lake Ontario fishery: the commercial fishermen. It is hoped that this study will provide a systematic and scientific view of the fishery from the "inside-out". This personalized and subjective view, based on first-hand familiarity and long experience, is compared with the objective, scientific viewpoint as expressed in government reports. It is hoped that such knowledge will be valuable to future management (Whyte, 1977, 11).

The study examines how commercial fishermen perceive the causes and effects of the historical fishery decline. It also documents their opinions of past and present fisheries management practices and determines what actions commercial fishermen deem necessary for improvement of the Lake Ontario fishery. The responses are also analyzed according to location, length of involvement, primary fishing gear used, and income in an attempt to determine which parameters have the most influence on attitudes.

Research in perceptions and attitudes in geography is a relatively recent development which lacks a firm theoretical framework, a well-developed methodology, and presents major measurement problems (Saarinen, 1974, 255). However, judging by the increased public dissatisfaction with decisions made on their behalf, and the increasing ability of man to alter his environment, it becomes increasingly more important to understand the social and behavioural variables in resource use (Saarinen, 1971, 13). White (1966, 109-110) suggests that:

Perhaps the greatest confusion arises from their (public administrators) not knowing what others do believe and from lacking means of finding out.

CHAPTER II

PERCEPTIONS, ATTITUDES, FORMATION and MEASUREMENT

The terms perceptions, attitudes, and environment have evolved to a state where their meanings are no longer precise. The purpose of this chapter is to clarify the terminology used and to provide a theoretical basis for this study. Included in this chapter is a short discussion of the factors that may affect attitude development, a discussion of the relationship between attitude and behaviour, and attitude measurement.

Environment

The objective environment which consists of all things external to man is referred to as the geographic environment. Within this all-inclusive environment is the milieu in which man's actions take effect and in which he is affected whether or not he is aware of it. It is known as the operational environment. Included in this environment is the perceptual environment, or the surroundings of which man is aware. Enclosed by the perceptual milieu is the behavioural environment. This portion of the surroundings is one which compels an action or behavioural response. The behavioural environment is of the greatest interest here because behavioural responses are measureable and reflect the perceptual milieu of the individual (Saarinen, 1963, 5).

Perception

In this study perception is conceptualized as much more than the sensory perception of actual stimuli by sensory organs. Its conceptualization here as social perception refers to the impression one has of a set of stimuli or a social stimulus after they have been

. . . screened by the physiological filters of our sense receptors and such important psychological filters as language, social class, personal values, value and need, culture, and some form of Gestalt or pattern seeking function (Saarinen, 1974, 253).

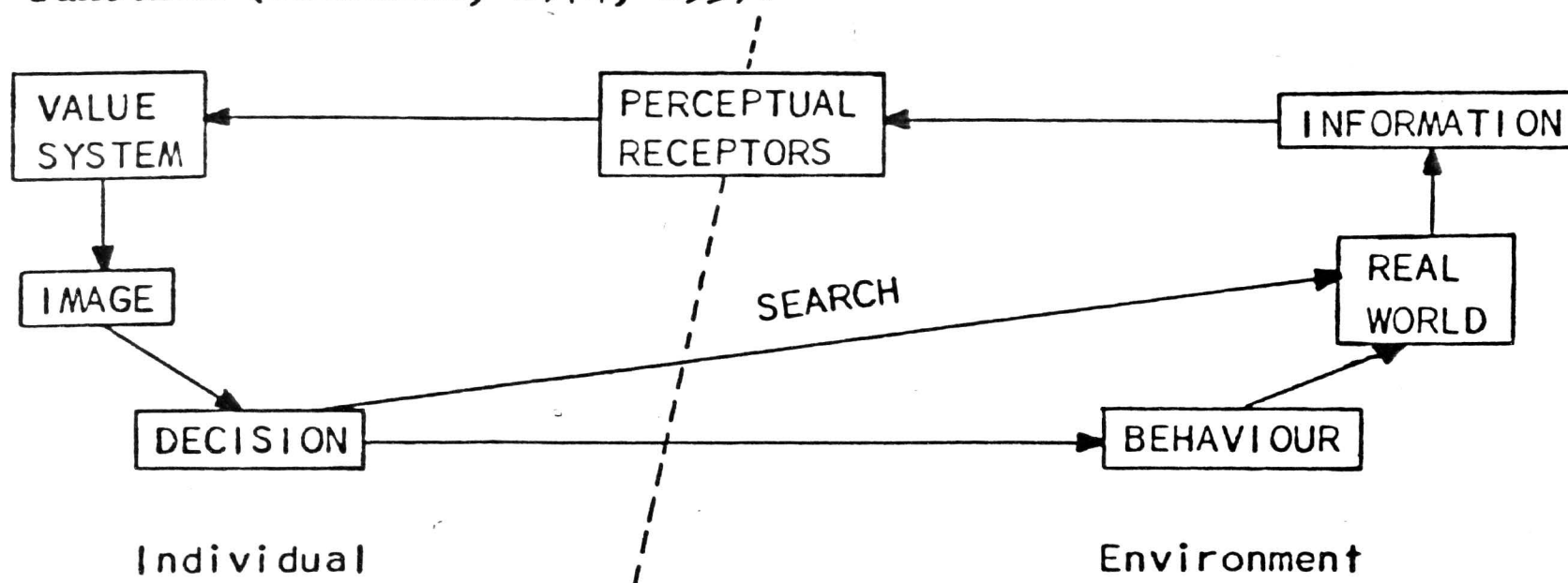


FIGURE 2: A Conceptual Schema for Research into Geographic Space Perception (Downs, 1970).

Perception, then, is a function not only of the stimulus present and the capabilities of the sense organs but also of past learning, motivation (Saarinen, 1966, 27), experience, and state of the individual when perceiving the stimulus (Schiff, 1971, 7). Whyte (1977, 86-96) provides a simple model of environmental perception illustrating these variables and linkages. Since there is no perception which is not organized on the basis of social experience it is not unusual to find that different groups or individuals have varying environmental perceptions which are often firmly entrenched (Saarinen, 1974, 255).

Attitudes

Social perception is the organization of input received by the sensory organs from a stimulus or set of stimuli which have been physically present. Perceptions are often ephemeral, stimulus-specific,

and subject to change. Therefore, perceptions are difficult to measure and would be unreliable as indicators of a person's beliefs. Consequently, examination of the more stable attitudes is used to assess an individual's "view of the world" (Campbell, cited in Schiff, 1971, 8).

According to Schiff (1971, 8) an attitude is:

. . . an organized set of feelings and beliefs which will influence an individual's behaviour.

Attitudes are generally considered to have three components. The first is the affective or emotional component which consists of an individual's feelings towards an object or event. The second is the cognitive or evaluative component which consists of the person's beliefs about an attitude object or event. The third is the conative or behavioural component and it is a product of the affective and cognitive components (Whyte, 1977, 93; Schiff, 1971, 8). The behavioural component is the disposition to act or respond. It is this third component, which includes verbal behaviour, that allows measurement of an individual's attitudes towards his environment in an objective manner.

An attitude, then, is the collection of feelings (affects) and beliefs (cognitions) which predisposes an individual to react in a certain way to the object of these affects and cognitions (Schiff, 1971, 8).

The theory of cognitive dissonance is required in a proper discussion of attitude formation. Cognitive dissonance occurs when evaluations or beliefs held by an individual are not consistent. When this occurs one of the individual's evaluations must be changed to restore cognitive consistency (Schiff, 1971, 9). White (1966, 110) describes this transformation as the "distortion of unfamiliar phenomena to adjust to a familiar orientation". The following two simplified examples should not be regarded as conclusions drawn from this study and are used only as illustrations of the cognitive dissonance theory.

In this study, commercial fisherman may believe that populations of the most desirable fish species are drastically reduced and that this decline is a result of overharvesting. The fisherman may resolve this dissonance by denying the decline of desirable species or by denying that overharvesting was the cause. Since the decline of the fishery is well-documented, the acceptance of overharvesting as the cause would force the fisherman to alter his methods and accept a reduced income. The immediate consequences of this change in lifestyle would be undesirable and leave the individual only one alternative: to change his cognition from overharvesting to another cause of decline. Such a shift would allow continuation of his present lifestyle.

On the other side of the coin, a fisheries resource manager may believe that a decline in the most desirable fish species has occurred and that the decline is due primarily to pollution. He may also feel that such degradation is irreversible and too massive a problem to combat. Again, since the decline of the high-value species is irrefutable, he must find ways to reduce pollution or change his beliefs concerning the cause of the decline. Since he feels that there is little possibility of reducing the nutrient input from the surrounding watershed he must search for an alternate cause of decline to restore cognitive consistency within himself.

Cognitive dissonance is not discussed here to suggest that attitudes are unimportant, but to illustrate that they are complex, often contradictory, and poorly understood. This theory does, however, help explain "the persistence of old ideas, even in the face of scientific evidence to the contrary" (Saarinen, 1974, 257). The point here is that the attitudes

possessed by an individual are not necessarily true; more importantly, the individual believes them to be so (Schiff, 1971, 8).

Apparently anxiety is aroused when an accepted mental schema is challenged as inappropriate (Saarinen, 1974, 257).

Attitude Measurement

Attitudes can only be assessed through the study of verbal and/or overt behaviour. Verbal behaviour includes both oral and written accounts of respondents' beliefs. Verbal behaviour can be registered using a questioning-listening procedure. Oral history, time diaries, unstructured interviews, projective tests, word tests, repertory grids, personality scales, and questionnaire surveys are all field techniques of this procedure (Whyte, 1977, 20). Overt behaviour can be observed directly or indirectly and it is the activity engaged in by the individual respondent. Since the direct observation of a large number of individuals is usually impractical, most research focusses on behaviour reported verbally in the assessment of attitudes.

Attitudes are measured in terms of their direction, strength, and consistency. Direction refers to the positive or negative feelings, beliefs, and behavioural tendencies towards the attitude object. Strength or magnitude refers to the intensity or extremity to which an attitude is held. Consistency of an attitude is related to both direction and strength. The assessment of consistency is a means of determining if an individual's cognitions and behaviour are compatible, or if different attitudes he holds are in agreement (Whyte, 1977, 93; Schiff, 1971, 10).

Inconsistencies between an individual's attitudes and overt behaviour might raise doubts concerning the validity of assessing verbal behaviour. However, if inconsistencies are apparent then it can be suspected that the individual's attitudes are in a state of transformation. The degree of commitment to an attitude may produce such inconsistencies, but it will provide a means of determining which attitudes are prone to change and which are likely to remain static. Understanding the variations in the intensity, as well as the direction, of an attitude is the key to understanding the diversity of human behaviour (Schiff, 1971, 10). Also if the experiences and attitudes of a group of people are compared, it might be possible to determine which experiences are most important in the development of certain attitudes (Aird, 1973, 25).

Summary

Although the relationship between attitudes and behaviour is unclear, it is accepted that attitudes are predispositions to respond and precede any behaviour. Behaviour, in this context, is the action by an individual in response to perception and choice by that individual (Whyte, 1977, 94). In the field of resource management the assessment of attitudes is important because it aids the manager in the selection of management options, in the anticipation of user reactions to these options, and as a post-audit of existing management strategies. It may also act as a form of public education and shows a willingness to listen to public preferences (Lowenthal, 1966, 132-3). Since attitudes are based on past learning and experience, "effective communication is limited to the context of the small group in which it is learned" (Saarinen, 1974, 255).

The only way to bridge the gap between the resource manager and the user is for the manager to become involved with the user group. This involvement can be accomplished through direct experience or the indirect experience of attitude assessment.

CHAPTER III

THE LAKE ONTARIO FISHERY: HISTORICAL PERSPECTIVE

Requisite to the understanding of this study is some background knowledge of Lake Ontario's biophysical characteristics, the major stresses affecting the lake and its fish populations, the historical development of the commercial fishery, and the current problems facing the fishery. This chapter is devoted to the concise provision of this essential information.

The Lake

The furthest downstream and the smallest of the Great Lakes in surface area, Lake Ontario is still an exceptionally large body of fresh water. It occupies an area of 19,011 square kilometers (7,340 square miles); 10,308 square kilometers of which are in Canada. With a mean depth of 80.5 meters (264 feet) and only a very small proportion of shallow inshore areas, Lake Ontario is a deep, cold lake and formerly supported a typical oligotrophic fish community. Important species in this open water community were Atlantic salmon, lake trout, and lake whitefish (LOFTPC, 1978, 10).

The more biologically productive shallow regions of the lake are found only in an extremely slender band around the perimeter. Only 5 percent of Ontario's surface area has water less than 30 feet (9.1 meters) deep. Expansion of this shallow-water habitat occurs only in the area east of Prince Edward County towards the St. Lawrence outlet and in the Bay of Quinte (Fig. 8). This more sheltered region supported a diverse fish community; prominent species were yellow pickerel (walleye), northern pike, muskellunge, smallmouth bass, largemouth bass, and lake sturgeon. Also, important to both the warm and cold water fish

communities were the tributary streams of Lake Ontario which were spawning grounds for many species (LOFTPC, 1978, 10).

Stresses Affecting Fish Populations

In Chapter I of this paper, where the purpose of the study is defined, it was noted that two viewpoints were to be ascertained. The first viewpoint to be solicited was the subjective, "inside-out" view of the commercial fishermen. The second viewpoint to be obtained was the objective, "outside-in" opinion of the resource managers. In the analysis portion of this study it will be seen that the two groups are not in complete agreement with each other concerning the stresses affecting fish populations. For the sake of brevity only the objective, "outside-in" viewpoint will be given here.

Loftus and Regier (1972) cited three main stresses affecting fish populations: over-exploitation, cultural eutrophication, and competitive displacement. The first, long-term over-exploitation, is thought to be the main factor in the present, complete disarray of the Lake Ontario fish community (Christie, 1973, 3). 100 years of improvements in fishing technology and increased harvest efficiency resulted in fishing efforts that were consistently above the stock's sustainable yields. High-value species were rapidly depleted and enough harvesting of depressed stocks persisted to prevent their recovery (LOFTPC, 1978, 9) (Fig. 3).

Cultural eutrophication, the second major detrimental influence on the Lake Ontario fish community, is defined as the accelerated and excessive input of plant nutrients from urban, industrial, and agricultural sources. Increased nutrient loading resulted in exceedingly eutrophic conditions, particularly in the inshore areas of the lake. These conditions favour "coarser" and less desirable fish species. The resultant deterioration of

habitat, especially of spawning grounds, attenuated the populations of many preferred species, particularly from the cold-water community (LOFTPC, 1978, 9).

The third major stress, competitive displacement, is the rapid proliferation of more opportunistic, exotic species such as American or rainbow smelt, alewife, white perch, and sea lamprey. Competitive displacement is thought to have occurred subsequent to the initial destabilization of the ecosystem. The faster growing, prolific species were at an advantage in the deteriorating lake environment and, thus were capable of preying on, and consuming the food supply of, the later-maturing, more desirable fish species (LOFTPC, 1978, 10). The three major stresses affecting the Lake Ontario ecosystem react synergistically and increase the susceptibility of fish stocks to other natural hazards.

Historical Development of the Lake Ontario Fishery

During the period of early European settlement a diverse fish community existed in Lake Ontario and its tributary streams. Much of this community consisted of mature, desirable food and game fishes. Atlantic salmon represented an important food and income source for settlers in the early 1800's.

Subsequent draining of marshes and widespread clearing of forests for agricultural purposes gave rise to extensive soil erosion within the watershed. This process resulted in the siltation of river and inshore spawning grounds. A myriad of dams were constructed on tributary streams to power grist mills, permanently interrupting spawning migrations, and altering flow regimes causing warming. Suitable shallow-water habitat and spawning shoals were eliminated in the reckless quest for aggregate materials used in

construction. A combination of these factors is thought to have contributed to the demise of the Lake Ontario Atlantic salmon population. This species, severely reduced by the 1840's, disappeared completely by 1896 (LOFTPC, 1978, 12).

Lake Ontario commercial fishing commenced with localized, near-shore seining operations. With the increasing use of sailboats and gillnets the fisherman's operating range included the deep, open water by 1860. Forty to fifty years later, when accessible lake trout and whitefish stocks had been reduced, vessels powered by gasoline-engines became popular further extending the fishery's operating range and harvest potential. Technological improvements to onshore storage and handling facilities accompanied the burgeoning harvests of lake trout, whitefish, and, to a lesser extent, burbot. The large, and seemingly infinite, harvests combined with the free-access nature of the resource encouraged a great influx of capital and labour into the fishery at this time.

In 1920, Lake Ontario's maximum harvest of cold-water species, 3.8 million pounds, was attained. Since then, lake trout and burbot declined rapidly to virtual extinction by 1950. Reasons for this decline are thought to be over-exploitation immediately followed by sea lamprey predation (Loftus, 1976, 13). Fishing effort then switched to deepwater cisco and lake herring stocks; that collapsed in the 1940's. At this time, rainbow smelt, first recorded in Lake Ontario in 1929, multiplied rapidly as a result of the decrease in the piscivorous, commercial species. The loss of deep-water fishing opportunities precipitated a reduction in the number of people fishing commercially, especially in the western portion of the lake.

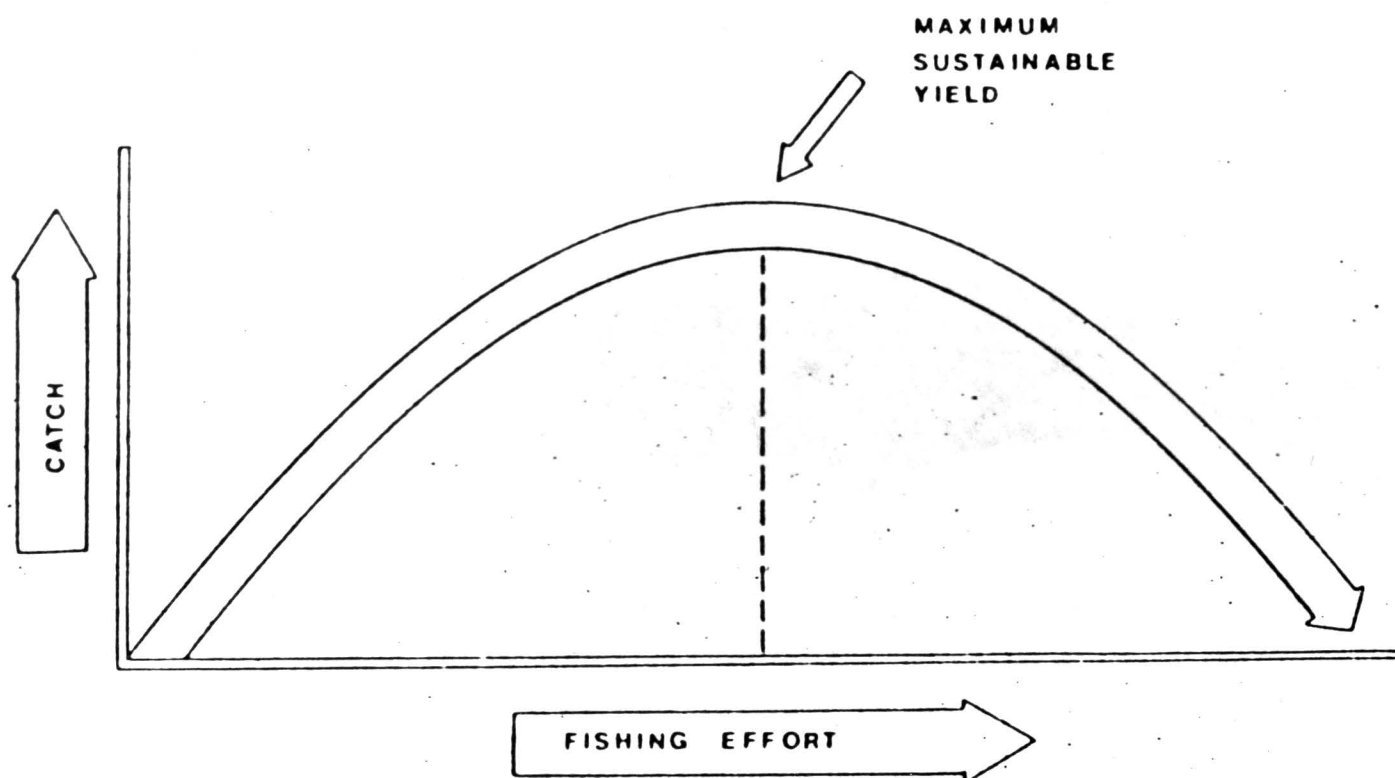


Figure 3 : THE VARYING EFFECT OF FISHING EFFORT ON CATCH OVER A PERIOD OF TIME

This is the fishery scientists' "catch-effort curve". In simple terms, it is saying that increased effort by fishermen results in increased catches—up to a point. This point is called the maximum sustainable yield. Beyond this point, additional fishing effort will actually result in a reduced catch. When fishing begins in a new area or is directed toward a new species, the total catch tends to rise in proportion to the fishing effort. As fishing effort passes the point of maximum sustainable yield, this excessive effort only yields fewer and smaller fish. If left uncontrolled, this over-fishing may reduce some populations to a level from which they cannot recover.

(Adams & Kolenosky, 1974).

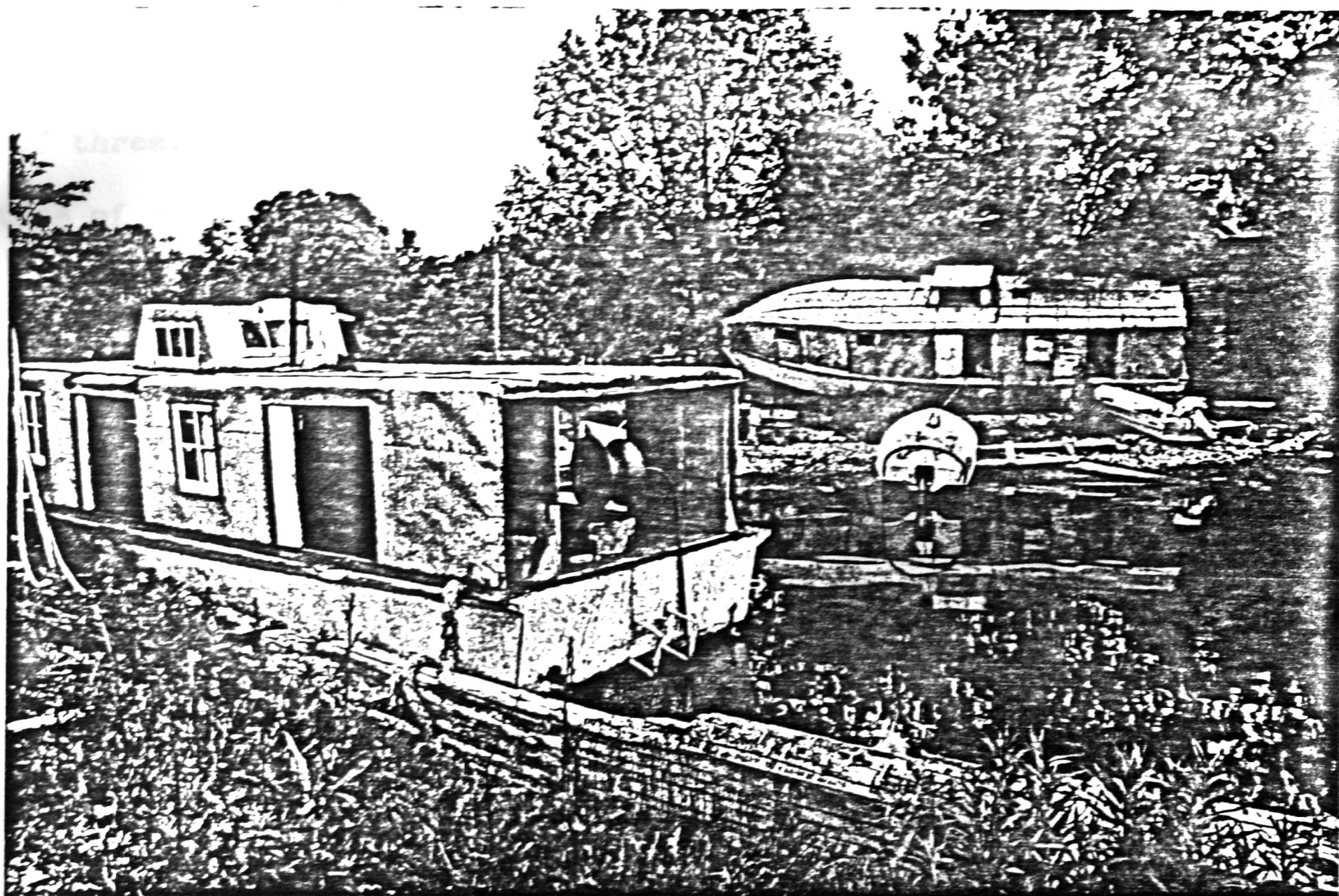


FIGURE 4: The use of large tugs has declined with the deterioration of the cold/deep-water fishery. They have been replaced recently with smaller craft (centre) which are more efficient, and used primarily in the harvest of eels.

Lake whitefish, an important commercial species over many decades, continued to produce harvests of 350,000 pounds per year until their abrupt decline in the early 1960's. Catches remained high due to the introduction of nylon gillnets, around 1950, that increased fishing efficiency by a factor of three. Increased efficiency and durability of nylon permitted the harvesting of previously uneconomical whitefish stocks (LOFTPC, 1978, 13). By the 1970's, at least one major and possibly distinct stock, which spawned in the Bay of Quinte, was eliminated. Another major stock which spawns on the south shore of Prince Edward County remains at seriously reduced levels. Presently, the largest biomass of fish in the open lake environment is smelt and alewives (Loftus, 1976, 13).

The decline and collapse of the cold-water fishery brought about a shift in fishing effort to warm-water species. (Fig. 5). Presently, warm-water species constitute nearly 100 percent of the Lake Ontario commercial harvest. Comprising most of this catch are yellow perch, white perch, carp, bullhead and catfish, sunfishes, and American eel. Formerly of greater importance were rainbow smelt, yellow and blue pickerel (walleyes), and northern pike. Walleye and northern pike historical catch records generally reflect the species abundance of each at that time.

Yellow perch, American eel, and carp, which was introduced to Lake Ontario in the 1880's, have been abundant throughout most of the history of the fishery. Increased yields of such species were usually due to the deficiency of more desirable species and more favourable market conditions (LOFTPC, 1978, 15).

With the exception of lake sturgeon, important changes in the species composition of the shallow-water fish community are not thought to result from overharvesting. Eutrophication caused by sewage from increasing urban populations, widespread agricultural development, and the use of detergents containing phosphates greatly increased the nutrient load in Lake Ontario. This triggered the dense growth of algae in the inshore areas, particularly the Bay of Quinte. Algae blooms decreased water transparency halting photosynthesis of rooted aquatic plants in the littoral zone. This contributed to the demise of numerous piscivorous species associated with these weed beds. With the decline of largemouth bass, northern pike, longnose gar, and bowfin, an explosion of forage fish favoured the growth of piscivorous alewife and walleye populations in the 1950's. Shortly thereafter, the dense algae mats sank and decomposed consuming much of the available oxygen, further reducing the reproductive and competitive ability of many preferred species. Casualties in this respect were the previously mentioned Bay of Quinte whitefish stock, and the walleye populations; both declined to critical levels in the 1960's.

Occurring simultaneously with the demise of the fish-eating species in the Bay of Quinte was the proliferation of exotic species, particularly white perch (Scott and Christie, 1963, 1193). The tremendous fecundity and predatory nature of this species suppressed the growth of more desirable fish populations. The number of yellow perch also increased dramatically in the shallows of the eastern basin (Loftus, 1976, 14). More recently, the abundance of gizzard shad in the Bay of Quinte pointed to the poor water quality there. This "coarse" species is a bottom-feeder and capable of

withstanding adverse temperature and dissolved oxygen conditions (Scott and Crossman, 1973, 136).

Loftus (1976, 14) summarizes:

Lake Ontario and its fish community have suffered from excessive exploitation, from excessive nutrient loading, contaminant loading, shore-line restructuring, and watershed modification; and it seems to have had more than a fair share of new species invasions.

Immediate Commercial Fishery Problems

Aside from the most obvious problems of the scarcity of high-value stocks, particularly in the cold-water sector, the fishery faces numerous other difficulties. As in the past, other watershed activities continue to deleteriously impact the Lake Ontario fish community. Agricultural land uses occupy 49 percent of the watershed and another 6 percent is urbanized. Such development is expected to increase and often results in the direct disturbance of stream channels causing erosion, siltation, and the loss of fish habitat. Deforestation, land drainage and storm sewers, combined with the impervious nature of the urban surface, have increased the "flashiness" of storm runoff and caused a reduction in groundwater storage. This exacerbates erosion in stream channels during periods of snowmelt or rain and causes ponding, warming, and evaporation during dry periods. Tributary stream dams obstruct 2,400 kilometers (1,490 miles) of potential salmonid habitat leaving only 246 kilometers (153 miles) of accessible spawning territory (LOFTPC, 1978, 22).

Nearshore regions still suffer from the effects of high nutrient input and direct physical modifications. Nutrient enrichment remains high from municipal sewage sources even though a reduction in phosphorus concentrations is evident. Such eutrophication continues to contribute to the growth of filamentous algae, subsequent turbidity, and dissolved oxygen deficiencies. In 1974, 20 to 30 percent of the Prince Edward County shore-line adjacent to

the open lake was covered with Cladophora accumulations (LOFTPC, 1978, 24). More recently studies have shown that much of the nutrient load is due to agricultural runoff. Heavy spring algae growths on spawning shoals may have been responsible for the collapse of the Bay of Quinte walleye stocks. The eutrophication process may be assisted further by thermal effluent emitted by Ontario Hydro fossil-fuel and nuclear generating stations. Since the heated discharge does not mix consistently with the cooler lake waters, thermal plumes may develop, acting as barriers to the in-migration cold-water species and preventing the vectoring of nutrients from the inshore community to the open lake (LOFTPC, 1978, 27).

Almost one-half of Lake Ontario wetlands have succumbed to residential, industrial, cottaging, and recreational pressures, especially in the more urbanized western basin. Marsh destruction, dredging, landfilling, and shoreline protection measures continue to reduce the already small littoral zone of the lake.

More recently, the problem of chemical contaminant concentrations in fish flesh has come to the fore. Heavy metals, insecticides, and industrial, organic compounds accumulate in sediments and are concentrated in fish, particularly the piscivores. These include: mercury, lead, mirex, dieldrin, aldrin, DDT and its associates (LOFTPC, 1978, 32).

Polychlorinated biphenyls (PCBs), a carcinogenic compound, have been found in mature coho salmon at levels excessive to Canadian standards for edible and commercial fish. All Lake Ontario salmonids, as well as white perch, smelt, and American eel, have high PCB concentrations.

2

Mirex, a similar compound, occurs in excessive concentrations in the fatty tissues of fifteen Lake Ontario fish species; most notably, the salmonids, white perch, and smallmouth bass. High mercury levels resulted in the closures of some species to fishing, most recently the carp.

Other adversities affecting the present commercial fishery include conflicts with anglers, and ineffective management primarily due to the lack of coordination among the various Provincial, Federal, and State agencies.

In summary,

Intensive multiple use of Lake Ontario water resources has, in the absense of integrated water management, impinged on the more sensitive uses such as . . .
[commercial] fisheries (LOFTPC, 1978, 48).

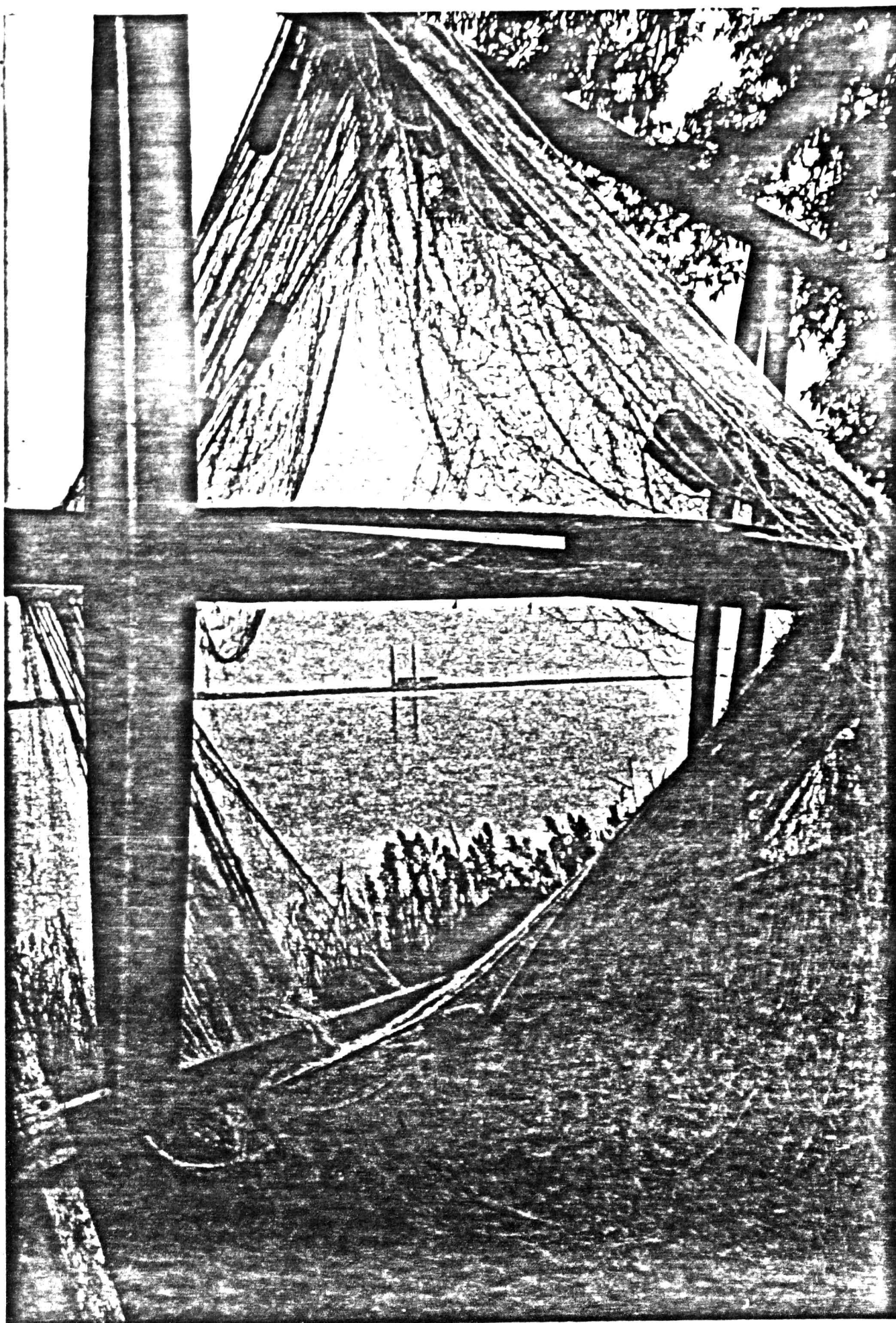


FIGURE 7: Nylon gillnet on rack for repairs. Prior to the use of synthetics, the racks were mainly used to dry cotton and linen nets. Framed by the netting is the Lennox Generating Station (background) which is thought to produce thermal barriers and impinge fish on intake screens.

CHAPTER IV

SURVEY DESIGN and ADMINISTRATION

A discussion of questionnaire use for data collection is presented in this chapter. Included are the general principles involved in questionnaire construction and the rationale for the incorporation and arrangement of the questions. The importance of the wording of various questions or statements is illustrated, and the rationale for questionnaire administration through personal interviews is discussed. At the outset of this chapter, a description of the present Lake Ontario fishery and its implications for the survey administration is present.

The Present Lake Ontario Fishery

As of March 1978, 191 licences to fish commercially in Lake Ontario were held by 131 fishermen. These permitted the use of 510,000 yards (466,344 meters) of gillnets, 821 hoopnets, 50 trapnets, 22,800 baited hooks distributed over 55 hookline licences, 99,000 yards (90,526 meters) of carp gillnets, and 1,300 yards (1,189 meters) of seines (LOFTPC, 1978, 45)(Fig.17).

In the five year period, 1971 to 1975, Lake Ontario commercial fish yields averaged 2.5 million pounds per year (Ridgley, 1976, 11). This declined slightly to 2,208,000 pounds annually from 1974 to 1977. Most of the harvest was yellow perch, white perch, carp, bullheads, American eel, and sunfishes; only 3% consisting of cold-water species such as lake trout, lake whitefish, and lake herring. Harvests from the Bay of Quinte (834,000 pounds) and Eastern Lake Ontario (822,000 pounds) accounted for exactly 75% of the Lake Ontario total from 1974 to 1977. A mere 30,000 pounds, only 1.4% of the total landings, were caught west of Cobourg primarily in the Hamilton-Niagara area.

Much of this meagre catch consisted of stocked coho and chinook salmon prior to the 1976 closure of these species due to excessive contaminants (Fig.8).

The 290 miles (467 kilometers) of gillnets used in Lake Ontario are responsible for 50%, approximately 1.1 million pounds, of the recent annual catch. This accounts for almost all of the west-end and cold-water harvests. Three-fourths of the licenced yardage is used in the Bay of Quinte and eastern Lake Ontario, primarily for harvesting yellow and white perch. Advantages in the use of gillnets are that they are very efficient, easy to manage, and highly mobile. However, they generally do not permit live capture and are not species-selective. This means that if undesirable or restricted species are caught they usually cannot be released. The only significant trend in gillnets yields from 1974 to 1977 is the decline from 287,000 pounds to 74,000 pounds per annum in the Central Lake Ontario Region. This decline is thought to be due to the use of an excessively small mesh size resulting in the overharvesting of the yellow perch stocks (LOFTPC, 1978, 41 and 44)(Fig. 8).

Impounding gear, comprising 821 hoopnets and 50 trapnets, account for 35%, or greater than 770,000 pounds of the current annual Lake Ontario harvest. This type of gear is restricted to the shallow waters of the St. Lawrence outlet and the Prince Edward County Region embayments. The major advantage of impounding equipment is that the fish are not "gilled" and, therefore, are captured or impounded alive allowing species and size selectivity. Fish that are not wanted, or are restricted, can usually be returned successfully to the lake. The lack of mobility of this type of apparatus and the shortage of protected sites in the western end of the lake restrict its usage.

Another 8%, 176,640 pounds, of the Lake Ontario annual harvest is

attributable to baited hooks on setlines. Baited hooks catch American eels almost exclusively, mostly from Prince Edward Bay. Hook licences are in great demand because eel prices skyrocketed to one dollar per pound in 1978. New permits have not been granted because of the already intense fishing pressure, market uncertainties due to contaminants, and inadequate knowledge of eel population dynamics (LOFTPC, 1978, 44). The remaining 7% of the harvest is produced primarily by the large-mesh carp gillnet. This fishery has been closed due to mercury contamination.

Generally, in terms of the poundage landed, the gillnet fishermen tend to manage larger individual fishing operations than the impounding gear fishermen. Of 96 fishermen, in the period 1974 to 1977, 25 gillnetters harvested 10,000 pounds or more while only 13 impounding gear fishermen attained the same level. Conversely, in the less than 5,000 pounds category there were 11 impounding gear fishermen and only 5 gillnetters. The most successful commercial fishermen in terms of pounds landed were those licenced for both gear types (LOFTPC, 1978, 46).

In the period 1974 to 1977, gillnets declined 10% in importance, and impounding gear increased by 8%. Each now accounts for 42% of the Lake Ontario yield. Baited hooks have increased 6 percentage points to 11% of the total harvest, and carp gillnets declined by 4% to only 5% of the total (LOFTPC, 1978, 47).

Even though the poundage landed remained nearly constant, the total landed value increased from 447,362 dollars in 1971 to 782,397 dollars in 1975. A significant portion of this increase was due to the quadrupling of eel prices since 1971 and the more than doubling of the poundage caught over the same

FIGURE 8: LAKE ONTARIO FISH HARVESTS BY AREA, 1974-1977.

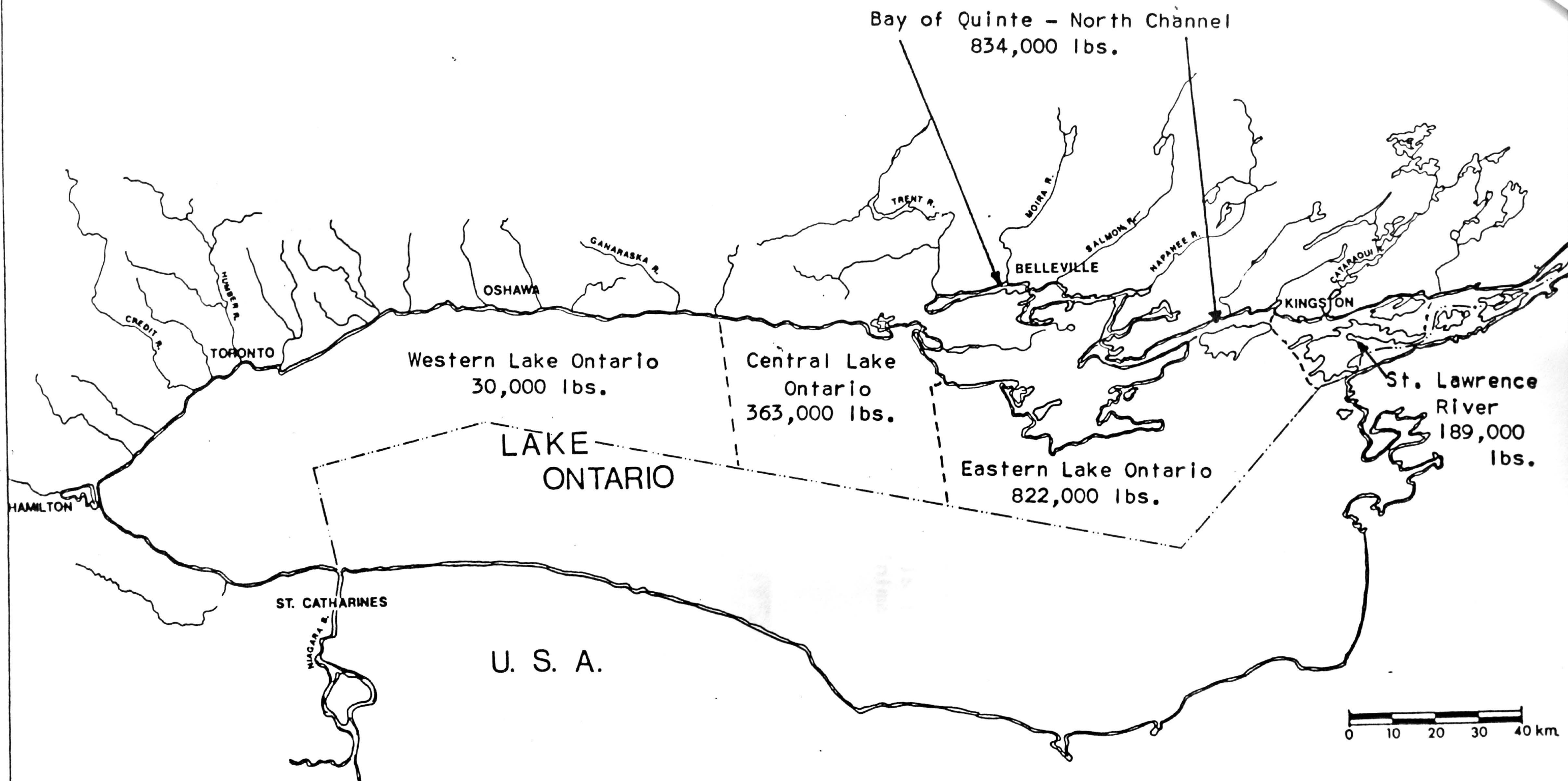




FIGURE 9: Fish house near Kingston is typical of the Lake Ontario fishery having minimal processing facilities.

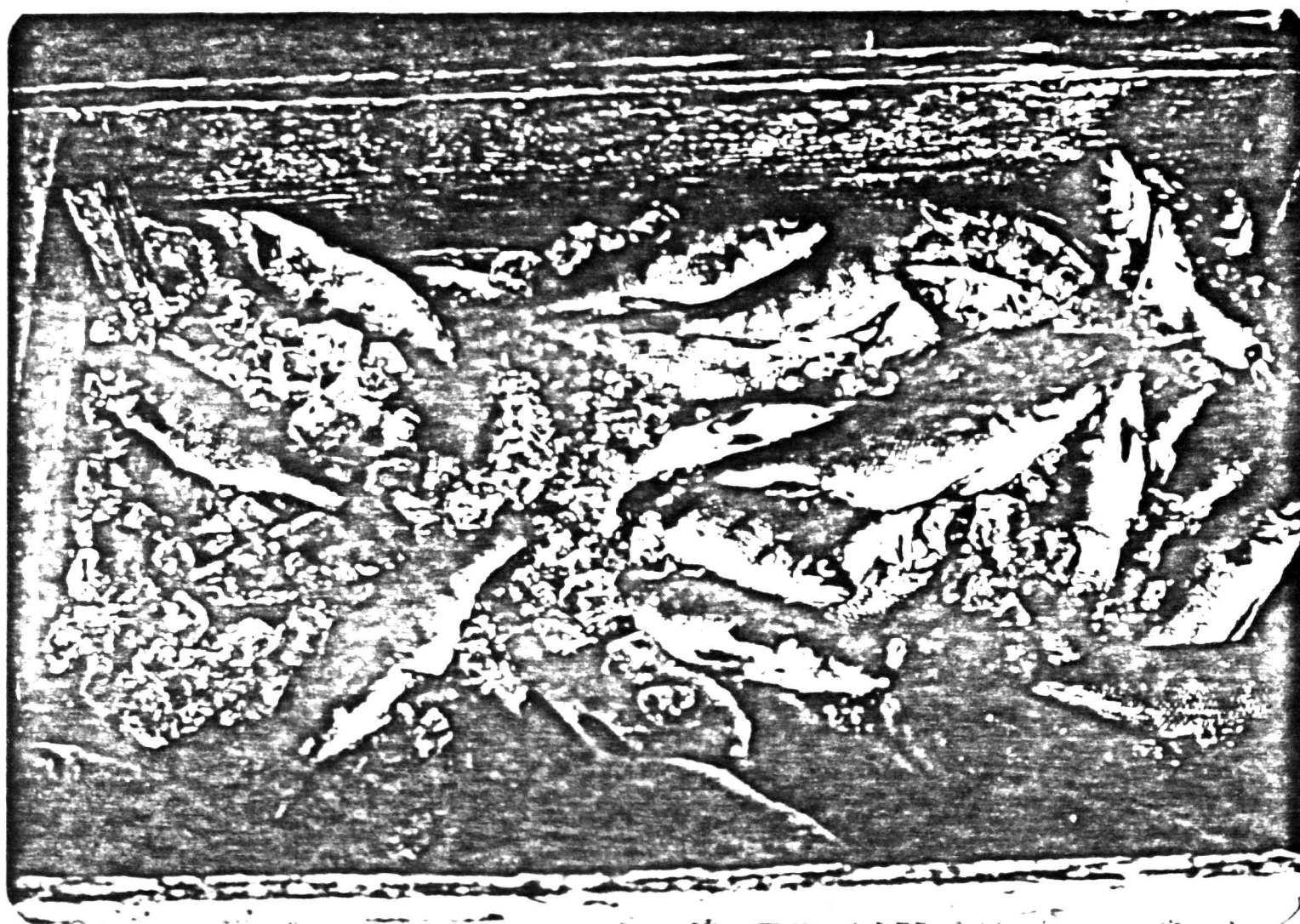


FIGURE 10: Since the collapse of the cold-water fishery, yellow perch have increased in most areas. Presently, they are the most harvested Lake Ontario species.

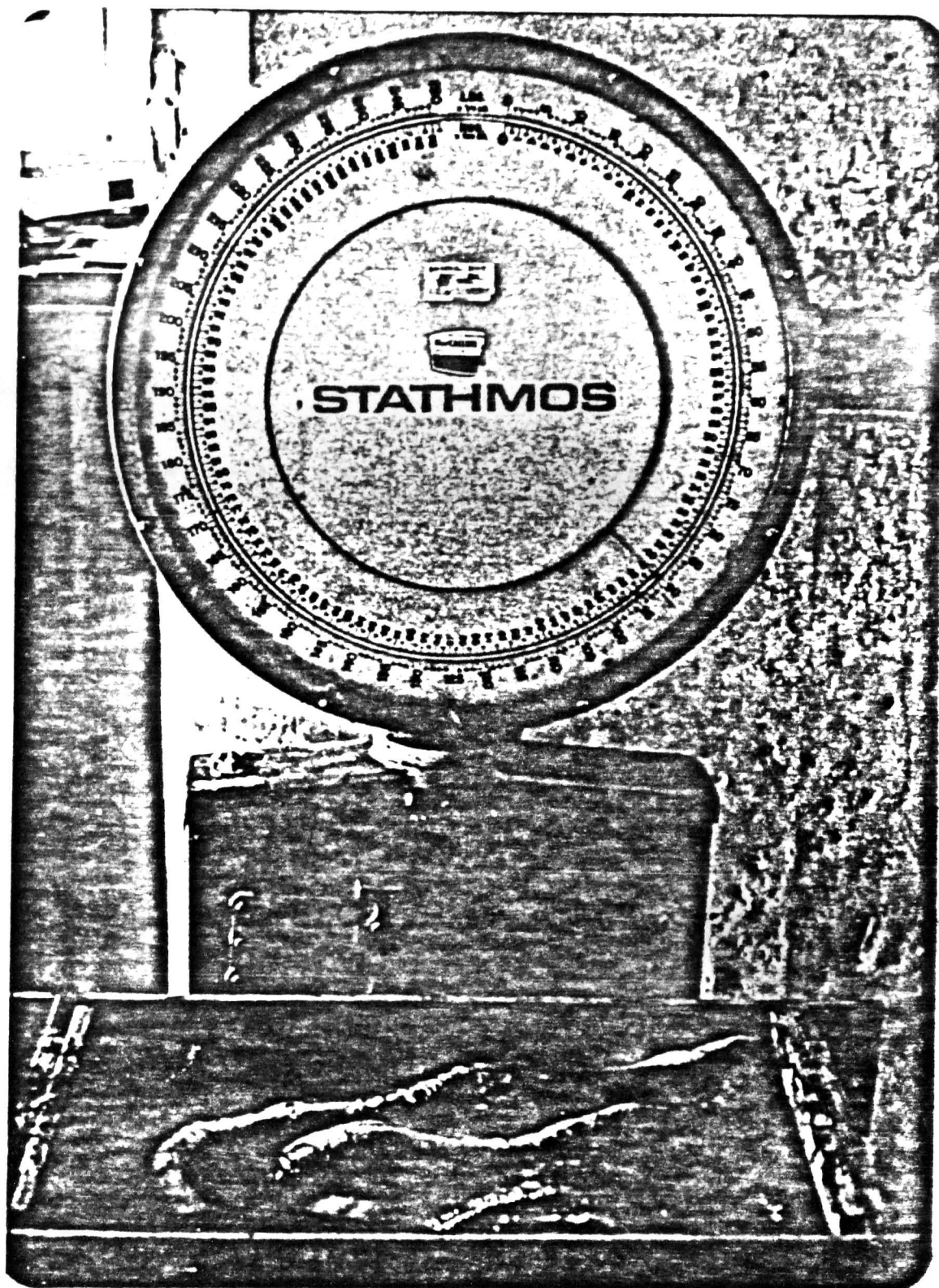


FIGURE II: American eels are regarded highly by commercial fishermen due to the unusually high price they now command.

period. The harvests of bullheads, carp, white perch, and sunfish have also increased immensely, but their prices appreciated only slightly (Ridgley, 1976, 11). According to Adams and Kolenosky (1974, 42), the Lake Ontario commercial fishery employs approximately 370 fishermen who invested more than \$900,000 in equipment.

Questionnaire Conceptualization and Rationalization

The use of questionnaires as means of obtaining data in evaluative social surveys is partially due to their relative economics in time and effort. The most objective approach to the assessment of attitudes is likely to be direct observation of the participant in the "situationally-defined" environment without his knowledge of being observed. This technique, however, requires long periods and, therefore, high monetary expenditures, pre-testing, trained observers, and objective interpretation (Whyte, 1977, 21). Interrogating people also provides information that could not be systematically observed, such as attitudes, feelings, and cognitions, and questions about the past and future (Whyte, 1977, 37).

The standardized interview schedule or questionnaire has numerous other inherent advantages. Since the questionnaire is consistent for all respondents, it allows responses to be coded, computerized, tabulated, and cross-tabulated. Although the questions are pre-determined and, therefore, biased by the preparer's preconceptions, this affect can be minimized through the use of open-ended questions.

Open-ended questions, although more difficult to code, are invaluable because they allow the respondent to answer using his own words rather than choosing from a pre-selected list of alternatives. As a general rule, open

questions precede closed ones covering the same topic area in order not to influence responses to the open questions (Whyte, 1977,40). Open question responses can be cross-checked using other, more specific questions, later on.

The questionnaire should be internally logical and consistent so that it exhibits a sense of direction. Questions that flow logically from one to another produce a questionnaire that minimizes respondent confusion and anxiety. In this respect, the clarity of instructions and question wording is essential to minimize ambiguities. At the outset of the survey the respondents should be put at ease by informing them of the purpose of the questionnaire, something about who is administering it, and the length of time required. Further, the confidentiality of their responses should be assured.

The interviewer serves a dual purpose in this particular survey. Firstly, the interview method ensures a 100% return of the questionnaires. Secondly, it was suspected that many respondents had little formal education, and, combined with the length of the questionnaire, would find it labourious to complete on their own. This also allows the interviewer to elucidate difficulties and pursue further the interviewee's area of expertise. Although, an interview represents a social interaction that inevitably influences the data obtained, the researcher can recognize these effects and take steps to minimize and account for them (Whyte, 1977, 39).

The use of a questionnaire is often a more reliable indicator of a user group's collective opinions than the often dogmatic views expressed by individuals in open meetings. The comprehensive survey method and its innate anonymity allow the respondent to voice beliefs that he ordinarily would not. This is particularly useful in instances where the more vocal

individual does not accurately portray the views of the group of which he is a member.

The Lake Ontario Commercial Fisheries Survey

The fisheries questionnaire is subdivided into three basic sections that assess attitudes and beliefs of the commercial fishermen. In addition, there are two other segments which provide background information that is essentially factual and not open to discussion (Appendix I).

The first section ascertains the interview location, the type of involvement the respondent has with the Lake Ontario fishery, and the duration of this association. These data provide descriptive information and not personal opinions. It therefore, acts as a good introduction to the survey.

The succeeding three parts of the questionnaire deal with past, present, and future Lake Ontario fisheries, in that order. Awareness of the historical fishery decline and the perceived causal factors are assessed in sector one. Which species have declined and which populations have grown are also revealed. The question of causes is purposely left open-ended so as not to bias the responses.

The second questionnaire stage is concerned with commercial fishermen perceptions of the fishery from 1970 to the present. Whether or not they are satisfied with the present state of the fishery is used as a base for further questioning. Open-ended questions are utilized to discover the perceived fishery problems and necessary corrective measures. These questions were thought to be so comprehensive that they would be impossible to answer without the aid of some topic headings. Five general categories were chosen, each concerning a different, but not mutually exclusive fishery aspect. Although

the use of such classifications tends to prejudice responses, the categories were purposely non-specific so as to provide only the minimal amount of needed guidance (Appendix I, numbers 7 and 8). The touchy issue of government management was intentionally left to the end so as not to obscure other potential problem responses. Finally, the effects of previously mentioned problems on the fishermen are obtained.

The third, more structured, stage of the questionnaire offers future alternatives for the Lake Ontario commercial fishery. Almost all questions are of the closed or scaled variety (Whyte, 1977, 41-42). Since these techniques force the individual to reply to a specific question or statement, the reasons for a choice are solicited in the open-ended style. Closed questions usually tend to simplify situations; however, they are generally less difficult to respond to than open questions which require the creation of an answer. This is an important consideration after the respondent has answered numerous long and fatiguing open-ended queries.

The third section is devoted to assessment of fishermen's support for a variety of possible management alternatives, such as the species preferred for restoration, the necessity of protection measures, the desired protection alternatives, the need for fish resource allocations among various users, the essentiality of payment for the use of the resource, the improvement of manager-user communication channels, the means of achieving adequate sustained yield levels, and so on.

The last portion of the third section is comprised of a series of scaled or Likert-type questions with five-point scales ranging from strongly agree to strongly disagree. The exact statement wording is extremely important

since the use of certain adjectives may invalidate the purpose of such affirmations (Whyte, 1977, 42).

A final questionnaire section requests information with respect to the personal and socio-economic characteristics of commercial fishermen. Age, education, income, degree of fishing activity, reasons for fishing as an occupation, proportion of income derived from fishing, and fishing gear types used and their relative importance, are all assessed.

Again, confidentiality of these data were assured and the reasons for their collections were elucidated.

Sampling Strategy and Procedure

The remainder of this chapter explains the procedure used in contacting and interviewing the Lake Ontario commercial fishermen. The intent of the researcher was to interview as large a proportion of the commercial fishermen as possible. This sampling goal was chosen because it reduces the problems associated with inferential statistics and confidence levels. It reduces the possibility of choosing a sample that does not adequately represent the whole population and results in misleading data interpretations.

A list of the currently licenced Lake Ontario commercial fishermen was provided by the Ontario Ministry of Natural Resources, but used sparingly by the researcher to reduce any perceived connection with this government agency. It was felt that such a perceived affiliation would result in affected responses or, indeed, an unwillingness to cooperate at all. The researcher relied heavily on respondents to provide him with names of other fishermen in his locale; the original list was used primarily as a supplementary aid and cross-checking mechanism. Very few fishermen were actually contacted without being referred to, or mentioned by, someone else.

The initial contact was made by telephone; the researcher explained the project and arranged an interview appointment. First to be contacted in each area were fish buyers, primarily because of their prominent position within the fishery. It was felt, by virtue of their relationship with many commercial fishermen, that these individuals would provide indications of the overall populations' ideas and supply leads to numerous other potential respondents.

The researcher travelled to all Canadian regions of the lake in an attempt to assess the opinions of commercial fishermen from different locations and backgrounds. This lake-wide survey procedure was seen as imperative in revealing the whole fishery in proper perspective and in the assessment of regional differences.

CHAPTER V

ANALYSIS AND INTERPRETATION OF RESPONSES

This chapter describes the data accumulated from the questionnaire in context with the Lake Ontario fishery. Some individuals' responses are compared and contrasted with their own, and others' expressed opinions to see which beliefs are internally consistent, which attitudes prevail throughout the fishery, and which are dependent on other variables. Viewpoints that differ from the interpretations of the scientific community are noted, and survey shortcomings are explored.

Initially, the sample of commercial fishermen is delineated with respect to their location, experience, involvement, income, education, and fishing gear used. Then, their awareness of the historical fishery, their perceptions of the state of the present fishery, and their feelings concerning the future directions of the fishery are ascertained.

The Survey Sample

In the period June throughout August 1978, 83 individuals involved directly with the Lake Ontario commercial fishery were surveyed. (81) 97.6% are licenced commercial fishermen; (1) 1.2% is a former commercial fishermen and the brother of a presently licenced commercial fisherman; and the other (1) 1.2% is the acting representative of a group of currently licenced commercial fishermen. Of the 81 fishermen interviewed, one is the president of the fishermen's association; five are also fish buyers and distributors; and three are tourist outfitters or angler guides as well.

The Lake Ontario commercial fisherman is usually a highly experienced individual, with the mean length of involvement being 32.4 years. An astounding

18.1% (15) of those surveyed have fifty or more years of fishing experience on the lake; 68.7% (57) have at least thirty years; only 6.0% (5) have spent less than ten years in the fishery.

Correspondingly, the Lake Ontario commercial fishermen population is aging with little recruitment of younger men occurring. 57.7% (46) of the interviewees are at least fifty years of age and 27.5% (22) are sixty years or more. A mere 3.9% (3) are under thirty. However, many fishermen mentioned that they have sons who would like to fish commercially if licences could be acquired.

Generally, Lake Ontario commercial fishermen possess little formal education to compliment their wealth of practical experience: 64.9% (37) have no secondary school training; roughly one-third benefit from varying amounts of secondary school education; and only a small number (2) possess any post-secondary instruction. This low level of educational attainment is probably correlated to the mature age structure of the population and the circumstantial lack of opportunity when they were younger.

Although the question of income derived from fishing is one of the last to be asked, many commercial fishermen did not wish to divulge this information; and many others are not certain of the actual amount their fishing income totalled. Those who refused to respond most often appeared to be quite successful and have been the subject of misleading journalism in the local newspapers. Unqualified statements that some commercial fishermen are earning more than \$1,000 per week harvesting eels were printed. A small minority verified this assertion, but explain that such an inflated income occurs for only a very short period of time -- not year round.

In view of this inaccurate exposure and a general reluctance to reveal such information, the interviewer resorted to some guess work concerning the fishermen's incomes that seemed obvious. Since the most distinct income groups are at the high and low ends of the scale, the data are likely to be polarized and should be regarded accordingly.

The most popular income groups, both total and net, derived from fishing commercially in Lake Ontario, are the less than \$3,000 per annum categories. 31.0% (18) of the Lake Ontario commercial fishermen earned a gross income less than \$3,000 last year; 41.4% (24) stated their net incomes seldom exceeded \$3,000 yearly. Approximately 80% of respondents report their net annual incomes to be below \$9,000. 25.9% (15) estimate their gross annual fishing incomes to be at least \$15,000. However, only 10.3% (6) feel their incomes after fishing expense deductions still fit in this category. This might suggest that many high-effort, high-yield fishermen operate with low profit margins and are susceptible to resource unpredictability. Almost two-thirds of the total sample feel that their fishing incomes are unreliable and easily vary 1,000 or more dollars from one year to the next.

The commercial fishermen were more cooperative when asked to estimate the proportion of their total earnings that are comprised of their net fishing incomes. 54.3% (38) respond that they earn at least three-fourths of their income from fishing. However, 35.7% (25) profess that they obtain less than half of their income in this way. Although many claim to earn a high percentage of their income from fishing, most are hard pressed to think of any fishermen who do not supplement their income with alternative employment for at least part of the year. 71.1% of the fishermen who depend highly on the

fishery as a primary source of income ply the open waters of the eastern basin or the Central Region near Brighton. Generally, North Channel fishermen, the shallow-water fishermen of the St. Lawrence outlet, and those at the western end of Lake Ontario depend on the fishery for less than half of their total incomes relying on other employment as their primary means of support.

TABLE I

Fishing Income

<u>Gross</u>	less than	\$ 3,000	18	31.0%
	\$ 3,000 to	\$ 5,999	8	13.8%
	\$ 6,000 to	\$ 8,999	11	19.0%
	\$ 9,000 to	\$ 11,999	5	8.6%
	\$ 12,000 to	\$ 14,999	1	1.7%
	\$ 15,000 or more		<u>15</u>	<u>25.9%</u>
			58	100.0%
<u>Net</u>	less than	\$ 3,000	24	41.4%
	\$ 3,000 to	\$ 5,999	10	17.2%
	\$ 6,000 to	\$ 8,999	12	20.7%
	\$ 9,000 to	\$ 11,999	2	3.4%
	\$ 12,000 to	\$ 14,999	4	6.9%
	\$ 15,000 or more		<u>6</u>	<u>10.3%</u>
			58	100.0%

24.3% (17) of those surveyed fished regularly most of the year round.

But approximately one-third of the population engage in fishing for six months of the year or less. Almost half of the commercial fishermen questioned exploit the Lake Ontario fish community for at least a period of nine months per year. Most of the activity occurs from the spring break-up to freeze-up in the late fall, but such habits vary from region to region, and with the

fishing gear used.

96.0% (72) of the commercial fishermen are self-employed in their fishing activities and almost all claim they thoroughly enjoy the lifestyle and the freedom and flexibility it permits. Few feel that a scarcity of alternative employment opportunities or their lack of training for other available jobs have any bearing on their choice of commercial fishing as a livelihood, although many admit that initially these may have been factors influencing their selection. 66.2% (45) agree that heavy capital investment in fishing equipment prohibits thoughts of leaving the fishery even when opportunities present themselves, though only half feel their present remuneration is good.

A large proportion of the Lake Ontario fishing activities appear to be single-man operations. Less than half of those surveyed hire others to help on a regular basis, and half of the employees were immediate family members. However, 29.2% (21) of the commercial fishermen are involved in a partnership or similar agreement with other licenced commercial fishermen, primarily for economic efficiency. Most state that having an experienced partner costs far less than hiring part-time helpers who are usually unreliable, demand high wages, and are not willing to work the odd or long hours required.

Gillnets are the most important fishing gear-type according to 50.0% (38) of the Lake Ontario commercial fishermen. Almost two-thirds (49) of those surveyed rank gillnets, excluding carp gillnets, in their first three selections. Hoopnets follow in importance, being the most significant gear-type of 36.8% (28) of commercial fishermen. Hoopnets are used by 50.0% (38) of those surveyed. Baited hooks on setlines are the third most valuable

gear-type overall and are currently used by nearly half (37) of the respondents. Although, hooks are the pre-eminent fishing equipment of only 13.2% (10) of the interviewees, they are second in importance to 27.6% (21) of the commercial fishermen. Carp gillnets, seines, and trapnets are used by 18, 9, and 6 commercial fishermen, respectively. An overwhelming 84.0% (63) prefer to use the fishing apparatus they employ presently rather than switch to new technology.

Notably, 27.6% (21) of the commercial fishermen are presently licenced for the use of both gillnets and impounding gear; several others would like to use both or the alternate gear not used currently; many more assist fishermen with different gear-types than their own. Both equipment types are deemed essential so that fishermen are able to harvest different species, at various locations, throughout the year. There was no mention of competition or animosity between gillnetters and impounding gear fishermen during this survey.

The sample of 81 commercial fishermen represents only 62% of the total Lake Ontario commercial fisherman population. If two others surveyed are included, the sample increases to 63.4%. A list was provided with 122 of the 131 present licencees and attempts were made to contact 116 fishermen. 87 fishermen were located but six adamantly refused to be interviewed; three of these were from the extreme western end of the lake. In effect, the researcher attempted to reach 95% of those listed or 89% of the licencees. 93% of those contacted were surveyed.

12.0% (10) of those questioned fish mainly in the waters of the Lake Ontario Central Region near Brighton (Fig.17). Bay of Quinte fishermen, from Glenora westward, including Hay Bay, represent 25.3% (21) of the respondents; and North Channel fishermen comprise 8.4% (7) of the survey sample. Commercial

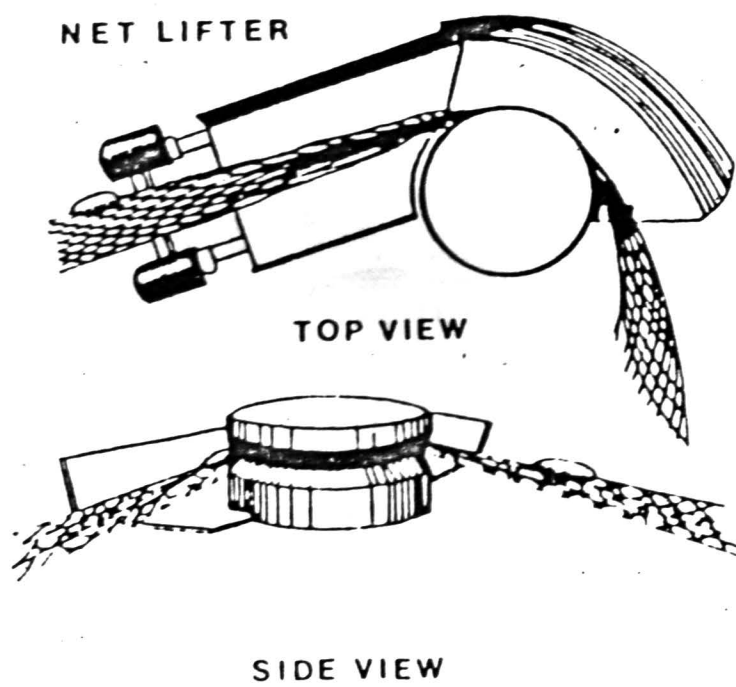
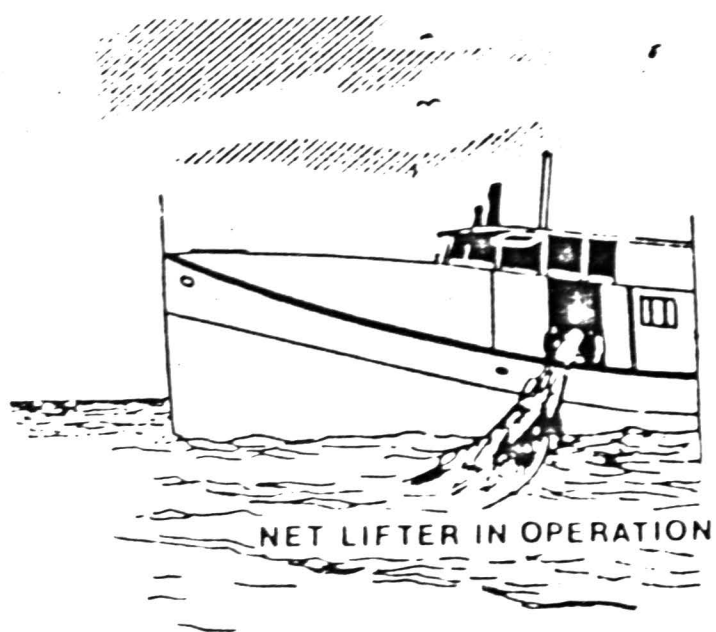
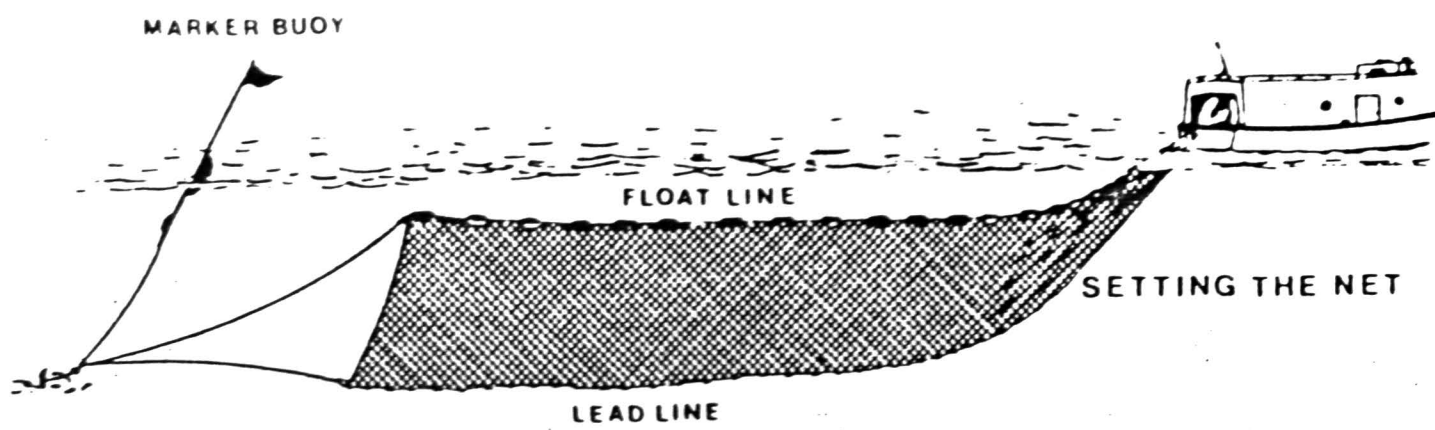


Figure 12: THE GILL NET

(Adams & Kolenosky, 1974).

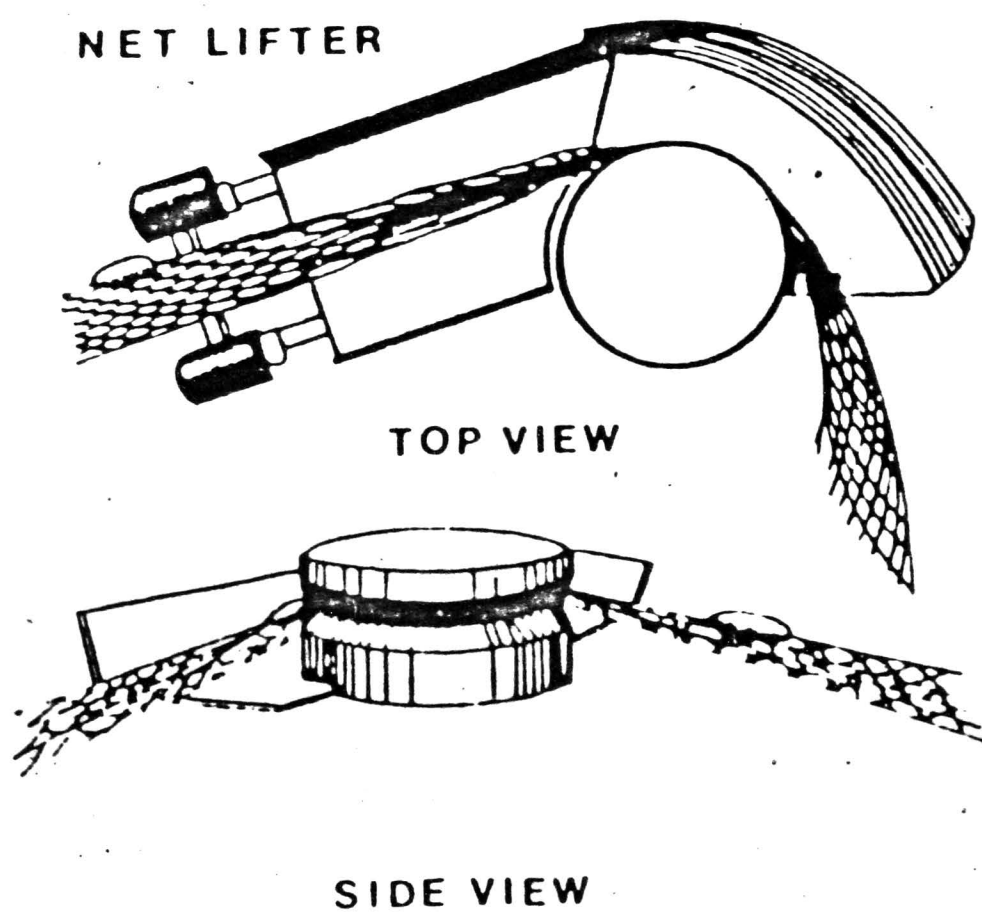
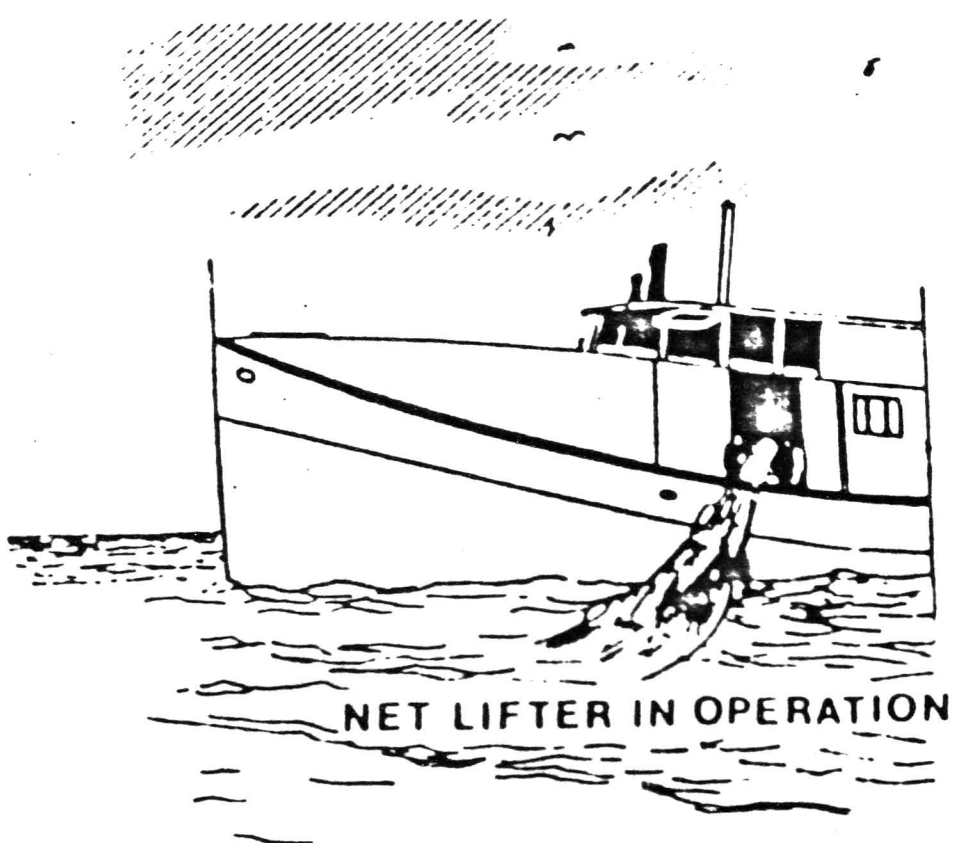
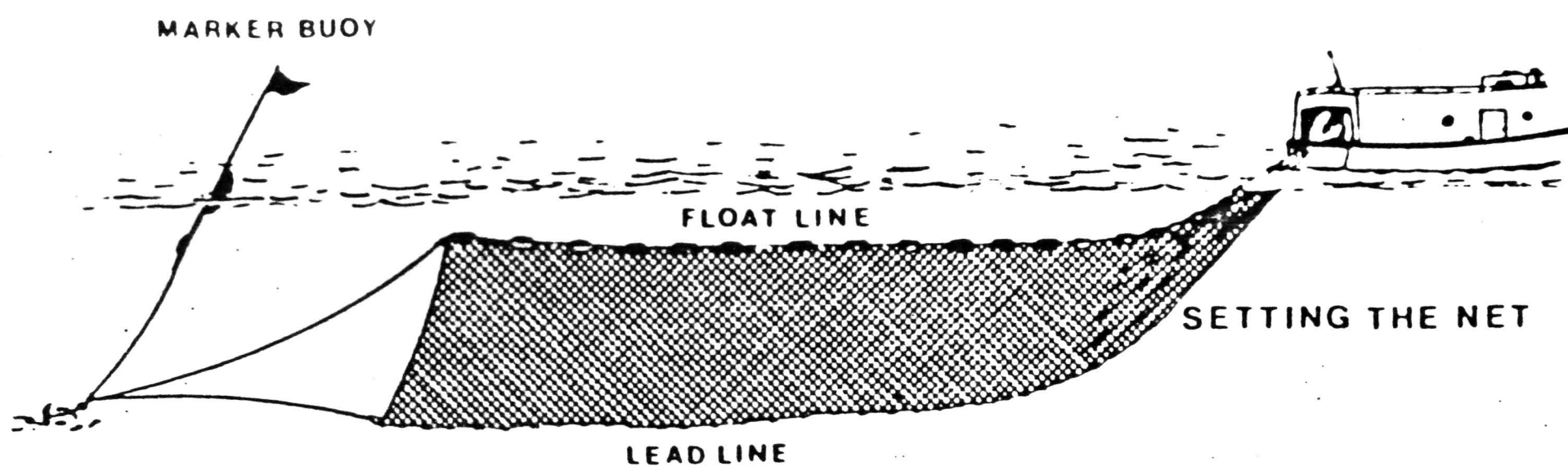


Figure 12: THE GILL NET

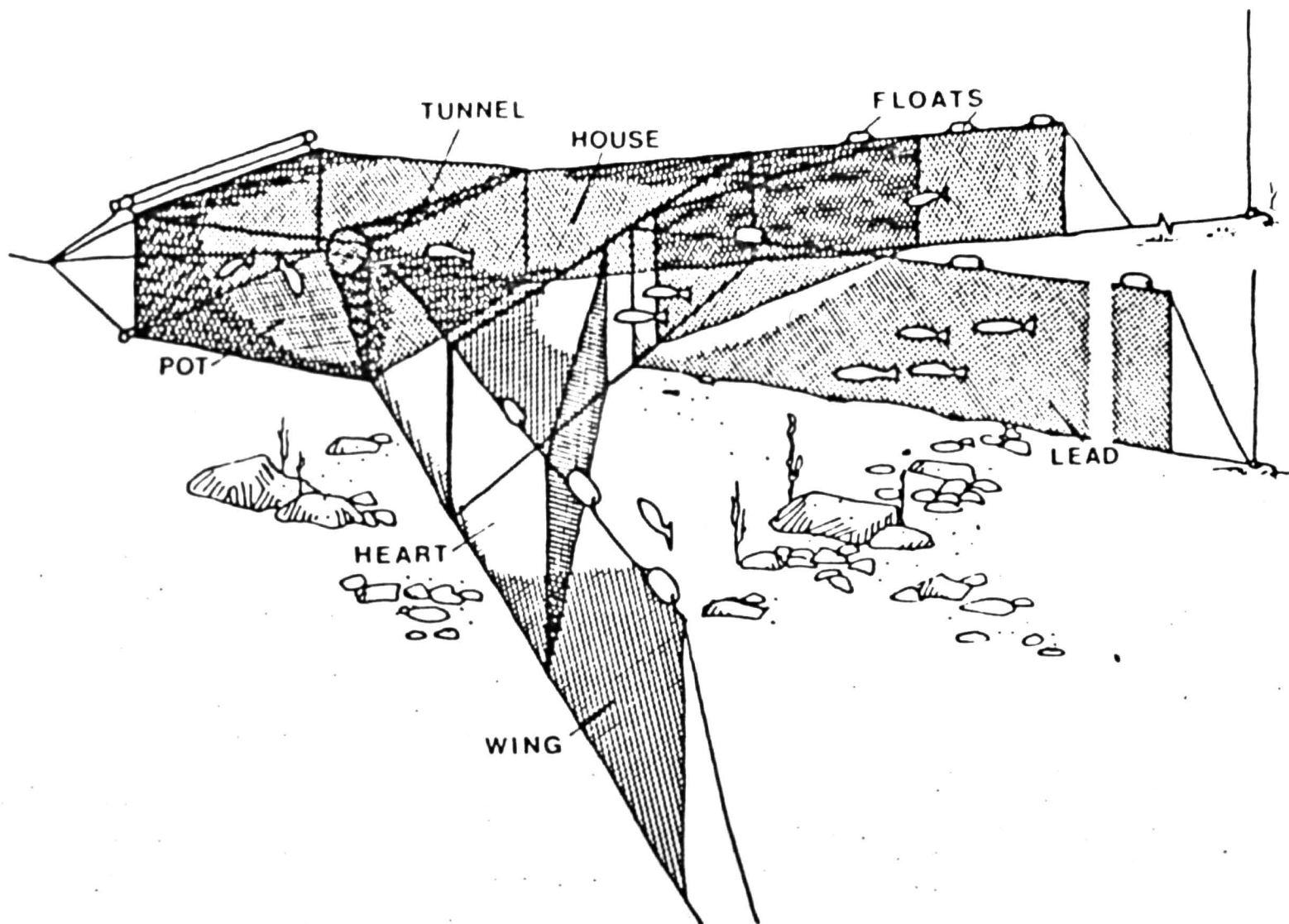


Figure 13: THE TRAP NET

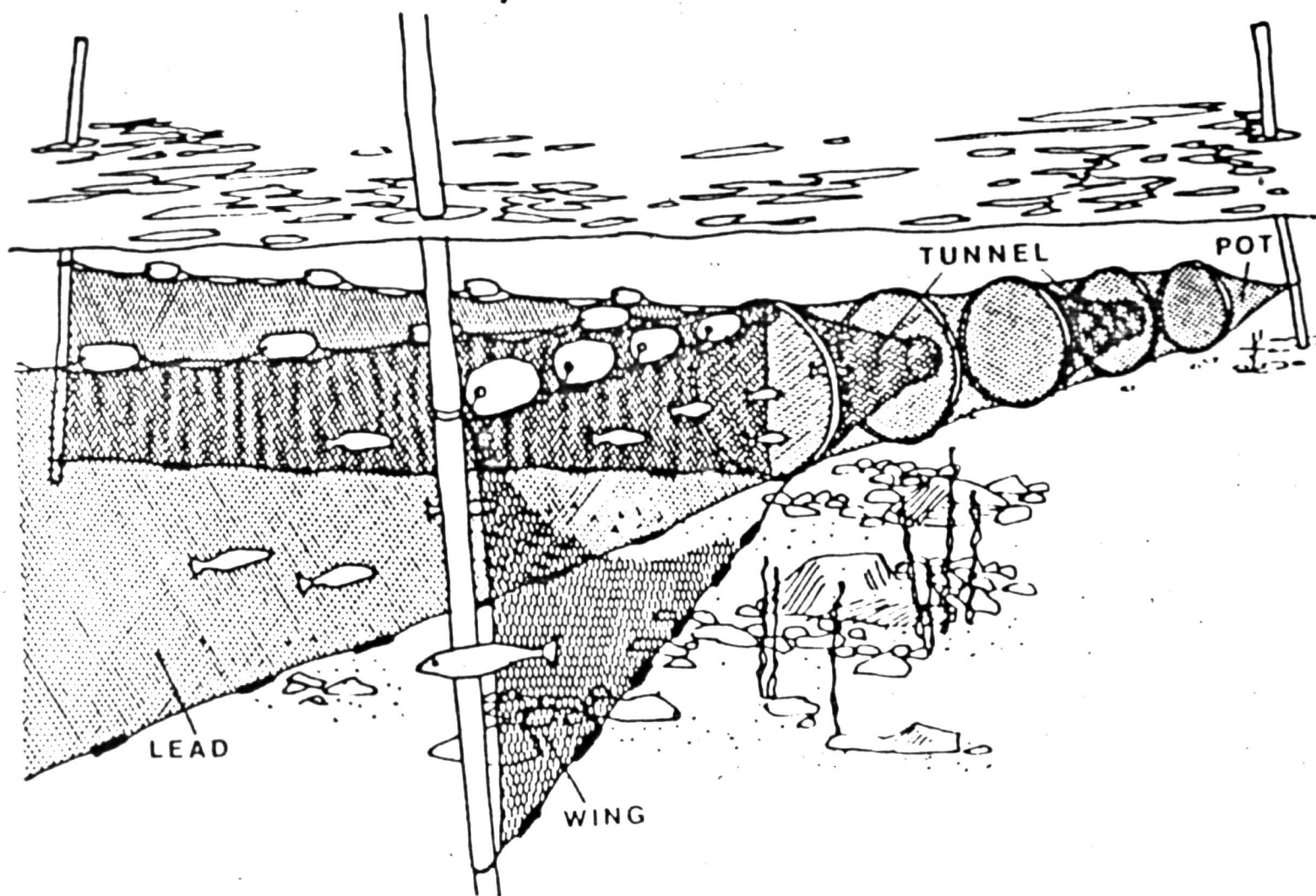


Figure 14: THE HOOP NET

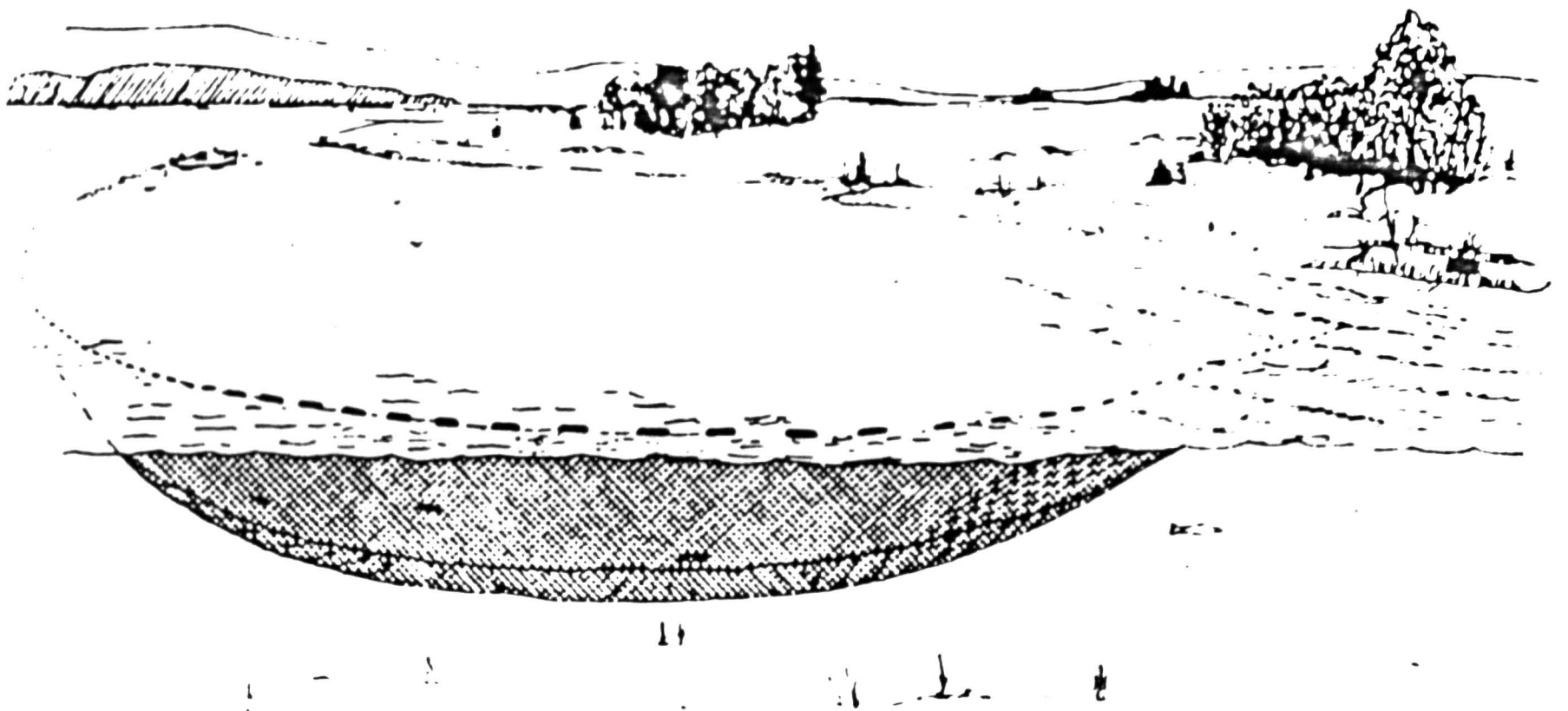


Figure 15: THE SEINE

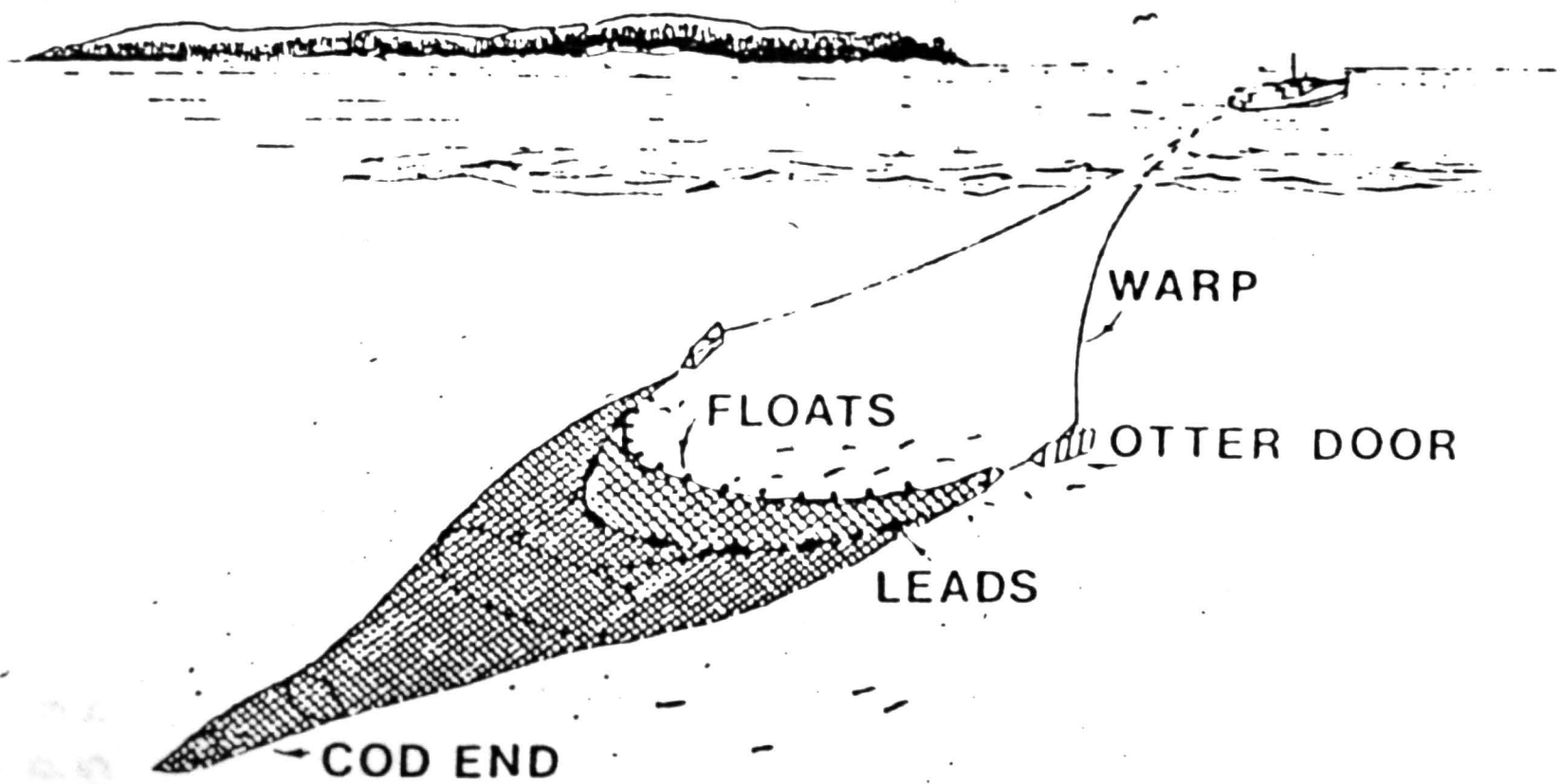


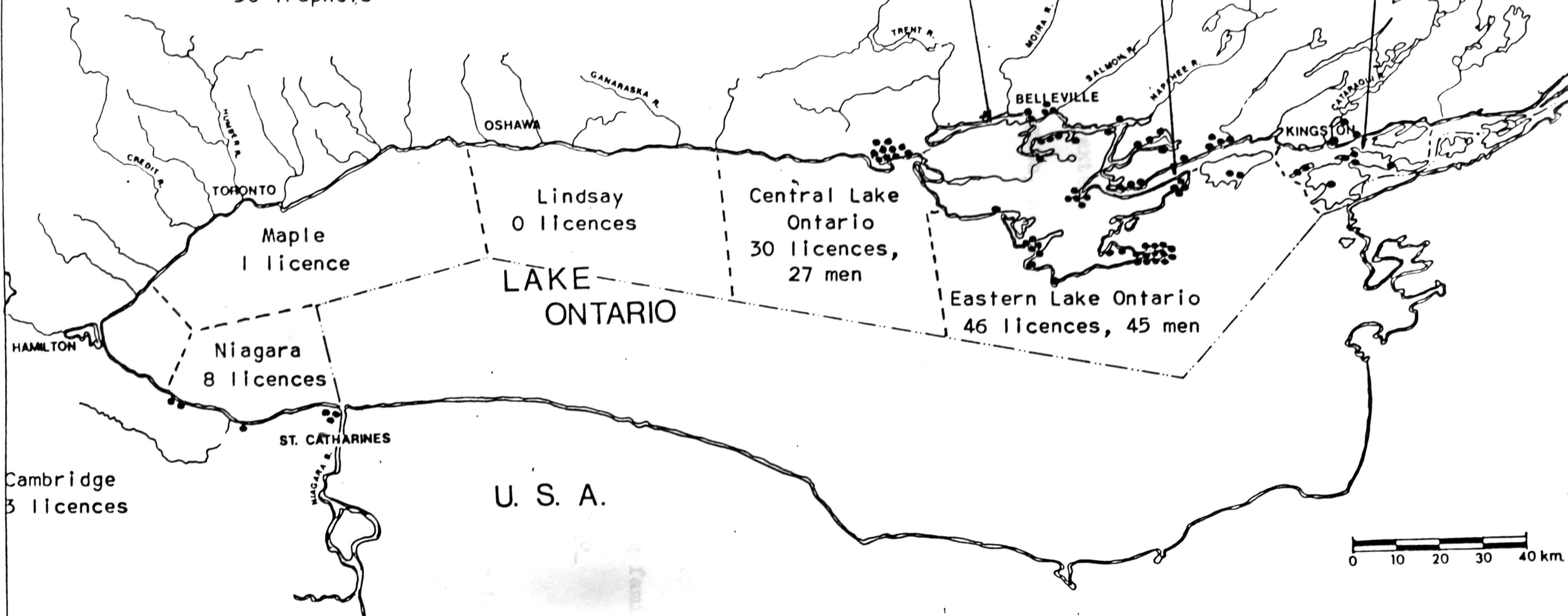
Figure 16: THE OTTER TRAWL

LAKE ONTARIO TOTALS

191 licences, 131 licencees
 510,000 yds. gillnet
 99,000 yds. carp gillnet
 22,800 hooks (55 hookline licences)
 821 hoopnets
 50 trapnets

Bay of Quinte - North Channel
 74 licences, 58 men

St. Lawrence River
 20 licences, 15 men



• Home port of interviewed fisherman

FIGURE 17: DISTRIBUTION OF LAKE ONTARIO COMMERCIAL FISHING LICENCES & FISHERMEN, 1978.
 (LOFTPC, 1978).

fishermen of the Eastern Lake Ontario region embody the largest population of the survey sample: 34.9% (29), and another 12.0% (10) consist of St. Lawrence outlet fishermen. The final 7.2% (6) of respondents are from the western basin of Lake Ontario, primarily the Niagara District. Although the survey seems weak in its representation of Bay of Quinte, Central Region, and western Lake Ontario fishermen, fishing areas are not mutually exclusive. A large number of fishermen extend their efforts to the Bay of Quinte, North Channel, and the Eastern region, not restricting themselves to just one of these districts.

In summary, the 62% sample of the Lake Ontario commercial fisherman population exhibits the following characteristics: almost exclusively male, self-employed, and aging, with an affluence of practical experience; a paucity of formal learning; a great dependence on a usually small fishing income; a reliance on gillnets, hoopnets, and hooks to provide the harvests; a relatively high capital investment in essential fishing apparatus; and a ubiquitous liking for this occupation, in most instances a long-standing family tradition.

The Perceptions and Attitudes of the Lake Ontario

Commercial Fishermen

Awareness of a phenomenon is seen as a prerequisite to the formation of an attitude towards an event. This axiom is tested at the outset of the questionnaire where the cognizance of the long-term decline in the Lake Ontario commercial fishery is assessed. 81.9% (68) feel that a decline has occurred while only 13.3% (11) feel the fishery has been relatively stable. 60.2% (50) think that the decline from 1920 to 1970 involved a reduction in the total poundage or quantity of fish caught, but 32.5% (27) are of the opinion that

has ever become significant commercially (Scott and Crossman, 1973, 126 & 136). Yellow perch is classified by the respondents as both an original and new species because it is indigenous to Lake Ontario; it gained importance commercially after the collapse of the cold-water stocks (Table 3).

TABLE 3

New Species Caught: 1920-1970

1. white perch *	53	63.9%
2. yellow perch	44	53.0%
3. American eel	30	36.1%
4. American or rainbow smelt *	22	26.5%
5. bullhead/channel catfish	19	22.9%
6. carp *	14	16.9%
7. sunfishes	7	8.4%
8. basses	7	8.4%

* exotic species

Since the commercial fishermen's awareness of the long-term decline has been ascertained, their knowledge concerning the reasons for this decline is also assessed. The Lake Ontario commercial fishermen generated 21 unprompted causal factors for the 1920 to 1970 declension, with the support of only 42.7% for the most commonly mentioned cause. This wide range of choices, and the lack of ubiquitous support for any of them, implies that the commercial fishermen are uncertain of the reasons for the fishery deterioration. This conclusion is enhanced by the fishermen's selection of 14 main causes, with only 31.3% (26) suggesting the most popular choice. Logically, the inability of any causal factor to gain prominence leads to the assumption that a combination of numerous conditions or agents promoted the fishery degradation. However, only 6.0% (5) of those surveyed explicitly arrived at this conclusion.

such a reduction has not occurred. However, an overwhelming 94.0% (78) state that the decline consisted of a change in the species composition of the harvest. These opinions and observations are accordant with the scientific viewpoint that: recent smelt and alewife biomass totals were not possible without the displacement of other species (LOFTPC, 1978, 14).

The species composition modifications described by the commercial fishermen are in keeping with the sequential change referred to as the "fishing-up" process. The most common responses for the species initially harvested are all-high-value species of great former importance to the Lake Ontario commercial fishermen. Four of the premier five species are primarily cold-water inhabitants. (Table 2).

TABLE 2

Species Originally Caught: 1920-1970

1. lake whitefish *	73	88.0%
2. lake herring *	57	68.7%
3. lake trout *	54	65.1%
4. yellow pickerel (walleye)	42	50.6%
5. deepwater cisco *	26	31.3%
6. lake sturgeon	7	8.4%
7. blue pickerel (b. walleye)	7	8.4%
8. burbot (ling) *	6	7.2%

* primarily cold-water species

The species that replaced or displaced the high-value fishes are primarily warm-water, low-oxygen tolerant, less economically valuable species. Three of the six mentioned most often are introduced species. Two other exotics are cited in the new species category: alewife and gizzard shad. But surprisingly, only by a few commercial fishermen. This is probably because neither species

Overall, the Lake Ontario commercial fishermen mentioned 7 different pollution or pollution-related causes for the decline; and 3 more of the 21 factors are the invasions of specific exotic species. Also, the unsolicited response of "no overfishing!" occurs 6 (7.3%) times.

Non-specific pollution is cited most often as the cause of the fishery deterioration. It is mentioned by 35 (42.7%) of the commercial fishermen and 26 (31.3%) felt it was the primary cause of decline. Algae or "moss" overlaying spawning grounds was the major factor identified by 13.3% (11) of the interviewees. American smelt and natural cycles received 7 (8.4%) votes each (Table 4). Smelt are said to reproduce earlier in the season allowing them to consume the fry of more valuable species. Some fishermen also stated that lake trout died from eating smelt which are impossible to digest. Others said they have seen species populations increase and decrease on numerous occasions, particularly whitefish and yellow pickerel stocks, and that currently they are on the rise.

TABLE 4

Perceived Causes of the Historical

Lake Ontario Fisheries Decline

	<u>Cited by</u>	<u>Main Cause</u>
1. pollution (unspecified)	42.7%	31.3% (1)
2. algae covering spawning grounds	39.8%	13.3% (2)
3. American smelt	23.2%	8.4% (4)
4. sea lamprey predation	20.7%	6.0%
5. industrial chemicals/contaminants	20.7%	4.8%
6. natural cycles	19.5%	8.4% (4)
7. organics/sewage/phosphates	13.4%	3.6%
8. overfishing	12.2%	1.2%
9. disease (yellow pickerel)	9.6%	1.2%
10. don't know	7.3%	7.2%
11. combination	---	6.0%

For the most part, the commercial fishermen's perceptions of the historical Lake Ontario fishery decline are similar to the resource managers' viewpoints delineated previously in this paper. There is, however, an inconsistency between the two groups on one, most significant, causal factor that is the crux of many current management strategy difficulties. That is overharvesting: only 12.2% cite it as a reason for the decline, and only one individual feels it was the fundamental factor involved. In contrast, there is widespread belief within the scientific community that long-term over-exploitation was the initial destabilizing agent, and prime factor in the present disarray of the Lake Ontario fish community (Christie, 1973, 3). The theory of cognitive dissonance, described in Chapter II, may well apply to these assessments.

Perceptions of the Present Condition of the Fishery

As could be expected from the large number of respondents who felt there had been a long-term decline in the Lake Ontario fishery, 73.5% (61) of the interviewees are dissatisfied with its present state. Only 19.3% (16) feel that the current fishery is satisfactory: a disproportionate number of these are hoopnetters. 35.7% of the hoopnetters are presently satisfied whereas only 13.2% of the gillnetters agree. This result could have been anticipated because hoopnets are set in shallow water and harvest the more abundant, warm-water species which, generally, have not experienced a large decline.

A vast array of current problems were spontaneously identified by the Lake Ontario commercial fishermen. An effort was made to group the responses accurately, without compromising detail, so that the frequencies of each could be tabulated. The result is the delineation of 42 perceived problems, in 5

categories, that are presently affecting the fishery. Even when asked to choose a single, most critical, obstacle confronting the present fishery, 14 difficulties were suggested and 5 (6.3%) fishermen could not decide. No respondent feels that the fishery is completely devoid of problems.

Under the heading of fish habitat and water quality, the most often mentioned problem is that created by algae mats covering spawning beds. Although 47.0% (39) identify this problem, 42.2% (35) of the fishermen feel that these eutrophic conditions have improved over the last 5 years. The incidence of chemical contaminants in Lake Ontario is cited by 36.1% (30) of the respondents and 19.3% (16) advise of the problem of water pollution in general. Chemical contaminants is the second most popular response (19.0%) for a single, main fishery problem. Also mentioned, to a lesser degree, are sewage and detergent input; agricultural runoff; spawning area destruction; impingement of fish on turbine intake screens at Cornwall, particularly American eels; pulp and paper effluent at Trenton; and cement plant dust near Picton.

The main problem fishermen associate with fish species and populations is the overabundance of salmonids they are not permitted to catch and interfere with their efforts to harvest other species (25.3%). 24.1% (20) feel there are too few high-value fish and 15.7% (13) respond that there is an overabundance of coarse species, especially carp. The recent yellow perch decline, fish population instability, and the profusion of white perch populations are also cited.

Very few problems concerning fish harvesting are suggested indicating that the commercial fishermen does not see himself as initiating or augmenting the fishery's deterioration. Only 9.6% (8) state that over-harvesting by gillnetters

exists and 4.8% (4) feel that impounding gear fishermen keep undersized fish. 7.2% (6) assert that the 2 5/8 inch yellow perch mesh is excessively large to permit a good harvest; all six are from the Brighton area. Here, and in the Bay of Quinte, fishermen claim that yellow perch never reach the size necessary for harvesting with this mesh size.

By far the most numerous response pertaining to the economic aspects of the fishery is the lack of markets due to unacceptable levels of contaminants in fish flesh (39.8%). Also noted are rapid and excessive fish-price fluctuations (15.7%) and the feeling that fish prices are artificially lowered by buyers (12.0%). High operating costs, and inadequate markets for coarse species, particularly bullheads, are each cited by 8.4% (7) of the respondents. Two (2.4%) individuals feel that the fish buyers hold a disproportionate number of licences giving them an unfair advantage.

The most extensive list of complaints (15) occurs under the heading of government management. 60.2% (50) feel that over-regulation and over-enforcement is a major issue; 20.3% (16), the highest frequency rate, selected it as the most pressing immediate problem with the Lake Ontario commercial fishery. According to 30.1% (25), the government-established, acceptable contaminant levels, and the resultant species bans, are overly stringent. Fisheries research is deemed ineffective by 27.7% (23) of the respondents and 19.3% (16) feel it is dishonest, inaccurate, and otherwise unavailable to the fishermen. There is also a strong feeling (26.5%) that government strategy is to gradually eliminate commercial fishermen from Lake Ontario in favour of anglers. The imprecise problem of government management in general is mentioned fifteen times (18.1%) and the insufficiency of eel licences is cited by eleven

(13.3%) interviewees. The latter problem can be expected to intensify if eel prices continue to rise. Other perceived management-related problems are: favouritism shown to certain "big" fishermen; lack of inter-agency communication and policies, and reactionary planning; inaccountability of resource managers for their decisions; inaction towards polluters; contaminant publicity; no stocking program for commercial species; an unofficial policy of reducing gill-nets; and a lack of public awareness. Table 5, below, lists the most often mentioned problems in order, regardless of the category they were cited in.

TABLE 5

Summary of the Most Prominent Present Fisheries Problems

	<u>Cited by</u>	<u>Main Problem</u>
1. too many restrictions/harassment	60.2%	20.3% *
2. algae/"moss" on spawning grounds	47.0%	3.8%
3. no markets due to contaminated fish	39.8%	6.3%
4. chemical contaminants in lake	36.1%	19.0% *
5. acceptable contaminant levels/ bans		
too strict	30.1%	6.3%
6. ineffective research	27.7%	2.5%
7. plan to eliminate commercial		
fishermen/favour anglers	26.5%	---
8. too many salmonids/restricted	25.3%	1.3%
9. too few high-value species	24.1%	---
10. pollution (unspecified)	19.3%	5.1%
11. research dishonest/inaccurate	19.3%	---
12. government management (unspecified)	18.1%	16.5% *

*three main problems

From the selection of main problem responses, 48.1% (38) are related to some aspect of government management, 35.4% to pollution, and 31.6% to chemical contaminants. 6 of the 10 most often spontaneously mentioned problems are

related to government management. This nearly ubiquitous aversion for the government administration is indubitably illustrated by the responses to a series of Likert-type questions at the end of the questionnaire. An average of 83.5% of the respondents feel that: no more enforcement of commercial fishing regulations is needed (91.0%); no increase in the penalties for breaking the regulations should be actualized (84.6%); the Ontario Fishery Regulations are overly complex and create more difficulties than they were intended to resolve (75.3%); the differences in opinions between managers and commercial fishermen are vast and probably not resolvable (79.5%); and the contaminants present in fish flesh are not detrimental to human health and, therefore, no prohibition of such species should be in affect (87.0%). On average, 64.1% agree strongly with these assertions with only 3.9% to 14.3% disagreeing at all.

The problem of chemical contaminants is mentioned in several different ways. However, responses to the latter statement suggest that government standards are more of a problem than pollution. Some reasons for this belief amongst fishermen is that they mistrust the testing procedure for contaminant concentrations; feel the testing is purposely done on fatty tissue where contaminants are concentrated; results are not made available to them; no proof of a hazard is forwarded; the levels are not universal and the same fish are acceptable elsewhere; fish consumption is too low to be harmful; other food-stuffs are equally as damaging but not banned; and they have eaten large quantities of fish throughout their lives experiencing no ill effects. The general feeling is that species closures, due to elevated contaminant concentrations in fish flesh, are just another form of government harassment directed at Lake Ontario commercial fishermen.

Grievances with government regulations and their enforcement are numerous and wide-ranging. Most fishermen surveyed are displeased with the requirement compelling them to submit monthly catch records. In many cases this means a special trip to the buyers to check their records, which is seen as an expensive waste of time, especially by less-active, part-time fishermen. Many feel it is unreasonable to be penalized if the licensee's name has been washed off net marker bouys. Another dilemma cited is that the incidental catch of restricted species cannot be brought ashore, but cannot be released either if dead. One fisherman feels that a \$250 fine, \$1 per baited hook that exceeded his licenced limit, was exorbitant, particularly since the hooks were all legitimate, but licenced to another commercial fisherman. The problem here is that such a fine would only be a minor deterrent to a more affluent fisherman, but unusually vindictive for most.

Alleviating the Perceived Problems

The steps Lake Ontario commercial fishermen deem necessary for the improvement of the fishery are not as all-inclusive as the problems they listed previously. Most measures suggested deal with specific, immediate issues: only a few promote holistic, longer-term approaches. Many who mentioned such incremental solutions admit that they do not know the answers to all of the fishery difficulties. Inadvertently, commercial fishermen's solutions seem to encourage reactionary management which is one of their major complaints with the present government administration.

To alleviate Lake Ontario water quality problems, 37.8% (31) fishermen felt that industrial polluters should be prosecuted and their effluent curtailed. 17.1% (14) are not specific, but suggest the need to clean up pollution. Only 8.5% (7) express the need for sewage treatment, and a few feel that polluting

industries should be forced to compensate fishermen for their financial losses.

23.2% (19) advance the idea of restocking programs, for high-value, commercial species, as the most beneficial solution to fish population inadequacies. The need to diminish exotic species populations, particularly carp, is expressed by 11.0% (9), and the essentiality of reducing nuisance salmonid populations, especially Pacific salmon species, is mentioned by 9.7%(8). Most feel that the stocking of such fish should cease unless commercial harvesting is allowed. Several (6.1%) feel that salmonid quotas should be established and fishermen should pay a royalty for the privilege of harvesting these fish.

Few solutions to the Lake Ontario fishery economic problems are forwarded. 6.1% (5) admonish the government to find or develop markets for coarse fish, particularly bullheads, to increase the fishery viability.

A large proportion of the perceived solutions involve changes in government management strategies. 24.4% (20) explicitly request a reduction in the number of restrictions imposed on them and feel they should be consulted regularly on fishery policy matters. A re-examination of the acceptable contaminant standards is deemed essential by 17 (20.7%) commercial fishermen and some (4) demand government compensation for species which are banned. 9.8% (8) want the government to find overseas markets for contaminated fish. The need for greater agency cooperation and the development of a long-range plan for Lake Ontario fisheries is expressed by 12.2% (10). 8.5% (7) feel that the replacement of the present managers is a prerequisite to effective management. 3 fishermen even suggest that no management of the fishery is required at all. 8.5% (7) are also in favour of lifting salmonid restrictions and another 7 admit that they do not

know how to combat the fishery's problems. 2 fishermen are extremely pessimistic and declare that commercial fishing on Lake Ontario is a dying industry with no future.

The Commercial Fishery: Desired Directions

In the third section of the questionnaire, Lake Ontario commercial fishermen are asked to express their preference concerning various specific alternative futures and management strategies. The first preferences assessed are the species commercial fishermen consider most desirable, and whether or not attempts should be made to restore such species if necessary. The need for, and the delineation of, limitations or restrictions on the harvest are ascertained as is the necessity of payment and licensing for the use of the resource. Further, the impact of other activities in the Lake Ontario watershed on commercial fishermen is determined, and whether or not fish resources should be explicitly divided amongst user groups is ascertained. Finally, the need for, and the optimal methods of, improving communications between fishermen and managers is assessed.

The fish species held in the highest regard by most Lake Ontario commercial fishermen is the lake whitefish; followed by yellow pickerel, lake trout, yellow perch, American eel, lake herring, bullhead, and carp. Lake whitefish is ranked first by 48.7% (39) of the respondents and mentioned by 77.5% (62) overall. Its premier ranking is probably due to the species' long-standing importance in the commercial fishing industry. 4 of the 6 most desirable species are former mainstays of the industry, but have declined drastically and now represent only a small fraction of the overall harvest. 3 of these are cold-water species (Fig. 6).

Yellow perch is ranked in the top 5 species by 71.3% (57) of the respondents,

second only to lake whitefish. This popularity is expected, although stocks have flourished and recently declined in some areas, the species is the current mainstay of the fishery.

Although chosen as the most preferred species by only 10.0% (8) of the fishermen, 58.7% (47) selected American eels as a desirable species the third most frequent choice. The high ranking accorded this species is probably due to its recent rapid appreciation in value and the low investment of capital and effort required in the harvest.

An overwhelming 86.5% (64) of the respondents feel that attempts should be made to restore populations of preferred species whose numbers are presently reduced. This is much higher than the 23.2% (19) who spontaneously mentioned the need for restocking commercial species earlier.

Fish populations capable of sustaining themselves through natural reproduction are preferred to hatchery-produced fish by 93.1% (67) of the fishermen. They believe that "natural" fish are healthier and better adapted to lake conditions, taste better and are therefore more saleable, and are more economical over the long term.

By a margin of almost 2 to 1 (46:25), commercial fishermen are of the opinion that limitations are not required to ensure the survival of the Lake Ontario commercial fishery. This response is consistent with the prime perceived problem of excessive restrictions and over-enforcement mentioned previously (Table 5). Those who agree, declare that the imposed restrictions are ineffective, are an attempt by management to get rid of commercial fishermen, and are unnecessary because the industry is self-regulating.

However, immediately a contradiction occurs: 63.9% (46) agree, 36.1% (26) strongly, that there is a need to limit the number of people permitted to fish commercially in Lake Ontario. Almost all qualified this assertion by stating that the present number of individual fishing is fine and no further reduction or enlargement need occur. This qualification implies that fishermen believe overharvesting is not a factor now; was not a problem in the past; but the potential could exist in the future.

68.0% (51) commercial fishermen disagree, 50.7% (38) strongly, with the need for establishing individual catch quotas or allowances as a means of ensuring future harvests. Most feel that such a limitation is unfair to the more resourceful fishermen. 24.0% (18) agree, only 9.3% (7) strongly, that this action may be necessary at some time.

The idea of establishing total harvest limits without concurrent individual quotas is met with even greater opposition from commercial fishermen. 88.7% (63) are against such a proposal, 73.2% (52) adamantly, because the smaller fishermen feel the competition generated would force them out of business.

The need to set aside certain areas where fishing would not be permitted is not clearly established in this survey. 52.8% (37) support the creation of fish sanctuaries while 41.5% (29) do not. Those in favour believe the present sanctuaries are adequate, and those who do not, feel that areas closed will never be re-opened. They cite the whitefish sanctuary off Prince Edward County as proof.

There is a much stronger agreement (63.4%) with the need for seasonal restrictions, although there is still a large group (29.6%) of dissenters. Seasonal closures are supported to allow fish to spawn. Bay of Quinte hoop-

netters agree that the summer closure reduces conflicts with anglers.

Minimum size limits for harvestable fish are supported by most commercial fishermen. 80.0% (60) are in favour, 64% (48) strongly, of mesh size limits for gillnets. 79.1% (57) feel hoop and trapnetters should continue to return undersized fish; 69.4% (50) strongly concurred.

Although such a high percentage of fishermen feel mesh size limits are essential, the researcher neglected to ascertain what mesh sizes are felt to be the most efficacious. Only 22 individuals were polled to see which yellow perch mesh size they preferred: 7 attest that it should be reduced to $2\frac{1}{2}$ inches; 8 feel it should remain at $2\frac{5}{8}$ inches; 5 want it to be increased to $2\frac{3}{4}$ or 3 inches; and 2 express no preference. The reduced mesh size is desired primarily by Central Region and Bay of Quinte fishermen, while those who want it to be enlarged are mainly North Channel fishermen. The latter group reason the yellow perch used to be much larger 10 years ago than they are now, and the larger mesh would allow them more time to grow. Several individuals state that the Brighton fishermen employed the $2\frac{1}{2}$ inch yellow perch mesh too long resulting in the over-exploitation of local stocks. Obviously, Brighton area fishermen do not agree with this assessment and feel the local yellow perch do not achieve the size necessary to be gilled by the $2\frac{5}{8}$ inch mesh.

Less than half of the commercial fishermen surveyed could think of any fishing gear type that should be prohibited from use in Lake Ontario. However, 29.6% (24) mentioned, without provocation, their intense opposition to the use of trawls (Fig.16). Another 7.4% (6) are averse to the employment of large trapnets. The commercial fishermen feel that the utilization of such equipment, particularly trawls, "clears out everything" and gives those who

can afford such gear a great competitive edge.

In the minds of a large majority of Lake Ontario commercial fishermen (71.4%), other uses of the lake do not conflict with their fishing activities. Of the 20 (26.0%) respondents who believe conflicts exist, 18 mention that recreational users, specifically pleasure boaters and sports fishermen, have damaged nets and markers. Four also feel that provincial park beaches encroach on prime fishing territory. The general lack of non-recreational conflict responses suggests that the question construction could have been improved to attract other replies. Only 6 mentioned industrial-chemical waste disposal; 7 say polluters conflict; 3 feel there is unhealthy competition with other commercial fishermen; 2 believe sewage input and agricultural runoff affect fish viability; and 2 complain that large quantities of fish are destroyed by intakes at the Lennox Generating Station on the North Channel.

Since so few complaints were registered about other uses of Lake Ontario, even those concerning sports fishermen, 67.5% (52) of the commercial fishermen see no need to explicitly divide Lake Ontario fish resources between themselves and anglers. Most feel that the two groups do not compete for the same species. Of the 21 who believe resource allocation is necessary, 13 feel the division is best accomplished by species. Commercial fishermen are adamantly against giving priority to anglers in the densely populated areas of the lake. They argue that fish are mobile and must be followed, and that fishing is a livelihood to them and far more important than recreational pursuits. If the views of outdoor writer, John Power, accurately represent the opinions of most sports fishermen, anglers do not support the latter attitude (Fig.18).

A large proportion of the interviewees, 69.1% (47), believe people should



Outdoors
John Power

Illegal netting is big trouble for 2 fishermen

Two Niagara District commercial fishermen are in trouble — big trouble. And so are a pair of fish vendors.

Under the guise of a perch netting permit, they caught and sold vast quantities of coho, chinook, lake trout, brown trout, rainbow trout and smelt from Lake Ontario's western basin.

How many pounds? Or should we say tons?

Natural Resources' fish and wildlife supervisor Ron Howell, who is uncommonly tight-lipped about the case, admitted: "Yes, I guess tons is true over the course of a year, although the charges will involve much smaller quantities."

Thus far, the accused have been charged with taking fish during the closed season, selling prohibited species, submitting false returns and using a prohibited net (monofilament nylon). According to Howell, other charges are pending.

The ministry must be getting very tired of hearing "I told you so" from the many anglers who, upon learning the perch netting permit was being granted, accurately predicted the outcome.

Face stiff penalties

If found guilty, the charged parties could face hefty fines. In addition, if the holder of a commercial fishing licence is convicted of violating any of its terms or conditions, his license can be cancelled — permanently.

Sport fishermen will be closely watching the outcome of the October trial, waiting to see if this section of the Fish and Game Act really has teeth.

FIGURE 18

(Toronto Star, August, 1978)

be prepared to pay for the use of Lake Ontario fish resources.

94.6% (70) of the survey sample agree that commercial licence fees should be levied, albeit, mainly as a means of controlling entry into the fishery. Predictably, most find the present fees acceptable; all feel that licence charges should not be increased.

Lake Ontario fishermen vigourously oppose the taxation of commercial harvests, by a margin of 91.5% (65) to 5.6% (4). Most feel they are taxed excessively at present and do not receive an adequate return on their tax dollars.

14.9% (11) spontaneously stated they would like to see the establishment of species quotas, whereby fishermen would contribute royalties for the privilege of catching certain species, particularly those restocked at government expense such as lake trout. These people complain that incidental lake trout catches are increasing, presently being wasted, and hinder efforts to harvest other species, especially lake whitefish.

As expected from problems listed previously (Table 5), 83.1% of the fishermen surveyed are convinced that communication between managers and commercial fishermen has not been adequate. To correct this situation, 56.9% (41) think more open meetings, where all may attend, are necessary. Many expressed the belief that they are not satisfactorily represented by the local fishermen's association. 41.7% (30) want regular bulletins or newsletters issued to inform them of impending policy changes and government research findings. 27.8% (20) believe that the selection of a committee to represent them at councils with government officials is more effective than open meetings. Only 19.4% (14) favour the use of questionnaires to obtain information. 2.8% (2) suggest that representatives from all fish user groups

meet with managers so that various opinions will be assessed and incorporated in future plans. One individual feels that relations have deteriorated to the point that an intermediary, Ombudsman-like group is needed to arbitrate between government managers and commercial fishermen.

CHAPTER VI

CONCLUSIONS and RECOMMENDATIONS

Lake Ontario commercial fishermen's great dissatisfaction with government management, particularly recent management policies, concerning the Lake Ontario fishery, has been firmly established in this survey. Although the barrage of management-related complaints may have been induced by a suspicion of the interviewer and his motives, it is obvious that a large rift had developed prior to the inception of this project. The first few fishermen surveyed asked "are you doing this for the government" or "the Ministry of Natural Resources?" stating that if this was the case they would not reply, fearing repercussions on the basis of their responses.

The explanations of thesis support was usually accepted with reservation, often putting the interviewer in an uncomfortable, ethical dilemma, especially since the Ministry of Natural Resources was interested in the final report. The approach seems unworkable when the monetary support for a venture is administered through the organization that is seen as the cause of the problems in the first place. The researcher admits, as well, that he lacked the background, skill, and confidence to adequately handle some difficulties that arose during the survey administration.

The basis for the current management-fishermen impasse stems from the refusal of fishermen to accept overharvesting as a factor in the deterioration of the fishery, and that continued exploitation may result in further depletions. On the west coast it has been estimated that current levels of salmon yield are about half of the levels produced in earlier years; Atlantic salmon populations are severely reduced in the east; and Great Lakes fisheries

exhibit serious reductions in yield quantity and quality. Over-exploitation emerges as a major problem for fisheries managers in all areas discussed.

The evidence implicating over-exploitation as a significant stress has always been imprecise because of the masking effect of other stresses, and has always been clearly evident only after the fact of depressed or collapsed stocks (Loftus, 1976, 17).

The great diversity of government regulations and restrictions have been imposed primarily to control harvests and protect fish stocks. Resource managers readily admit that their incremental actions, in the past, have usually been too late to prevent fish stock reductions, although they may be responsible for the preservation of remnant stocks. Therefore, the effectiveness of such measures are not obvious to commercial fishermen and serve only to frustrate them in their fishing efforts. This accounts for the general lack of faith in government research, which appears ineffective because fish populations have not recovered to their former levels. In fact, some fishermen expressed the belief that government fisheries scientists contrive fisheries problems to justify their jobs, high salaries, and budgets.

The "band-aid" approach to fish resource management, characterized by a vast array of disjointed legislation, has produced a credibility gap between commercial fishermen and resource managers that will be difficult to bridge. There is an obvious need to review and evaluate current regulations for their efficacy. That a coordinated, long-range management strategy, which considers important social and economic factors, is immediately required, has been recognized by the Ontario Ministry of Natural Resources; the Lake Ontario Fisheries Tactical Plan is in its early stage of development and implementation.

A bilateral exchange of ideas and information between managers and fishermen is requisite to the development of mutual understandings and trust, and acceptable management for the fishermen as well as the fish.

Regardless of the causes of the fishery decline, it seems absurd to continue exploiting seriously depleted fish stocks just because the fishermen absolve themselves of any responsibility for its present poor condition. The historical decline and the scarcity of high-value species is acknowledged by a large proportion of the Lake Ontario commercial fishermen. Whether or not overharvesting was a causal factor is not important; but the fact that the potential for overharvesting exists now, especially for already stressed fish populations, is fundamental. Inadvertently, commercial fishermen agree with this assessment when the majority of them feel that an upper limit to the number of individuals permitted to fish in Lake Ontario is needed. If overharvesting is not possible then there is no need to limit entry into the fishery.

A belief expressed by numerous fishermen is that harvesting controls are not required because the industry and the economics of the situation act as self-regulating safeguards. They assert that, when fish stocks decline, there is a commensurate reduction of effort concentrated on those stocks because of the greater costs involved, allowing them to recover. However, this assertion is neither verifiable nor logical when dealing with a common pool, nonindividually owned resource (Hardin and Baden, 1977).

Generally, when a commodity or resource becomes scarce its value increases. In the case of a fishery, reduced fish stocks are likely to be the most valuable and, therefore, there is little incentive to quit harvesting such species. In the past, the high investment in equipment prevents the fisherman from

reducing his effort for depleted stocks because he needed an adequate return on his invested dollar (F-PCOF, 1976, 1). Indeed, in a common property system, voluntary conservation measures are self-defeating because not all individuals would comply, even if harvesting guidelines could be agreed on. The individual who does not reduce his harvesting effort for depleted stocks gains an advantage by reaping the profits and further degrading the resource. The conscientious conserver is left empty-handed: no income, a depleted resource, and an abundance of useless equipment. The few, who do not conserve voluntarily, soon become a majority because, even if the fishery collapses, they realize that they can invest their profits elsewhere -- if they get out in time.

If the preceding scenario is doubted, then the same logic can be applied to industrial polluters of Lake Ontario. The conscientious industrialist may realize that dumping pollutants into the lake will eventually destroy it, but that voluntary pollution control or treatment is useless unless all polluters adopt the same policy. Again, the companies that comply willingly with pollution standards are at a disadvantage due to the diversion of capital into pollution abatement devices which, otherwise, could have gone into increased production (Baden, 1977, 139). Thus, it is established that, when dealing with common pool resource usage, a regulatory body is required to ensure that individual actions are consistent with public interest. Fishermen demand that polluters be prosecuted and strict regulations enforced. Therefore, they should realize the need for parallel measures in their own industry.

The problem of accountability or, more accurately, the lack of accountability of the regulatory body was cited many times by commercial fishermen. Although the necessity of regulations is apparent, the guidelines followed by

the administrations in the past have primarily been biological, with few socio-economic considerations. To overcome this problem, one individual recommended the establishment of liaison group to mediate between managers and fishermen, reducing the managers' legislative powers, and relegating government agencies to advisory roles. This step would certainly enhance and purify the meaning of "public servant", but the funding of the intermediary group is a major question. The problems of government support and the conflicts of interest that develop have already been examined. Again, this points to the need for greater public participation in the decision-making process.

Management has cited the lack of perceived value of fish resources amongst users as a significant problem. The feeling is that if something is provided for free or at negligible costs, it is usually wasted. To create value in a public resource, a tax on commercial landings was suggested so that fishermen would realize that fish are not free (LEFMP, 1976, 19). It has also been mentioned that the present commercial licence fee is too low to represent the true value of the fishery. An increase in fees and taxes are unlikely to have the desired effects however, particularly since fishermen are against such actions. Instead, such measures would likely be viewed as more unaccountable attempts by the government to eliminate them, resulting in more frustration and less cooperation. Secondly, the more an individual pays, the more he feels entitled to. Instead of increasing the perceived value of fish resources, such actions might result in intensified effort for what fishermen feel they have paid for, resulting in overexploitation.

In conclusion, mismanagement of the commercial Lake Ontario fishery is obvious. However, commercial fishermen need to realize that their views are

not the only ones of importance in a multiple-use system. The resource managers are compelled to consider and appease the desires of Lake Ontario sports fishermen who, in 1970, generated at least \$10 million in fishing-related expenditures (Cox and Straight, 1975). Whether or not their feelings are justified, anglers seem to have general distrust of commercial fishermen. Commercial fishermen who believe their livelihoods are more important than the provision of recreational opportunities are misinformed. Indeed, if the value of a resource is culturally determined, the Lake Ontario commercial fishery is insignificant and pales in comparison to the economic and social importance of other activities on and around the lake.

Finally, for any improvement to occur in present fishery conditions, it must be accepted that: commercial fishermen are not isolated from other lake activities; the government cannot be the only scapegoat; and cooperation is imperative. Moreover, public awareness is essential before the potential value of the resource is realized. A people policy for fisheries is need:

Although commercial fishing has long been a highly regulated activity in Canada, the object of regulation has, with rare exception, been protection of the renewable resources. In other words, fishing has been regulated in the interest of the fish. In the future it is to be regulated in the interest of the people who depend on the fishing industry. Implicit in the new orientation is more direct intervention by government in, controlling the use of fishery resources, from the water to the table, and also more direct participation by the people affected in the formulation and implementation of fishery policy.

(Anon., 1976)

BIBLIOGRAPHY

- Adams, G.F. and Kolenosky, D.P. 1974 -
Out of the Water: Ontario's Freshwater Fish Industry.
 Ontario Ministry of Natural Resources, 68 p.
- Aird, Wm.J. 1973. "Measurement and Perception of Bathing Water Quality".
 Unpublished M.A. thesis, University of Western Ontario, 22-23.
- Anderson, R. 1978. "The Need for Human Sciences Research in Atlantic Coast Fisheries". J. Fish. Res. Board Can. 35 (7): 1031 - 1049.
 Report No. 16.
- Alverson, D.L. and Paulik, G.J. 1973. "Objectives and Problems of Managing Aquatic Living Resources". J.Fish. Res. Board Can. 30: 1936 - 1947.
- Babbie, Earl R. 1973. Survey Research Methods.
 Belmont, Calif.: Wadsworth, 49 - 156.
- Baden, John. 1977. "A Primer for the Management of Common Pool Resources".
Managing the Commons. Edited by G. Hardin and J. Baden.
 San Francisco: W.H. Freeman, 137 - 146.
- Burton, Ian and Kates, R.W. 1964. "The Perception of Natural Hazards in Resource Management". Natural Resources Journal, III, 412 - 441.
- Burton, Ian. 1971. "The Social Role of Attitude and Perception Studies".
Perceptions and Attitudes in Resource Management. Resource Paper No.2.
 Ed.by Sewell & Burton. Ottawa: Energy Mines & Resources, 1-6.
- Christie, W.J. 1974. "Changes in the Fish Species Composition of the Great Lakes". J.Fish. Res. Board Can. 31: 827 - 854.
- Clark, C.W. 1977. "The Economics of Overexploitation".
Managing the Commons. Edited by G. Hardin and J. Baden.
 San Francisco: W.H. Freeman, 82 - 95.
- Crowe, Beryl L. (1969) 1977. "The Tragedy of the Commons Revisited".
Managing the Commons. Edited by G. Hardin and J. Baden.
 San Francisco: W.H. Freeman, 53 - 65.
- Downs, Roger M. 1970. "Geographic Space Perception: Past Approaches and Future Prospects". Progress in Geography, Vol. 2, 65 -108
- Federal-Provincial Committee for Ontario Fisheries (F-PCOF). 1976.
Federal-Provincial Strategic Planning for Ontario Fisheries: Management Strategies for the 1980's. Fourth Report. Ontario Ministry of Natural Resources and Environment Canada. Unpublished, 21 p.

- Fife, Daniel, 1977. "Killing the Goose". Managing the Commons. Edited by G. Hardin and J. Baden. San Francisco: W.H. Freeman, 76 - 81.
- Fletcher, H.F. 1977. "Toward a Relevant Science: Fisheries and Aquatic Scientific Resource Needs in Canada". J.Fish. Res. Board Can. 34 (7): 1046 - 1074.
- Frick, Harold C. 1965. "Economic Aspects of the Great Lakes Fisheries of Ontario". Fish. Res. Board Can. Bulletin No. 149, 160 p.
- Gulland, J.A. and Robinson, M.A. 1973. "Economics of Fishery Management". J.Fish. Res. Board Can. 30: 2042 - 2050.
- Hardin G. and Baden, J. 1977. "Preface: The Evolution of Cultural Norms". Managing the Commons. San Francisco: W.H. Freeman.
- Hardin, G. 1977. "Rewards of Pejorative Thinking". Managing the Commons. San Francisco: W.H. Freeman, 126 - 136.
- Hardin, G. 1977. "Denial and Disguise". Managing the Commons. San Francisco: W.H. Freeman, 45 - 52.
- Hubbs, C.L. and Lagler, K.F. 1958. Fishes of the Great Lakes Region. Ann Arbor: University of Michigan, 213 p.
- Kates, Robt. W. 1967. "The Perception of Storm Hazard on the Shores of Megalopolis". Environmental Perception and Behaviour. Dept. of Geog. Research Paper No. 109. Edited by David Lowenthal. Chicago: University of Chicago, 60 - 71.
- Kolenosky, D.P. ed. 1975. Exploratory Trawling in Lake Ontario. Ontario Ministry of Natural Resources, 23 p.
- Lake Erie Fisheries Management Plan (LEFMP): Information For Public Interest Groups. 1976. Unpublished Report, Ontario Ministry of Natural Resources, 22 p.
- Lake Ontario Fisheries Tactical Planning Committee (LOFTPC). 1978 Lake Ontario Fisheries Background Report. Ontario Ministry of Natural Resources. Unpublished, 1 - 18.
- Lambert, L. 1975. Ontario's Lake Erie Commercial Fishery - A Social and Economic Profile. Ontario Ministry of Natural Resources, 38 p.
- Larkin, P.A. and Wilimoosky, N.J. 1973. "Contemporary Methods and Future Trends in Fishery Management and Development". J.Fish. Res. Board Can. 30: 1948 - 1957.

- Loftus, K.H. 1976. "Science for Canada's Fisheries Rehabilitation Needs".
J.Fish. Res. Board Can. 33: 1822 - 1857.
- Lowenthal, David. 1966. "Assumptions Behind the Public Attitude".
Environmental Quality in a Growing Economy. Edited by Henry Jarrett.
Baltimore: Johns Hopkins. 128 - 137.
- Ontario Fishery Regulations. 1977. Ontario Ministry of Natural Resources,
178 p.
- O'Riordan, Timothy. 1971. "Towards a Strategy of Public Involvement".
Perceptions and Attitudes in Resources Management. Resource Paper
No. 2. Edited by W.R. Derrick Sewell and Ian Burton.
Ottawa: Dept. of Energy, Mines and Resources. 99 - 110.
- Regier, H.A. 1973. "Sequence of Exploitation of Stocks in Multispecies
Fisheries in the Laurentian Great Lakes".
J. Fish. Res. Board Can. 30: 1992 - 1999.
- Ridgley, J.I. 1976. Ontario Commercial Fish Industry: Statistics on
Landings, 1971 - 1975. Ontario Ministry of Natural Resources,
10 - 15.
- Rothschild, B.J. 1973. "Questions of Strategy in Fishery Management and
Development". J.Fish. Res. Board Can. 30: 2017 - 2030.
- Saarinen, Thomas Frederick. 1966. Perception of Drought Hazard on the
Great Plains. Dept. of Geog. Research Paper No. 106.
Chicago: University of Chicago, 24 - 41.
- . 1969. Perception of Environment. Commission on College
Geography Resource Paper No. 5. Washington, D.C.: Assoc. of
American Geographers, 37 p.
- . 1971. "Research Approaches and Questionnaire Design". Perceptions
and Attitudes in Resources Management. Resource Paper No. 2.
Edited by W.R. Derrick Sewell and Ian Burton. Ottawa: Dept. of Energy,
Mines and Resources, 13 - 26.
- . 1974. "Environmental Perceptions". Perspectives on Environment.
Edited by Ian R. Manners and Marvin W. Mikesell. Publication No. 13.
Washington, D.C.: Assoc. of American Geographers, 252 - 289.
- Schiff, Myra R. 1971. "The Definition of Perceptions and Attitudes".
Perceptions and Attitudes in Resources Management. Resource Paper
No. 2. Edited by W.R. Derrick, Sewell and Ian Burton. Ottawa:
Dept. of Energy, Mines and Resources, 7 - 12.
- Scott, W.B. and Crossman, E.J. 1973. "Freshwater Fishes of Canada".
Fish. Res. Board Can. Ottawa, Bulletin No. 184, 966 p.

- Scott, W.E. 1954. Freshwater Fishes of Eastern Canada.
Toronto: University of Toronto, 128 p.
- Sewell, W.R. Derrick. 1971. "Integrating Public Views in Planning and Policy Making". Perceptions and Attitudes in Resources Management. Resource Paper No. 2. Edited by W.R. Derrick Sewell and Ian Burton. Ottawa: Dept. of Energy, Mines and Resources, 125 - 132.
- Smith, Robt. Leo. 1974. Ecology and Field Biology.
2nd ed. New York: Harper and Row, 592 - 627.
- Swanson, Diane. 1971. "Public Perceptions and Resources Planning." Perceptions and Attitudes in Resources Management. Resource Paper No. 2. Edited by W.R. Derrick Sewell and Ian Burton. Ottawa: Dept. of Energy, Mines and Resources, 91 - 98.
- Thompson, P.C. 1974. "Institutional Constraints in Fisheries Management". J.Fish. Res. Board Can. 31: 1965 - 1981.
- Tuan, Yi-Fu. 1967. "Attitudes Toward Environment: Themes and Approaches". Environmental Perception and Behaviour. Dept. of Geog. Research Paper No. 109. Edited by David Lowenthal. Chicago: University of Chicago. 4 - 17.
- White, Gilbert F. 1966. "Formation and Role of Public Attitudes". Environmental Quality in a Growing Economy. Edited by Henry Jarrett. Baltimore: John Hopkins. 105 - 127.
- Whyte, Anne V.T. 1977. Guidelines for Field Studies in Environmental Perception. MAB Technical Notes 5. Paris: UNESCO. 117 p.