The Introduction of Individual Transferable Quotas to the Lake Erie Fishery

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THE INTRODUCTION OF INDIVIDUAL TRANSFERABLE QUOTAS TO THE LAKE ERIE FISHERY

by

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ABSTRACT

COWAN, E.R., and J. PAINE. 1997. The introduction of individual transferable quotas to the Lake Erie fishery. Can. Tech. Rep. Fish. Aquat. Sci. 2133: V + 36 p.

Uncontrolled access to fisheries resources has invariably led to the depletion of fish stocks and a fishing industry characterized by excess investments in fishing effort, relative to the value of the resource, and dissipated profits. The history of the Lake Erie commercial fishery in Canada follows a similar pattern. During the history of Lake Erie, both the fishing industry and the government experimented with management systems designed to protect fish stocks, incomes and investments. Destructive competition for the available harvest, habitat alterations and the introduction of exotic species, however, worked against the stable harvest of fish stocks and stability in the economic performance of the fishing industry. During the period 1960 to 1980, the condition of fish stocks and the performance of the fishing industry became so untenable to both the Government of Ontario and fishermen that a new system of management was introduced. In 1984, an individual quota system of management, allocating a share of the harvest to fishermen, based on historic production was initiated. This paper traces the history of the Lake Erie commercial fishing industry leading to the introduction of individual transferable quotas through the post implementation period of 1984 to 1993.

Keywords: Lake Erie, fishery, uncontrolled access, excess investments, dissipated profits, depleted fish stocks, destructive competition, stable harvests, economic stability.

RÉSUMÉ

COWAN, E.R. and J. PAINE 1997 The introduction of individual transferable quotas to the Lake Erie fishery. Can. Tech. Rep. Fish. Aquat. Sci. 2133: V + 36 p.

L'accès illimité aux ressources halieutques a invariablement abouti à l'épuisement des stocks de poisson et à une industrie de la pêche caractérisée par des investissements excessifs dans l'effort de pêche par rapport à la valeur de la ressource, et par des bénéfices dispersés. L'histoire de la pêche commerciale canadienne dans le lac Erié suit la même tendance. Au cours de l'évolution de cette pêche, l'industrie et le gouvernement ont essayé des systèmes de gestion concus pour protéger les stocks de poisson, les revenues et les investissements. Toutefois, une concurrence destructive pour la récolte disponible, des transformations à l'habitat et l'introduction d'espèces exotiques ont nui à la bonne exploitation des stocks de poisson et à la stabilité du rendement économique de l'industrie de la pêche. De 1960 à 1980, l'état des stocks de poisson et les résultats de l'industrie sont devenus si précaires por le gouvernenment de l'Ontario et pour les pêcheurs qu' on introdisit un nouveau système de gestion. En 1984, un système de quotas individuel, allouant une part de la récolte aux pêcheurs en fonction de leurs prises historiques fut adopté. Les présent document décrit l'histoite de la pêche commerciale dans le lac Érié, l'introduction des quotas individuels transférables et la période qui a suivi la mise en oeuvre de ce système de 1984 à 1993.

Mots-clés: Pêche dans le lac Érié; accès illimité; investissements excessifs; bénéfices dispersés; épuisement des stocks de poisson; concurrence destructive; récolte stable; stabilité économique.

THE TRAGEDY OF THE FISHERY

The economic literature on fisheries attributes many of the problems in fisheries to the management of fisheries resources as common property. Uncontrolled access, coupled with the rule of capture, forces fishermen to compete for the available harvest. As a result of this competition, there is little incentive to restrict fishing effort in the interest of conserving fish stocks because any fish left by one fisherman may be taken by another. Rather, the competition leads individual fishermen to invest in more and more equipment in the interest of catching the greatest possible share of the harvest. The net result of this competition is excessive investments in fishing effort, relative to the value of the harvest, low returns to individual fishing effort and, often, depleted fish stocks. This has been referred to as the tragedy of the commons, as the concept applies to fisheries resources (Hardin 1974).

For economically accessible fisheries, the "tragedy of the fishery" has resulted in the dissipation of the economic value of fisheries resources to the detriment of the industry and to society (Cauvin 1979). First, the fishing industry in Canada has generally been characterized by production costs which are excessive relative to the value of the harvest. As a result, fishermen often find themselves in untenable positions with investments in vessels and equipment that cannot be liquidated, and few employment opportunities that are consistent with their skills and experience. Second, as a result of excess fishing effort, and in spite of harvest control measures designed primarily to control fishing "inputs", fisheries resources are subject to depletion. Third, because fishing costs are excessive relative to the value of production, resource rents are dissipated.

The Ontario Ministry of Natural Resources (OMNR) has established a system of management from which fisheries managers in other parts of Canada can study and learn. To this end, this paper is intended to provide a history of Lake Erie to illustrate the tragedy of the fishery and to identify pressures that ultimately led to the establishment of individual transferable quotas. The main objective of the paper is to explain how the individual transferable quota system operates, including the self policing that has been undertaken by the fishing industry.

The innovations for the management of the commercial fisheries in Ontario over the past ten years place Ontario in a leadership position in the management of fisheries resources in Canada. The introduction of individual transferable quotas on Lake Erie, for example, is reported to have mitigated the "tragedy of the commons". It has contributed to the control of fishing effort and to the rationalization of the industry.

Fishermen have been provided with more security of tenure and greater stability. They are now able to enter or exit the industry more easily, much as is the case in other businesses in Canada. Fishermen have a greater degree of freedom in the allocation of resources within the commercial industry. That is, they are able to negotiate the transfer of quotas between each other. In the process, it is understood that cooperation between government and the industry has been enhanced. Enforcement costs are reported to have declined and compliance with regulations is reported to have increased.

A HISTORY OF THE LAKE ERIE FISHERY

The history of Lake Erie has been divided into three time periods which loosely correspond to the systems of management that existed during the development and evolution of the commercial fisheries on the lake. Important features of the fish stocks, the industry, the management system and the pressures that led to changes in management are described for each period.

YEARS OF EMERGENCE (1790 TO 1900)

Fish stocks and harvest

Lake herring (Coregonus artedii) was the principle native species harvested commercially prior to 1900. Other species fished commercially included lake whitefish (Coregonus clupeaformis), sauger (Stizostedion canadense), lake sturgeon (Acipenser fulvescens), walleye (Stizostedion vitreum), blue pike (Stizostedion vitreum glaucum) and yellow perch (Perca flavescens) (Baldwin and Saalfield 1976). However, the harvest of these species was generally less than that of lake herring during this period.

It is thought that exotic species such as carp (Cyprinus carpio) and alewife (Alosa pseudoharengus) may have been introduced during this period by, among other things, the construction of the Welland Canal during the 1820's and the Erie Canal during the 1840's (Frick 1965).

Fish stocks were regarded as stable during much of this period. Although markets and fishing effort were expanding, the fisheries management theory of the day did not address fishing effort as there was a belief that fish stocks in large lakes could not be over fished (Gilmour 1986). Nevertheless, the first significant decline in a species occurred in the 1890's with the decline of the lake sturgeon. To the extent that lake sturgeon is a stream spawner, the decline of the species is thought to have been attributed, primarily, to habitat damage (Harkness and Dymond 1961). Land clearing and the damming of streams and rivers for power generation and mill sites are considered as the major factors that disrupted spawning and contributed to the decline of the species.

The fishing industry

Settlers arrived on the north shore of Lake Erie in the 1790's, following the American Revolution. Initially, the settlers fished for food using hoop nets, long or trot lines and beach seines. A commercial fishery gradually emerged to serve small local markets and periodic market pulses, such as those which occurred during the war of 1812, the construction of the Welland Canal in the 1820's, the construction of the Erie Canal in the 1840's and the building of the railways in the 1850's (Prothero 1980).

Development of rail links to major cities in the United States during the 1850's provided access to new markets and allowed expanded commercialization. Both pound nets and gill nets were introduced in the 1850's. Because pound nets permitted live harvests there was a quality advantage and this gear was used for over seventy percent of the harvest. By 1872 there were 191 fishermen with average incomes of one hundred dollars (Koelz 1923, Prothero 1980).

During the late 1800's, commercial harvests on the Canadian side of Lake Erie grew from a level of one million pounds in 1875 to ten million pounds in 1899. The Canadian harvest was approximately one quarter of the total Lake Erie harvest. Lake herring represented almost one half of the harvest.

Early management

Prior to Confederation (1867), the management of Lake Erie's fisheries resources was the responsibility of Upper Canada. There were no fishery wardens. Local police enforced rules and regulations were simple (Payne 1967). The placement of hoop nets, for example, was controlled to ensure escapement for spawning and to provide fish for upstream fishermen (Gilmour 1986). There were no limits imposed on harvest volumes and, in most areas, any resident could purchase a fishing licence. It is of interest to note that exclusive rights to fish were granted in a few areas, such as Point Pelee on Lake Erie and the Fishing Islands on Lake Huron (Prothero 1980). However, open access generally prevailed.

Following Confederation, the federal government assumed responsibility for the management of Ontario's fisheries resources (Thompson 1974). In executing its responsibilities, the federal government established the Canada Department of Marine and Fisheries, developed regulations relative to the protection of fisheries and collected licence fees. Regulations included closed seasons, closed areas and restrictions on gear types and mesh size. Open access continued in the sense that anyone could purchase a licence.

The Government of Ontario challenged the federal government's assumed jurisdiction over Ontario's fisheries and in 1898 the Privy Council changed the nature of federal involvement in freshwater fisheries (Thompson 1974). Essentially, the courts determined that the federal government's legislative jurisdiction over non-tidal, freshwater fisheries was confined to the protection of fisheries resources. In this regard, the federal government could make regulations pertaining to how much fish could be harvested and what technology could be used. By virtue of it's proprietary rights over fisheries resources, the Government of Ontario could determine who could fish, what privileges would be conveyed and what fees would be paid.

The solution to the division of labour between the federal and the provincial governments was achieved by delegating the administration of federal responsibility to the Province of Ontario. Without a revision to the Constitution Act, the federal government cannot delegate responsibility for conservation and retains that responsibility today.

Pressure for change

In 1898 the Ontario Game and Fish Commission had expressed alarm at the depletion of fish stocks (Thompson 1974). The conservation movement was gaining momentum in North America during this period and there was pressure to manage resources on a sustained yield basis (Glaken 1956). By 1900 the fishery had access to large markets and relatively modern gear, including power launches and net lifters, all of which could change the scale of impact of commercial fishing on fish resources (Koelz 1926). Changing fishing technology and growing public concern over the depletion of fish stocks created pressure for change.

YEARS OF INSTABILITY (1900 TO 1960)

Fish stocks and harvest

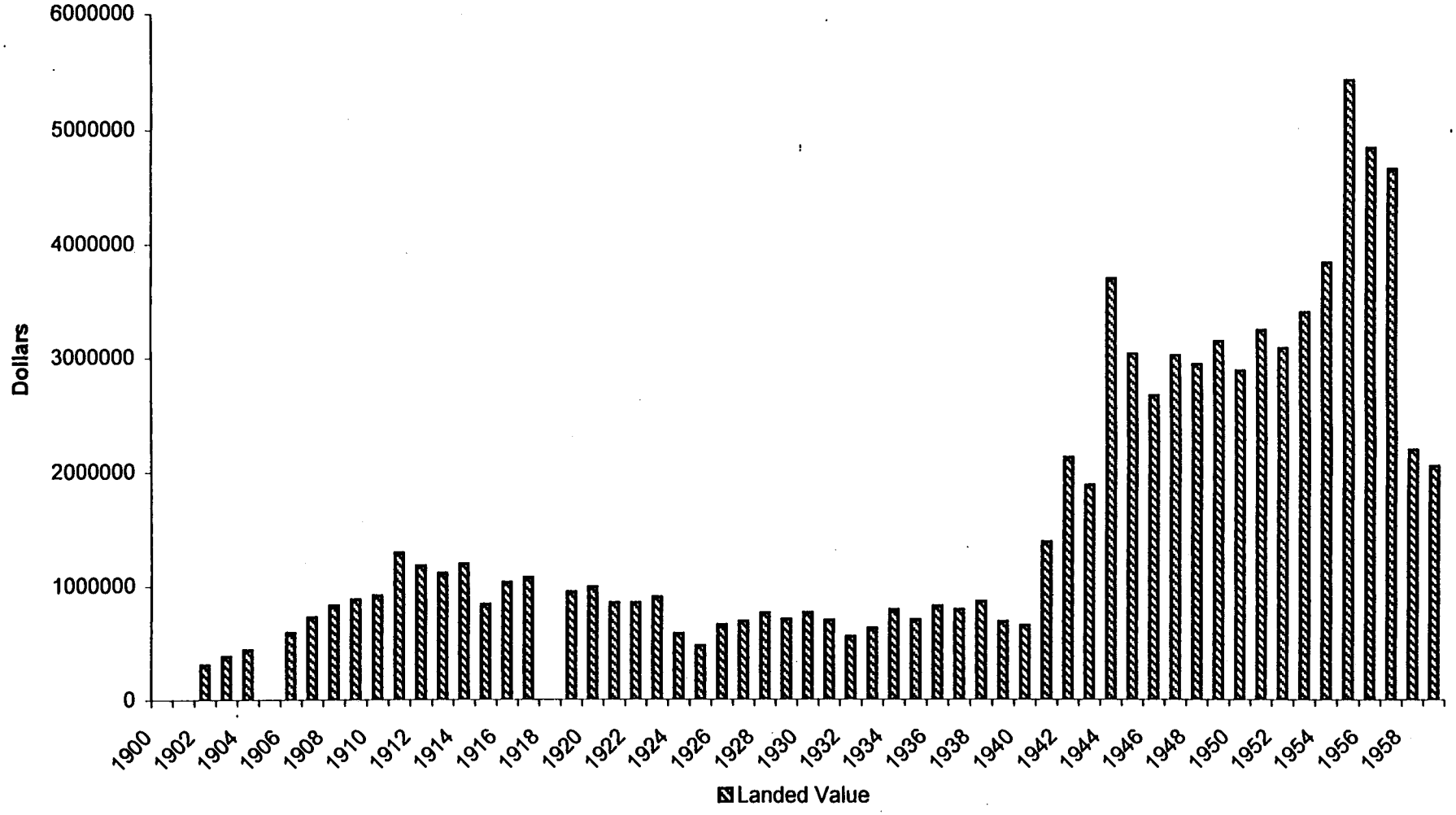
At the turn of the century, lake herring and blue pike were the predominant species harvested commercially (Figure 1). The harvest was supplemented with yellow perch, walleye, lake whitefish and sauger (Figures 1 and 2). Over the years of settlement, however, Lake Erie's watersheds were changing dramatically. Agricultural development and forestry resulted in the clearing of land which, ultimately, impacted on fish habitat. In addition, sea lamprey (Petromyzon marinus) was discovered in Lake Erie in 1921 and rainbow smelt (Osmerus mordax) appeared in 1935 (Scott and Crossman 1973).

Modification of habitat, species introduction and increased fishing effort contributed to high variability in the abundance of different species. Thus, between 1900 and 1960, the species composition of the harvest changed dramatically and frequently.

Year to year shifts in individual species were common (Figures 1 and 2). However, as one species declined, it was usual for another species to gain dominance. During the period 1900 to 1960, the harvests of commercial species became increasingly unstable after they had attained prominence in the fishery.

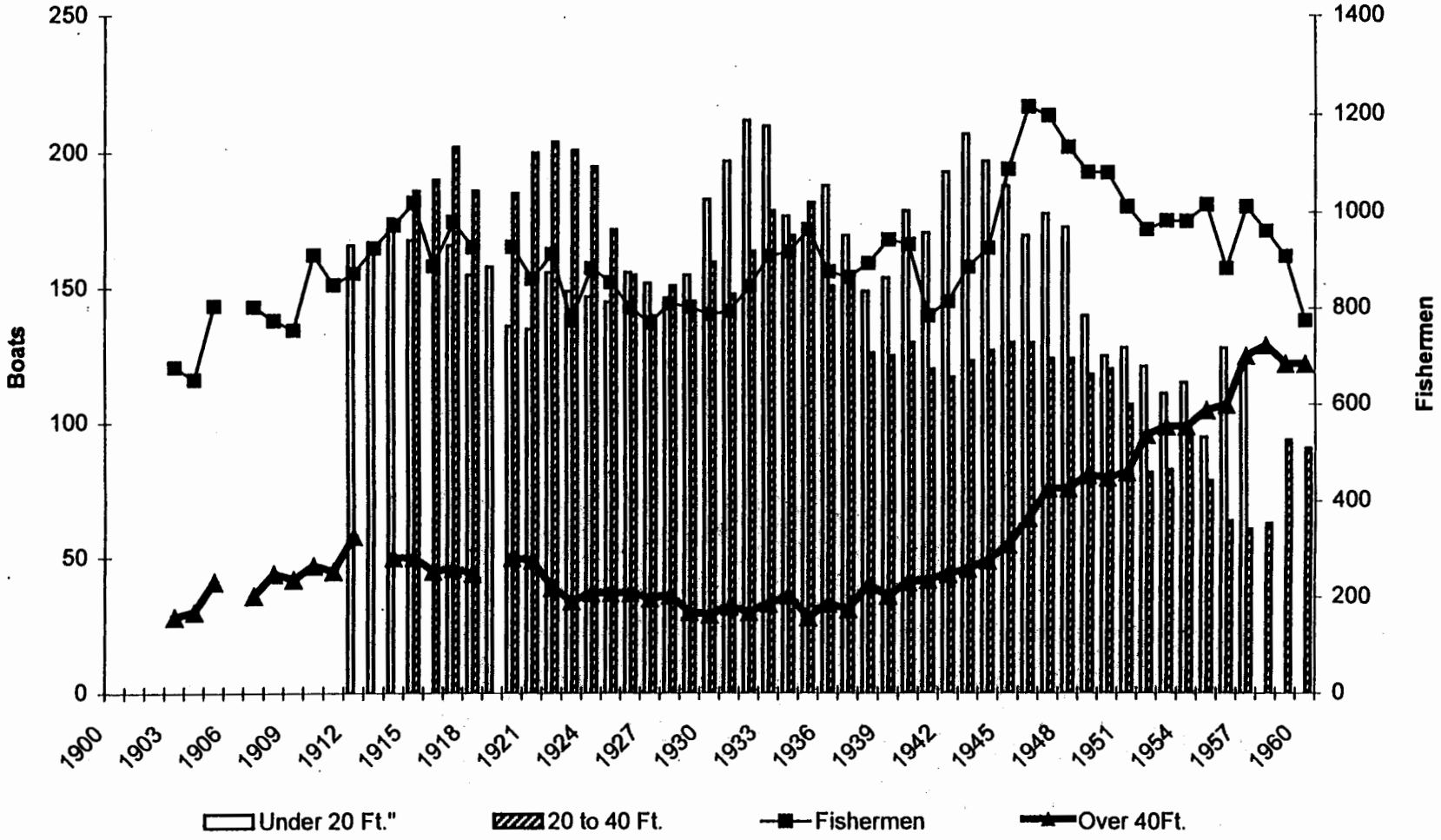
Lake herring virtually disappeared for commercial purposes in 1923. While it reappeared in the commercial harvest in the 1940's it was largely eliminated and is rarely found in the harvest today. With the decline of the lake herring, blue pike and lake whitefish represented the dominant species in the commercial harvest during the 1930's. These were supplemented by yellow perch, walleye and sauger. Sauger, however, had

Figure 1: Lake Erie landed value: 1900 to 1960



Source: Annual Statistical Reports of OMNR

Figure 2: Lake Erie vessels and employment: 1900 to 1960



Source: Annual Statistical Reports of OMNR

effectively disappeared from the harvest after 1936.

The disappearance of sauger was followed by blue pike, which was essentially eliminated from the commercial fishery by 1957. Blue pike is now regarded as an extinct species. Following the blue pike, walleye assumed a major role in the commercial harvest for a brief six year period in the early 1950's. However, walleye and lake whitefish had also virtually disappeared from the harvest by 1960. Once again, the loss of habitat, the introduction of exotic species and excessive fishing effort have variously been considered as major reasons for their decline (Hartman 1972).

By the latter part of the 1950's, only yellow perch, along with lesser volumes of white bass (Morone chrysops), remained as a major native species in the harvest. However, rainbow smelt (Osmerus mordax), an introduced species, was rapidly increasing in abundance.

The fishing industry

The Lake Erie commercial fishery grew rapidly in the early part of the century. Steam powered net lifters first appeared about 1899 (Koelz 1926). The number of pound net licences increased from 258 to 689 between 1900 and 1918. Gill net yardage expanded from 301,000 in 1900 to 1,587,000 in 1918 (Koelz 1926). The landed value of the harvest was reported to be $1.3 million in 1912, an increase of $980,000 over 1903 (Figure 3). Similarly, the number of fishermen reached a peak of 1,017 in 1915, an increase of 343 fishermen over 1903, and the number of vessels reached a peak of 424 in 1917, an increase of 82 vessels over 1903 (Figure 4). A labour shortage during World War I popularized gas fishing launches, which had appeared on Lake Erie at the turn of the century, and mechanical net lifters. These developments contributed to a further increase in fishing effort.

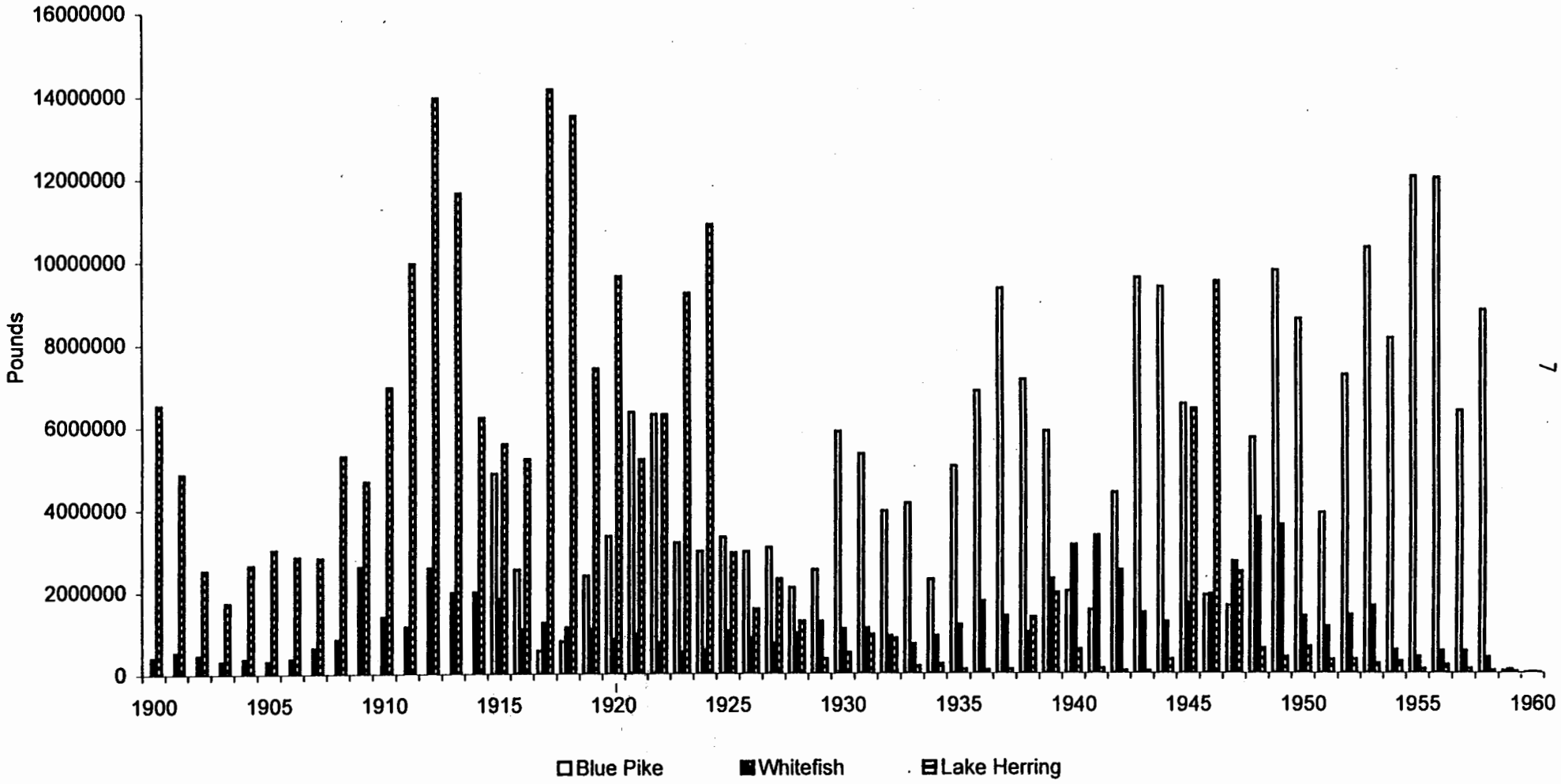
Following the First World War, the commercial fishery began to contract and in 1926 the landed value of the harvest dropped to $474,000 (Figure 3). Similarly, by 1927 the number of fishermen decreased to 769 and the total number of vessels decreased to 322 (Figure 4).Fish prices increased moderately during this period. For example, the price of blue pike increased from $.0383 per pound (US) in 1903 to $.0496 per pound (US) in 1922 (Koelz 1926). Similarly, the price of lake herring increased from $.038 per pound (US) in 1903 to $.0498 per pound (US) in 1922. Lake whitefish prices increased from $.0759 per pound (US) in 1903 to $.188 per pound (US) in 1922 (Koelz 1926). The fishery was considered to be prosperous during the 1920's.

Two forces destabilized fish stocks and incomes during the 1930's. The first was a general decline in prices as a result of the depression. In spite of low prices fishermen continued to fish as there were no alternative forms of employment. The second force was the relative efficiency of gear. Pound nets produced fresher fish, but were costly. The setting of gill nets was restricted to areas five miles or more offshore and a minimum of one mile from pound nets. However, enforcement of these requirements was difficult and, in practice, gill nets could be set anywhere and could intercept fish before they reached the pound nets (Cox 1992). These advantages promoted a further shift to gill nets, which had commenced in the 1920's. The combination of low prices and gear competition led to heavy fishing.

World War II revived the fishery, even though export markets were controlled and prices were fixed. In spite of export controls, revenues rose from $690,000 in 1940 to $1,900,000 in 1944 (Figure 3). And, while employment in the fishery declined slightly, the number of vessels increased. In 1944, for example, there were 925 fishermen compared with 933 in 1940 and the number of vessels totalled 347 in 1944 compared with 341 in 1940 (Figure 4).

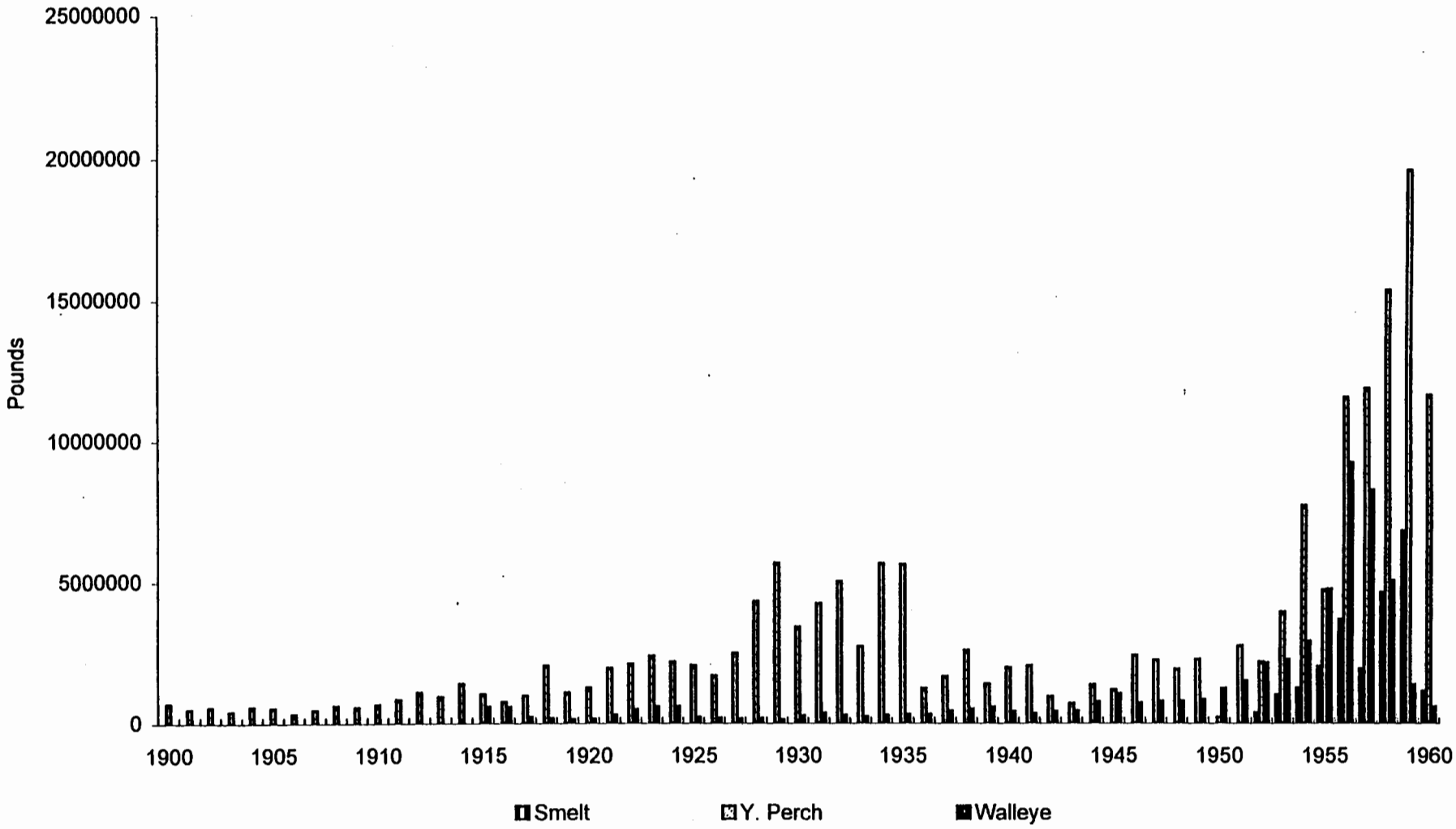
Following the war the Lake Erie fishery began expanding once more. In 1946, the number of fishermen in the Lake Erie fishery once again hit a peak of 1215, compared with the previous peak of 1017 fishermen in 1915 (Figure 4). Similarly, in 1946 the number of vessels increased to 402, the same number of vessels that

Figure 3: Lake Erie harvests of blue pike, whitefish and lake herring: 1900 to 1960



Source: Annual Statistical Reports of OMNR

Figure 4: Lake Erie harvests of walleye, smelt and yellow perch: 1900 to 1960



Source: Annual Statistical Reports of OMNR

existed in 1915. However, in 1946 there were 65 vessels over 40 feet in length compared with 50 vessels in 1915 (Figure 4).

During the 1950's, a number of commercially valuable fish stocks were in various states of decline. Lake herring had effectively disappeared after a brief recovery in 1946. Walleye, blue pike and lake whitefish stocks were in decline, leaving the yellow perch fishery and the rainbow smelt fishery, which was starting to develop in the 1950's, to sustain the commercial harvest(Hartman 1972, Leach and Nepszy 1976). With the decline of the traditional high valued species, yellow perch gained prominence in the fishery. Rainbow smelt is not indigenous to Lake Erie. This species was first reported in Lake Erie in 1935, having been introduced into the Lake Michigan watershed in 1912 (Scott and Crossman 1973). Rainbow smelt was a low valued species, compared with the species it replaced in the harvest. The harvest of rainbow smelt required the development of different fishing and processing technology. This encouraged a shift to larger vessels for smelt and an increase in processing and freezing capacity. The change in the species composition of the catch on the lake varied from east to west. Yellow perch were common in the west end and rainbow smelt dominated the east end. In this regard, although two major commercial species remained in the lake, individual fisheries were dominated by one species.

The total volume harvested on Lake Erie increased during the 1950's. And, during this period, the industry adjusted in accordance with the new species and harvest volumes. Referring to Figures 1 and 2, it is noted that the total harvest increased, primarily, the result of increased yellow perch, walleye and smelt harvests. As U.S. fishermen did not invest to harvest smelt, the U.S. share of the total harvest fell, while Canada's share rose. The adjustment in the industry can be measured in terms of employment and in terms of vessel numbers and size. In 1951, for example, employment in the fishery returned to the levels of 1915 at 1,011 fishermen (Figure 4). The decline in employment continued during the 1950's and by 1961 there were 688 fishermen (Figure 4). Vessels over 40 feet rose from 82 in 1951 to 107 in 1961, while smaller vessels fell from 280 in 1951 to 185 in 1961(Figure 4).

Management by licence area

Following the decision of the courts on the division of responsibilities between the Government of Ontario and the Government of Canada in 1898, Ontario assumed responsibility for the management of it's fisheries resources. At the turn of the century, regulations that prevailed included:

1. Licence fees ($25.00 for gill nets, $50.00 for pound nets).

2. Area licensing, restricting licensees to waters off of their county of residence.

3. A royalty on the annual harvest volume.

4. A negotiated condition of licence specifying the amount and kind of net that could be used.

5. Seasons, gear and fish size control.

Open access continued as any Canadian could purchase a licence. Initially, the licence fees may have been high enough to deter casual fishermen. However, the restrictive effect of the fee was lost as incomes rose.

The major change in the regulation of the fishery at the turn of the century was the introduction of area licensing. Area licensing was created with the intention of reducing fishing pressure and simplifying the fisheries wardens tasks (Loblaw 1990, pers. comm.). Essentially, each fisherman was licensed for the waters off of the county in which the fisherman resided. "Roving" licences, which allowed fishing outside of waters adjacent to the county of residence, existed in the east end of Lake Erie (Cox 1992). For the most part,

however, area licensing reduced competition, between fishermen living in different counties, for the largest share of the annual harvest. That is, to the extent that fishermen were limited to a small part of the lake, each fisherman could be expected to curtail investments in fishing effort in accordance with his harvest expectations. By dividing the lake into areas, corresponding to adjacent counties, the incentive to invest was less than if the fishermen had access to the entire lake. Thus, area licensing provided some control on investments in fishing effort and reduced the tendency to over-capitalize the fishery.

A royalty system existed in Ontario from about 1904 until 1970 (Cox 1992). However, a gill net fisherman could harvest 5 tons per year for each 3,000 yards of net allowance on his licence without paying a royalty. Harvests over 5 tons per year per 3,000 yards of gill net were subject to a royalty of one quarter cents per pound. Similarly, pound net fishermen were subject to a royalty of one quarter cents per pound for harvests over 16 tons.

Fishermen negotiated the condition of their licences with the district fisheries warden. The condition of licence established the number of yards of gill net that could be set, the number and size of pound nets and trap nets (trap nets were introduced in the 1950's) that could be set, and other forms of gear that could be used. The location where the nets could be set was also negotiated.

Interestingly, if additional yardage was not granted through negotiation, fishermen could increase their fishing effort by simply buying a new licence, which was accompanied by a yardage allowance. The maximum yardage allowed on a licence was 36,000 yards. The extra net allowances permitted more fishing effort and reduced the requirement to pay a royalty (Frick 1965). That is, the extra net allowance increased the amount of harvest that was not subject to a royalty. For example, a fisherman with 15,000 yards of net could harvest 25 tons without paying a royalty. On the other hand, a fisherman with 12,000 yards of net could only harvest 20 tons before being subject to a royalty.

This management regime persisted, virtually unchanged, for almost sixty years. It persisted through two world wars, the depression, numerous and dramatic fluctuations in fish stocks and the species mix of the commercial harvest, and considerable variability in the performance of the commercial fishing industry.

Pressures for change

In spite of the fluctuating harvests and the decline in the numbers of fishermen, the system of management remained unchanged. Ontario was occupied with concerns other than the state of the fishery. During the depression there were few resources available to address fisheries problems and fishermen were allowed to make a living as best they could. Stock collapses were viewed as one more aspect of hard times. Fishery science, until the mid Twentieth Century, was quite primitive, intuitive and often quite wrong (Gilmour 1986). Especially for big lakes, there was a belief that stocks could not be over fished, that cyclical fluctuations were normal and that commercial fisheries had to adapt to the cycles. As a result, regulatory systems were static.

During World War II, the fisheries served the purpose of providing as much food as possible. After the war, the movement of labour to cities was viewed more a sign of prosperity and urbanization than as a problem in the fishery.

Following World War II, fisheries management, like many science and technological disciplines, changed. The understanding of fish stocks in relation to over fishing, habitat changes and economic factors grew. Fisheries managers were alarmed by the fluctuations and collapse of fish stocks and the shifts in the composition of the fish stocks (U.S. Bureau of Commercial Fisheries 1966). These were seen as shifts away from the natural order that should be resisted and reversed.

The transition from traditional species to reliance on a former low valued species, yellow perch, and on rainbow smelt, an exotic species, was disturbing to managers. There was a fear of further species collapses.

However, sea lamprey on the upper Great Lakes overshadowed the collapse of the Lake Erie fishery and no action was taken to change the management regime (Smith and Tibbles 1980).

YEARS OF CHANGE (1960 TO 1980)

Fish stocks and harvests

Generally, the commercial fishery has harvested a range of species over the years. However, it appears that only two or three species have been prominent in the harvest at any given time. By 1960, yellow perch and rainbow smelt dominated the commercial harvest (Figure 5). Yellow perch, a native species, was predominant in the west end of the lake. Rainbow smelt, an introduced species, was predominant in the east.

Populations of yellow perch fluctuated relatively widely over the twenty year period of 1960 to 1980 (Figure 5). In 1976, for example, the harvest of yellow perch was approximately five million pounds compared with thirty million pounds in 1969, when a strong year class was moving through the fishery.

The rainbow smelt harvest fluctuated moderately through the 1960's and early 1970's after which an increase in the harvest occurred. This increase was associated with an expansion of markets to Japan in 1976 and 1977. This market provided an opportunity for the use of small smelt, which when previously caught were sorted on board the fishing vessel and discarded (Dunlop and Paine 1983).

Walleye, which had effectively collapsed and had disappeared from the commercial harvest in 1957, remained a minor part of the catch. However, in the late 1970's, the walleye population began to recover and enter the fishery once again (Hatch et al. 1987).

The fishing industry

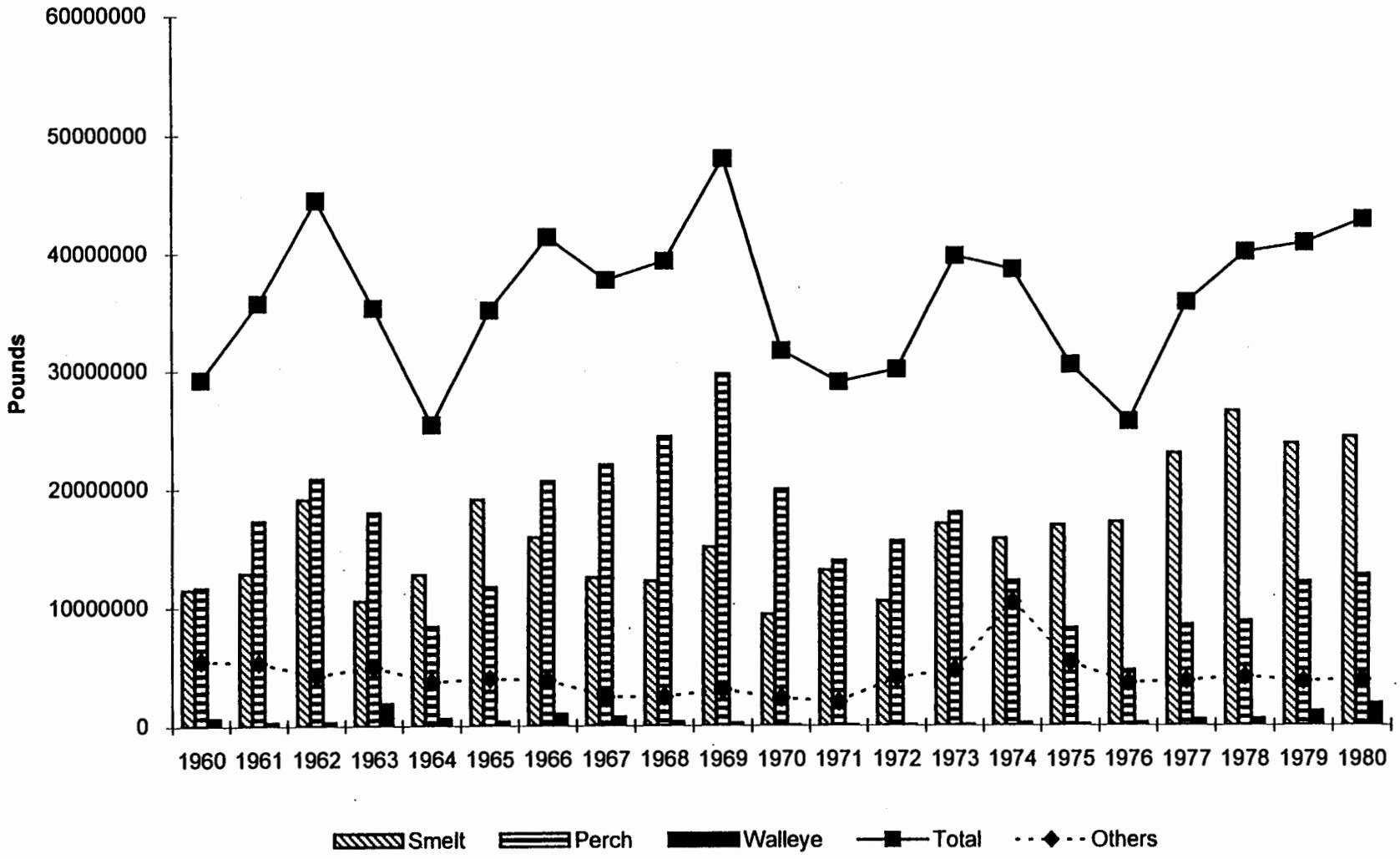
The fishing industry suffered through considerable turmoil during the period 1960 to 1980. The markets for both yellow perch and smelt were weak. The landed value of the harvest in 1960 totalled two million dollars, compared to three million dollars in 1946 (Figure 6). Income gains had virtually been eliminated. With the number of fishermen estimated at 688 in 1961, employment had declined to levels similar to those at the turn of the century (Figure 6). Cost pressures on fishermen also continued through the 1960's and became more intense in the 1970's as fuel prices and interest rates rose. Rising costs coupled with soft markets, erratic prices and fluctuating harvest volumes placed fishermen in a precarious position.

The harvesting and processing of smelt required trawls, sonar, more powerful boats and completely new processing and freezing capacity. While the total number of vessels declined during the period 1960 to 1980 (Figure 7), investments in the number of vessels over 40 feet in length increased. These investments had to be made at a time when markets were weak and incomes were low. It is interesting to note that American firms made no effort to fish or process smelt. As a result, Canadians captured all of the smelt market. To make the necessary investments in processing capacity to take advantage of the market for smelt, however, Canadian processors needed a way to reduce risk.

Changes in the management of the fishery

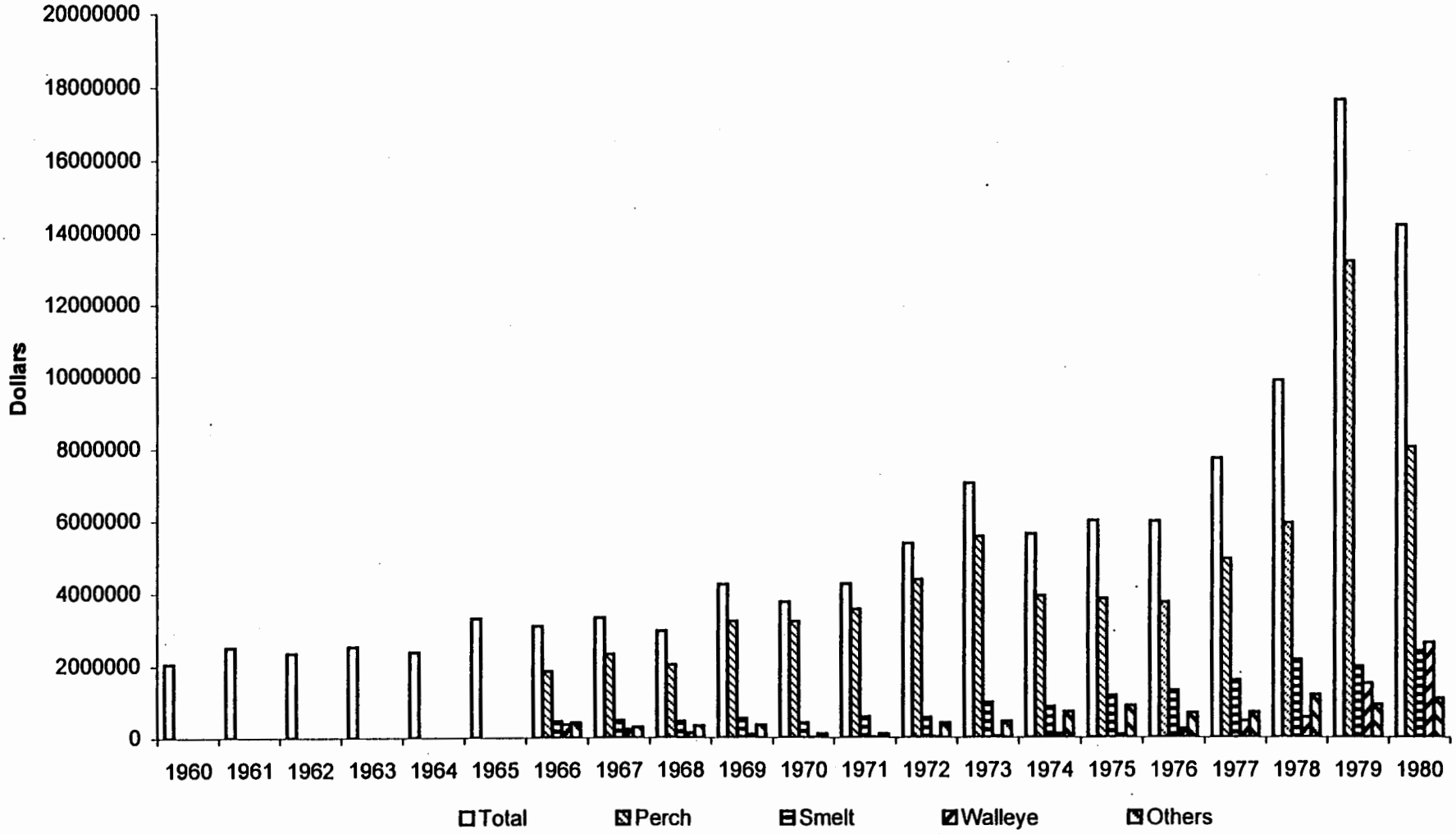
The transition in the composition of fish stocks, the weak condition of the industry, the emerging market for smelt and the requirement to reduce risk set the stage for an interesting sequence of changes in the managment of Lake Erie. These changes are considered in turn.

Figure 5: Lake Erie harvests of walleye, yellow perch and smelt: 1960 to 1980



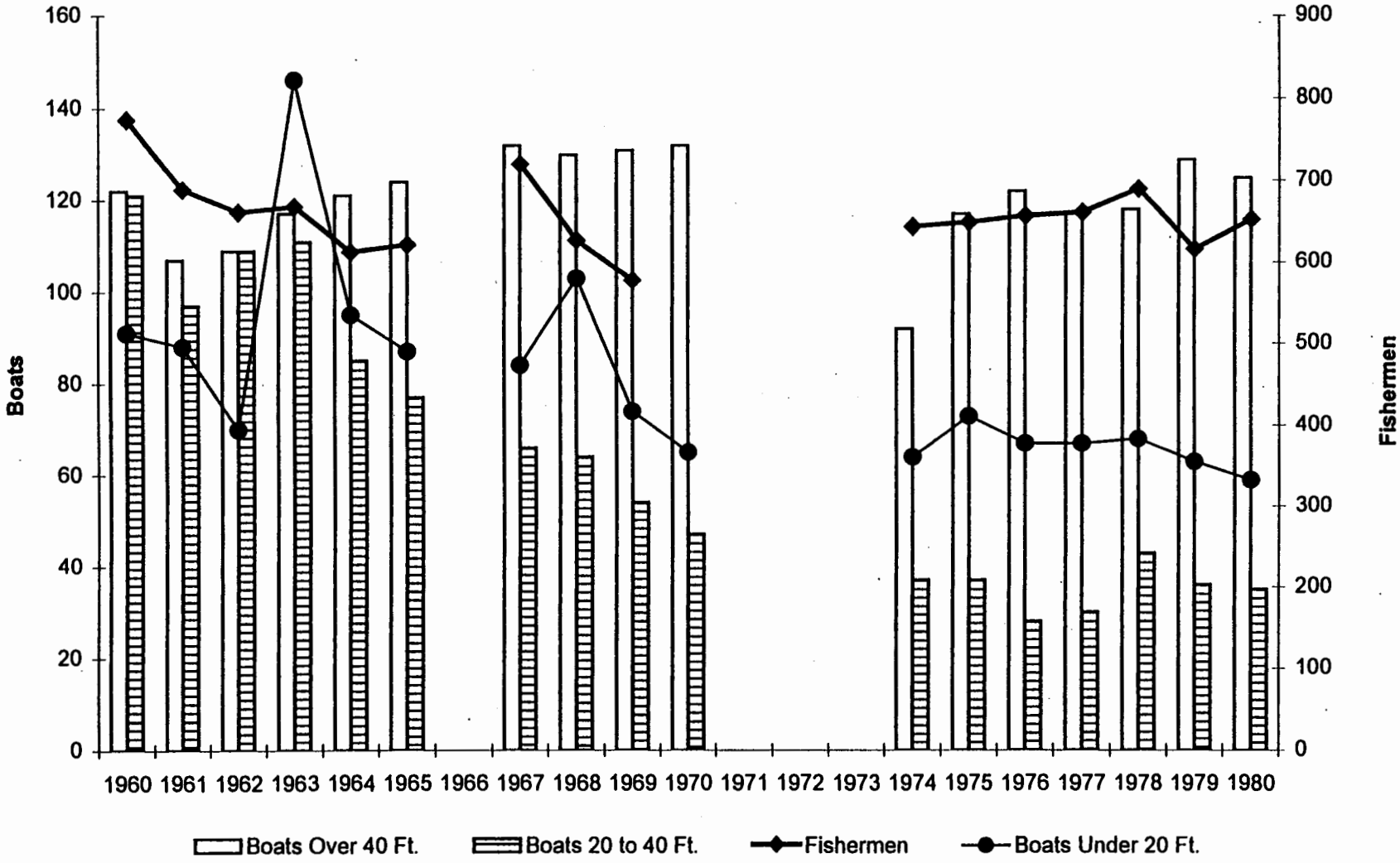
Source: Annual Statistical Reports of OMNR

Figure 6: Lake Erie landed value for walleye, yellow perch and smelt: 1960 to 1980



Source: Annual Statistical Reports of OMNR

Figure 7: Lake Erie vessels and employment: 1960 to 1980



Source: Annual Statistical Reports of OMNR

Processor quotas: Processor quotas for smelt were instituted as early as 1960 in an effort by processors to protect their new investments. Essentially, processors advised selected fishermen of how much smelt they were prepared to purchase and when they were prepared to purchase it. The quotas were, basically, determined by the capacity of the processors' plant and the extent of the market. Vessels operated by processors and vessels operated by independent fishermen were not assigned the same quotas. Processors assigned quotas to independent fishermen based on expected market shares, plant capacity, the harvest capability of their own vessels and the harvest requirement of independent fishermen. Fishermen referred to the processor quotas as "fishing with a purchase order". It is important to note that processor quotas were a short term, informal arrangement between processors and fishermen and the terms of the quotas could be altered on a day by day basis.

With the understanding that their sales could not exceed their assigned quotas, fishermen adjusted their fishing practices accordingly. As a result, the quotas made smelt fishing relatively efficient and modestly profitable for the selected fishermen. For processors, the quotas assured a supply of smelt that allowed them to make the best use of their plants, control costs and maintain a stable market share. During the period 1960 to 1974 smelt prices ranged from six to twelve cents per pound (OMNR 1960 to 1975).

Processors' quotas may have inadvertently acted as a control on open access and contributed to the protection of new investments and income. Although licensed commercial fishermen were able to participate in the smelt fishery, a second prerequisite was an association with a processor willing to purchase the catch. To the extent that the market and the number of processors capable of handling smelt were limited, the number of smelt fishermen was also limited and the value of production was shared accordingly among the participants. As a result, fishermen's incomes were likely larger and more stable than they otherwise would have been.

For processors, the quotas provided a flow of raw material at agreed prices and contributed to reducing the risk of investing in smelt processing. Processor quotas limited the total harvest in an amount equal to plant capacity and the extent of the market. Thus, while processor quotas were initiated with no consideration given to the biological capacity of the resource, or to the conservation of the resource, to the extent that plant capacity was less than the sustainable yield, processor quotas provided a form of regulation on harvest volumes.

The termination of open access: Processors' quotas permitted smelt fishermen to achieve a position of relative stability. Yellow perch fishermen, however, were dependent on a limited market for a species that had previously been a low valued species. In 1963, a glut of yellow perch and food poisoning in New York, which was wrongly attributed to Lake Erie fish, caused yellow perch prices to fall to three cents per pound. At the same time, fisheries on the upper Great Lakes were suffering from the collapse of lake trout following the earlier introduction of sea lamprey (Scott and Crossman 1973). These problems prompted Ontario fishermen to petition the government for assistance. And, in 1963, at the request of fishermen, province wide, the OMNR stopped issuing new licences. This marked the end to open access management of the fishery.

The termination of open access management on Lake Erie had little effect. Fishermen had been leaving the fishery steadily since 1945. As such, regulations were not required to keep people out. Looking ahead, however, closed access ensured that those fishermen who remained would not have to share the next upturn in the fishery with everyone who wished to enter the fishery. New people could still enter the fishery by buying a fishing operation from an existing fisherman. However, closed access ensured that the number of fishing licences would not increase (Frick 1965). The expectation was that the number of fishing vessels would not increase. In 1963 there were a total of 374 vessels: 117 vessels over forty feet, 111 vessels between twenty and thirty nine feet and 146 vessels under twenty feet (Figure 7).

As of 1963, Lake Erie's fish stocks were no longer managed as common property in the sense that access was no longer open. This measure was considered to be satisfactory to the OMNR, processors and most fishermen.

Area licensing: Relaxation of residency requirements: Two events remain indelibly imprinted on the history of Lake Erie. The first was the collapse of blue pike and walleye in the late 1950's, which set the stage for the fisheries in the 1960's and 1970's. The second was the limitation placed on the fisheries in 1970 as a result of mercury contamination. Mercury contamination forced the closure of the fishery for white bass for one year and the fishery for walleye for three years. This limitation was restricted to the west half of the lake in Essex and Kent counties (Figure 8). The fishery for walleye remained closed for an additional three years for conservation reasons. These two species (walleye and white bass) represented less than two percent of the harvest in 1969.

In response to the closure, the federal government provided income support and vessel subsidies. The federal government also undertook a promotion campaign to rebuild the reputation of Lake Erie's fishery (Dodge 1990 pers. comm.). To assist fishermen affected by the closure, the OMNR relaxed the long standing residency requirement of area licensing. Prior to the mercury closure, fishermen could hold only one licence to fish Lake Erie and were permitted to fish only in that area of the lake adjacent to their residence. To circumvent the single licence and the residency requirement, fishermen began purchasing licences (e.g. inactive or small operations from existing fishermen) in the names of family members to fish in adjacent counties. This practice was reported to have occurred in the 1960's (Frazer 1994, pers. comm.). In relaxing the residency requirement, the OMNR appeared to be acknowledging an existing practice.

Notwithstanding the change of access control, the main body of Lake Erie continued to be managed according to three areas which were adopted in 1952 (Figure 8). Essex County formed one licence area. Kent County formed a second licence area and the counties of Elgin, Haldimand, Norfolk and Niagara formed a third licence area. To gain access to a licence area, fishermen were still required to purchase an existing fishing operation. However, the requirement for residency in a fisherman's respective licence area no longer held as, increasingly after 1970, any one could purchase an existing licensed fishing operation to fish in other parts of the lake.

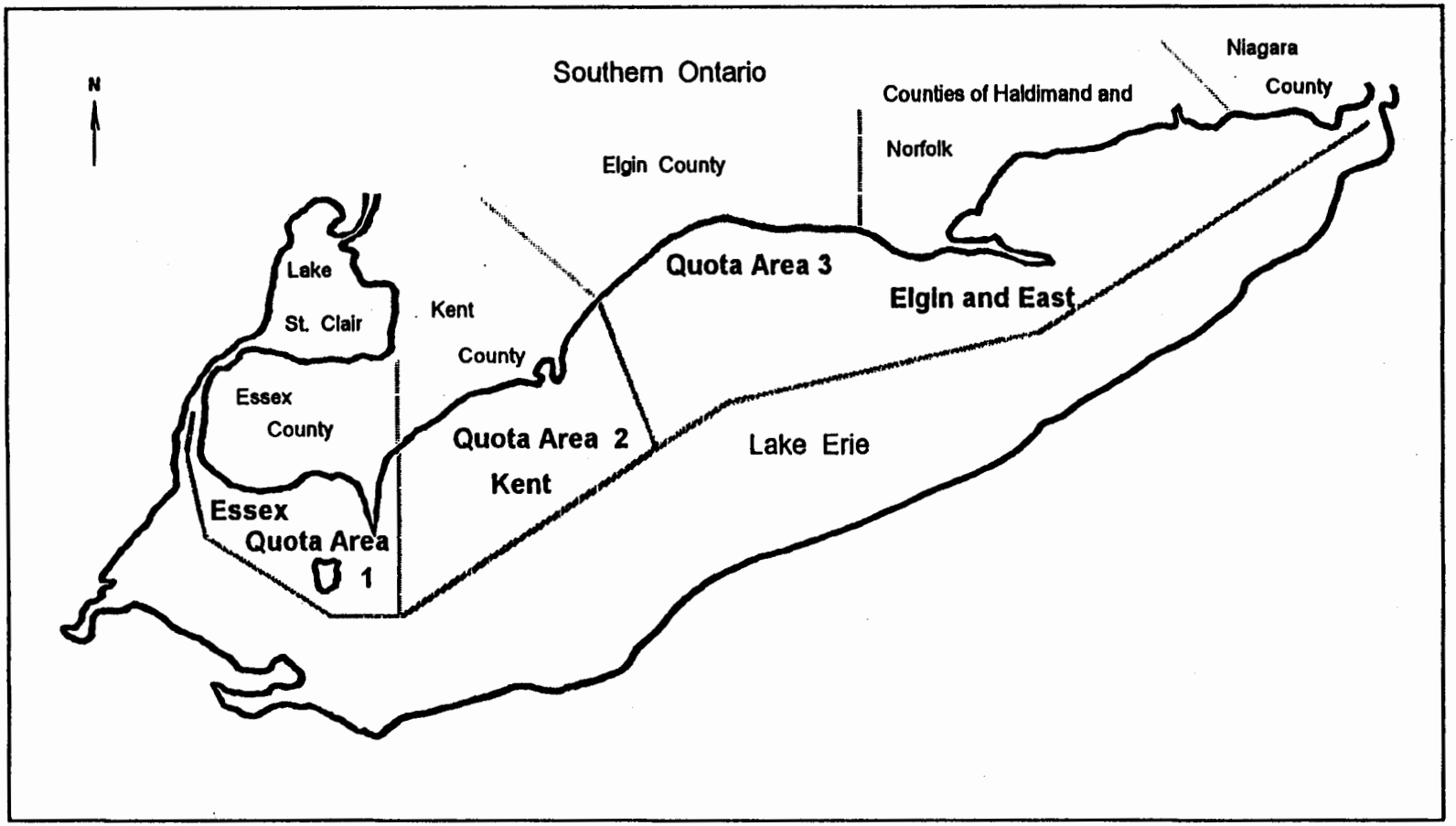
With the effective relaxation of the residency requirement for area licensing, gear restrictions, seasons and size limits were the remaining instruments available for achieving conservation goals. Processor quotas were a private device intended to ensure effective use of processing plants. Conservation benefits, if any, were an unintended side effect. They were effective only when total processing capacity was less than the sustainable yield of the fishery. However, processor quotas provided an introduction to individual quotas.

Innovations in management: Concern for the decline of yellow perch stocks, heavy fishing of smelt stocks and concern for the recovery of walleye stocks led to four management changes. These changes provided the OMNR with additional experience in the effectiveness of different management systems.

The first management innovation on Lake Erie involved the introduction of lake wide quotas for yellow perch on Lake Erie in 1968. Lake wide quotas had been in place on other Ontario lakes since 1963. Introducing yellow perch quotas on Lake Erie reflected the need for further regulations. The quotas were established in the Ontario fishing regulations and required fishermen to file weekly reports. However, the weekly reporting system was never used on Lake Erie. Rather, the monthly report of fishing by each licensee remained the vehicle for monitoring the catch. Further, the quotas were set so high that they could not be reached by commercial fishermen. As such, the Lake Erie offices of the OMNR found that there was no need to enforce the quotas.

The second management innovation applied to rainbow smelt in 1970. Although there was no lake quota for rainbow smelt, a regulation limiting the harvest of a vessel to twenty tons per week was introduced. While this had little conservation effect, it compelled a wider sharing of processor quotas than might otherwise have occurred. Plant owned vessels and independently owned vessels were limited in the volume they could harvest, so more fishermen had the opportunity to fish for rainbow smelt. This regulation promoted equity in sharing,

Figure 8 Lake Erie Quota Management Areas



Source : OMNR

not efficiency or conservation. There is no record of how many vessels were harvesting more than twenty tons per week, so it is not clear to what extent the regulation redistributed income.

The third innovation applied to walleye in 1976. Walleye stocks had collapsed by 1960, after which they became a minor component of the annual harvest. In 1970 the walleye fishery was closed initially for three years due to mercury contamination. The closure was extended for three years, however, to permit stocks to recover. In 1976, the walleye fishery was reopened in the western half of the lake. At the same time, Ontario, Michigan and Ohio agreed to a total allowable catch for those waters considered as walleye habitat in western Lake Erie. The total allowable catch or quota was shared in accordance with the proportional area of walleye habitat that occurred within the respective jurisdictions. Given Ontario's share of the quota, the OMNR further subdivided it's share of the quota between the Essex and Kent licence areas. Finally, licence area shares were allocated in equal shares to each vessel. The allocation of walleye stocks is considered to have been a prelude to the individual transferable quota system.

Finally, in 1976 strong efforts were made to enforce the minimum size limit regulation on yellow perch, a regulation that was introduced in 1965. This regulation was instigated by processors who complained that small perch were not suited to filleting machines and it was not efficient to fillet them by hand. Subsequently, "on board" size sorters were introduced by fishermen and undersized fish were dumped. The dumping of undersized fish had the effect of subverting the conservation effect of the size limit policy. Four years later, after more than 50 prosecutions a year (Harvey 1990, pers. comm.), the OMNR concluded that the extra enforcement effort was not working.

Pressures for change:

The strict enforcement of the yellow perch size limit policy created tension between fishermen and the OMNR. The OMNR felt that dumping of undersized and immature yellow perch was not in the best interest of yellow perch stocks or the fishermen in the long term.

Costs to fishermen were rising due to such factors as high interest rates and escalating fuel costs. Investments in fishing effort, the result of competition for the available stocks of fish, were considered excessive relative to the value of production. Fines and legal costs also added to the expense and frustration of fishermen. Each year, for example, almost one third of the yellow perch fishermen where charged and the fines and legal fees added to fishermen's operating costs (Harvey 1990, pers. comm.). Fishermen were also dissatisfied with the system of management, including stock assessment. This dissatisfaction did little to enhance relations with the OMNR or to promote understanding and adherence to harvest regulations.

Enforcement costs to the OMNR were also increasing and relations with the fishing industry were unsatisfactory. There was general dissatisfaction with the system of management that prevailed. The Ministry wanted to maintain fish stocks on a sustained yield basis. The current system was achieving neither sustained yield or good working relations with fishermen. These factors compelled a search for a better approach to management in an effort to rebuild relations between government and industry.

Following the internal admission by the OMNR that enforcement on the size of yellow perch was not working, talks were initiated with fishermen aimed at establishing vessel quotas for yellow perch. However, discussions of changes to the management of Lake Erie were temporarily suspended when province wide plans to change the system of management were initiated.

On the positive side, walleye stocks were becoming a success story as, commencing in 1976, stocks and harvests grew slowly but steadily (Hatch et al. 1987). It is against this background that a new management system emerged.

THE ADVENT OF INDIVIDUAL TRANSFERABLE QUOTAS

In late 1979, in response to province-wide problems and general dissatisfaction with existing management systems, the OMNR organized a committee of managers and fishermen to review fisheries management and to propose improvements. The review was province wide, not just for Lake Erie. The report, called the Modernization of Ontario's Commercial Fisheries, was released in January of 1982.

The modernization committee focused its attention on conservation issues, restoring the industry to a sound business footing and achieving cost effective enforcement. Initiatives were proposed in five areas (OMNR 1982):

1. Increased licence fees,
2. Setting royalties similar to stumpage in forestry,
3. Deregulation of fisheries management,
4. Establishing individual quotas, and
5. Self-policing.

These initiatives are discussed in turn:

LICENCE FEES:

Licence fees were not a contentious issue. There was general agreement that fees were low and that they should be high enough to cover the costs of issuing licences. Everyone agreed that a one hundred dollar licence in the 1980's was a bargain compared to a twenty five dollar fee in the 1890's.

ROYALTIES:

Although a royalty of two to four percent of landed value was suggested, the modernization plan was not specific about when or how royalties should be introduced. There was a general feeling that royalties were fair in the sense that other resource users paid royalties (e.g. timber, metal ores, etc.). In this regard, a four percent royalty on landed value would generate between $500,000 and $1,500,000 annually. However, it was not clear how the royalty would be collected or how much the collection system would cost.

The concept of a royalty drew a great deal of opposition. Fishermen argued that anglers paid nothing for access to fisheries resources and licence fees were not even being proposed for anglers. Moreover, fishermen claimed that they paid taxes that included payment for the fish. They also contended that they were suffering from high interest rates and fuel costs and even a small royalty would take a large part of fishermen's profits.

The royalty concept remained. However, implementation was deferred. It is possible that by dropping the suggestion of a royalty, opposition to individual quotas was reduced. As a result, rationalization of fisheries management was able to proceed. In the process, the opportunity to capture some of the rent from the fisheries resources of Lake Erie to offset the costs of management was foregone. A royalty system was implemented in 1994, ten years after the introduction of the quota system.

DEREGULATION: CONDITION OF LICENCE

It is probably correct to say that the fishing industry is one of the most regulated industries in Canada. In this regard, the modernization plan recommended that the fishery be de-regulated. This was a popular idea as de-regulation suggested that fishing regulations would be reduced and fishermen would have more freedom to operate. This, it was felt, would allow fishing costs to fall as was reported in other industries.

Actually, almost no de-regulation occurred. The requirement to file an annual fishing and investment report was no longer required and minimum size limits on yellow perch were dropped. In addition, limits on the yardage of net that could be set were eliminated. However, most other rules remained in place. An alternative to dependence on federal regulations was found.

Provincial fishery management agencies had expressed frustration about the time and difficulty involved in changing federal regulations for a number of years. Further, penalties under the regulations involved relatively small fines. Such fines were seen as costs of doing business by fishermen and, as such, created an incentive to increase fishing effort to cover the fines and legal fees. A better mechanism to regulate fisheries was needed. The OMNR noted that fisheries management control measures (e.g. seasons, sanctuaries, mesh size) could be imposed as conditions of licence without the need to amend federal regulations.

The rules under which the current quota management system operate are contained, to a large degree, in the conditions of fishing licence. The Ontario Fishery Regulations, made pursuant to the federal Fisheries Act, set out what may be regulated under conditions of licence. The Ontario Game and Fish Act sets the form of the licence. Essentially, the licence is a provincial instrument, under the Ontario Game and Fish Act, and the conditions of licence are a federal instrument, under the Fishery Act. Violation of the conditions of licence is a federal offence and upon conviction for an offence against the Ontario regulations, made pursuant to the federal Fisheries Act, the Ontario Game and Fish Act automatically cancels the licence after which time the licensee may apply for re-instatement of the licence. Such a penalty involves a direct loss of income. The potential loss of income is considered to be a greater deterrent than a fine and is considered to be very important in obtaining compliance with conservation measures.

In addition to the actual quota appearing in the conditions of licence, rules relating to seasons, areas where fishing can take place and the type of fishing gear are defined. The conditions of licence also include the requirement for reporting harvest on a daily basis.

Having the rules under which the fisheries operate contained within the conditions of licence has a number of benefits. For example, changing the condition of licence is more expedient than changing the regulations, made pursuant to the Fisheries Act. The flexibility gained through use of conditions of licence enables rules to be changed rapidly when the need arises. In instances when the OMNR and the fishing industry agree that a rule requires change, the ability to respond rapidly enhances the working relationship between the two groups.

THE INTRODUCTION OF INDIVIDUAL QUOTAS

The OMNR notified all fishermen by letter in 1981 of the intention to change the existing system of management and advised them to avoid making major investments for the next two years. The notice cautioned fishermen that they may not be able to recover new investments under the proposed new management system.

The modernization plan was made public in January 1982 by the Minister of Natural Resources at the annual meeting of the Ontario Fish Producers Association. By involving the Minister in the announcement, the OMNR signalled a high degree of political commitment to change. The announcement was followed by a second letter

from the Ministry to each fisherman stating the intention to implement individual quotas and repeating the caution regarding new investments. The letter also explained that there would be meetings of Ministry staff with fishermen in each district to explain the proposals.

Through 1982 and 1983, the OMNR met with fishermen to discuss the features of the quota system. The meetings were arranged jointly by the Ontario Fish Producer's Association and the Ministry. Although fishermen were interested in putting forward opposition to the idea of individual quotas, the Ministry did not discuss whether or not there should be quotas (Haxcel 1986, pers. comm.). The Minister had announced that the policy in the Modernization Plan was to have individual quotas. OMNR staff did not waiver from this position.

The allocation of quotas in Lake Erie

The meetings between 1982 and 1983 did not reach an agreement on how quotas should be allocated. In the absence of agreement, an allocation formula proposed by the OMNR was used. Starting in 1984, individual quotas would be allocated to each fisherman for selected species of fish (i.e. walleye, yellow perch, smelt, white bass, whitefish) that they had historically reported in their catch.

Quotas were based on fishermen's average harvests for the best three years during the period from 1974 to 1980. First, the three year average harvest of individual fishermen was calculated. Second, the three year average harvests of all fishermen were totalled to estimate the total average harvest. Third, given the total average harvest, each fisherman's percentage share of the total average harvest was calculated. In later years, quotas were adjusted in accordance with the allowable annual harvest and each fisherman's percentage share. This approach was called the "Provincial Formula".

The Provincial Formula penalized past under reporting and favoured those fishermen who had reported accurately. Those who reported accurately would not support a system that gave the others an advantage.

In 1986, fishermen in the western end of Lake Erie agreed among themselves and with the OMNR to a revision of the Provincial Formula. It was agreed that one third of the annual allowable harvest of yellow perch would be shared equally by all fishermen. The remaining two thirds of the yellow perch allowable harvest was subsequently allocated on the basis of the Provincial Formula. Fishermen felt that this provided a fair distribution (Harvey 1990 pers. comm., Loblaw 1990 per. comm.) Fishermen in the east end of the lake chose not to deviate from the Provincial Formula. This was also accepted by the OMNR.

The annual allowable harvest continues to be based on stock assessment, which includes past harvest data in concert with other information (e.g.catch per unit of fishing effort, age class distribution, growth rates and species composition). The implementation of the quota system in 1984 was accompanied by an improved catch reporting system which is attributed with producing improved catch and effort information. Also, in 1989, partnership assessment projects designed to monitor changes in the fish community were undertaken by the OMNR and the commercial fishing industry. As the time series data from these initiatives lengthens, the credibility of stock assessment has improved. This cooperation is considered to have enhanced the relationship between the OMNR and fishermen.

The transferability of quotas

The intent of the new management system, as recommended in the "Report of the Committee on Modernizing Ontario's Commercial Fishery", was to create an individual quota system in which the quotas were transferable. After the introduction of the quota system on Lake Erie, the concept of transferability of quota remained a topic of discussion by the fishing industry and OMNR. This discussion focussed on the interpretation and application of transferability of quota. The OMNR considered that the transfer of quota from one licence to another was a single action which was, essentially, final in nature (i.e. sale of quota). The

fishing industry wished to have the added flexibility to transfer quota on a temporary basis (i.e. lease of quota).

The OMNR did not move from their position that the transfer of quota from one licence to another was final and a distinct transaction. However, they did allow that the transfer could be reversed by a second distinct transaction which was separate from the first. In this way, the licensees remained the principals in any transfer and the OMNR would not risk becoming an active third party in the process in the event of failure. The details of any agreement between licensees wishing to transfer quota at a point in time and reversing that transfer at a later time remained the business of the licensees involved. The OMNR simply administered the transactions. In practice, this process met the intent of having each transfer a distinct and final one and at the same time allowed licensees to gain access to quota on a temporary basis.

During the initial implementation phase of the quota system in 1984, the OMNR was not supportive of the transfer of quota from one licence to another. In part, the reluctance was associated with the development of the process used to transfer quota, including the interpretations as described above. Additionally, there was a desire to provide a period of adjustment to the new system. And, the authority of the OMNR to impose the quota system was being challenged in the courts. To allow rationalization of the fishery to proceed, the OMNR permitted transfers to occur approximately one year after the implementation of the quota system. Transferability allowed fishermen to adjust the size of their operation as well as alter the mix of quota species.

Permission is required from the OMNR to transfer quota from one licence to another. Quota may be transferred only to another licence which is valid for the same quota area. The OMNR's role in the transfer of quota is primarily administrative. However, conditions surrounding the transfer are examined prior to the transfer. For example, in transferring a quota from one licence to another, the OMNR will ensure that adequate quota remained to accommodate the by-catch (i.e. the harvest of species incidental to the target, quota species) associated with the transferred species.

Quota transfers on Lake Erie are usually partial transfers, where a part of a quota is sold to a fisherman who targets a species. Once again, some quota will be retained to cover the by-catch associated with the target species. This specialization allows fishermen to concentrate their fishing effort and reduce the variety of nets they possess. Sale prices have reached as high as $250,000 for 300,000 pounds of walleye and yellow perch quotas in 1987-88 (Cicerone 1989). This suggests that resource rents are being generated and that a royalty on landed value is reasonable and valid.

Early in 1985, a concern was registered that quotas were becoming concentrated in the hands of a few fishermen. However, a review of all transfers processed in 1985 found no evidence of concentration (Bedi 1988, pers. comm.). No similar reviews have been conducted since 1985.

Dissent

Most fishermen adopted a wait and see attitude towards the implementation of the individual quota system. However, fishermen who had recently entered the fishery, had expanded investments in the fishery or, perhaps, had under reported past production were opposed. These fishermen felt that their share of the annual allowable harvest would be inadequate to cover their owning and operating costs. As all discussion had focused on non-transferable quotas, fishermen were concerned about how they could adjust the scale of their operations to cover costs. Some dissent took the form of illegal fishing in 1984. These fishermen were charged, convicted and penalties imposed.

Two fishermen challenged the quota system in court, arguing that the OMNR could not allocate fish to individuals. It was argued that the Ministry could only allocate fish stocks to groups or classes of people and that individual allocations were a form of discrimination. The Supreme Court of Ontario upheld the fishermen's claim in February of 1985. On appeal, however, the Supreme Court of Canada confirmed that

provinces own the fish and could allocate fish to individuals. Regardless, support for the case had weakened as it became apparent that Lake Erie was beginning to prosper under the individual quota system.

Appeals

In 1984, shortly after the proposal to introduce quotas was announced, the Fish and Game Licence Review Board was delegated the responsibility of forming sub-committees to hear quota appeals. The appeal boards consisted of a local member of the public who was familiar with the fishery and two employees of the OMNR, usually a senior manager and a senior fisheries biologist in the area.

Province wide, approximately one hundred fishermen appealed their quota allocation. However, no major revisions were made to the allocations, in large part, because the appeal boards did not have a reserve to adjust quotas and they were not free to reduce the quotas of other fishermen. Small increases were possible by expanding the annual allowable harvest (Haxcel 1986, pers. comm.).

The initial allocation of quotas made no assurance that the quotas would be large enough to cover the total cost of fishing. Nevertheless, twelve Lake Erie fishermen appealed for financial relief on the basis that their quotas were insufficient to make a living. Two of the fishermen were bought out by the OMNR in mid-1984. No help was offered the remaining fishermen, who were still operating three years after the quotas were introduced.

SELF POLICING AND QUOTA MONITORING

As indicated previously, neither the Lake Erie fishermen or the OMNR were satisfied with the previous management regime. Compliance with regulation was considered poor and enforcement was expensive. There was a need for change. The needed change, among other things, took the form of self policing. Self policing was proposed as part of the modernization plan as a way to establish a management system that was effective, inexpensive and equitable.

Self policing on Lake Erie involves a system of enforcement that relies on cooperation and agreement among fishermen, processors and the OMNR and provides a high degree of certainty with respect to quota compliance. Self policing contributes to the cooperation that makes the quota system workable. It also illustrates a dramatic change in attitudes on the part of the Ministry and fishermen compared to those that existed under the previous management regime.

Self policing as it relates to the quota system was made possible by the assistance of a commercial fishing industry association which involved all major fish packers and processors as well as producers operating in the western part of Lake Erie (i.e. Essex and Kent licence areas). This association, the Lake Erie Fish Packers and Processors Association (LEFPPA), was formed prior to the introduction of the individual transferable quota system. And, during the implementation of the system, it was able to represent the industry in the western part of Lake Erie with a single voice. In the absence of a comparable organization in the eastern end of Lake Erie (i.e. Elgin county and the Regional Municipalities of Haldimand-Norfolk and Niagara) self policing has not been implemented.

The OMNR and the Lake Erie Packers and Processors Association worked together to develop the self policing program, which was centred on the monitoring of the newly imposed quotas. The program was created in partnership and co-funded by the Ministry and the Association. The Association pays its share of the program through a self imposed fee based on the harvest volume. Fishermen and processors contribute equal amounts. The Lake Erie Packers and Processors Association is responsible for the coordination and delivery of the program through it's manager. Essentially, under self policing, dock-side observers who monitor and record the daily fish harvests of individual fishermen. The observers, though employed by the fishermen and

processors, are deputy conservation officers and provide evidence of infractions to the OMNR. To the extent that fishermen in the western part of Lake Erie had been introduced to an individual quota system through the allocation of equal vessel shares of the walleye harvest in 1976, the industry was well equipped to operate under a system of individual transferable quotas for a range of species.

In the eastern part of the lake, where self policing does not exist, the OMNR employs port observers who function in a manner similar to port observers employed by the Lake Erie Fish Packers and Processors Association in the west. While the degree to which compliance with the quota system is considered high in the east, the positive interaction between the OMNR and the commercial fishing industry is not considered to be at the same level as in the west where self policing exists.

The quota system requires a reliable means of monitoring the harvest of individual fishermen. As a condition of licence, fishermen must provide the OMNR with a daily record of catch for each day fished. In addition, fishermen must have all or part of their catch weighed on request. Like most things involving people, the reporting requirements work best if there is cooperation. Quota monitoring involves the following steps at the dock:

1. As they return to harbour, fishermen are required to prepare a Daily Catch Report (DCR) stating where they fished, the amount of effort used (e.g. length of net fished, size of mesh fished, hours and minutes of trawl time, etc.) and the volume of fish caught by species.

2. Generally, fishermen pack their fish in fish boxes (i.e. approximately 100 pounds) and specify the average weight per box which they have tried to attain. The port observer then weighs a sub-set of the boxes to confirm the packing weight.

3. For high volume species, fishermen pack their fish in fish totes. Totes are larger than fish boxes, are typically insulated and have lids that can be secured and sealed. Given that totes can be sealed, the weight of fish can be measured in the processing plants in the presence of a port observer or OMNR representative.

4. The Daily Catch Report is given to the port observer and it is checked for completeness and accuracy. The number of boxes or totes of fish is confirmed by on-board inspection.

5. If the sampled boxes are more than five percent off of the Daily Catch Report weight, the fish are re-packed and a more accurate estimate of the catch is made. Warnings are given if repacking is required. Warnings continue but charges do not result providing fishermen comply with the requirement to repack the days catch.

Fishermen contend that it takes time at the beginning of each season to learn to pack containers to a set weight. Some vessels carry a simple beam balance to check weights themselves. Most fishermen have learned to judge the weights of containers from experience. Errors in fish boxes and tote weights are not considered to have been a problem and there have been no complaints from fishermen about the enforcement of self policing conditions (Harvey 1990, pers. comm.). Accurate estimates of fish boxes are possible at dockside as port observers/conservation officers have portable balances. Tote weights are declared at dockside. Subsequently, accurate tote weights can be made in the plant where fork lifts and large scales are available.

The Daily Catch Report is composed of an original form and five copies. After the captain of the vessel signs the Daily Catch Report form, the port observer confirms the estimated weights, checks and signs the form. The port observer retains the original form and one copy. The original form is retained for office use and the copy is retained as an unmarked copy to be used in the event of any future legal action. The remaining four copies accompany the catch to the processor where a scale weight is obtained and price information is entered.

The processor retains one copy and forwards the remaining three copies to the OMNR, the licensee and the designate. The designate is generally the captain and the signatory of the Daily Catch Report.

Each week, in the western part of the lake that operates under self policing, the copies of the Daily Catch Report, which have been completed by the processors for the previous week, are collected and paired with the original form and audited prior to data entry. After data entry, which occurs in the same week as the forms are received from the processors, summaries are generated giving the harvest to date and the quota remaining by species for each licence. Area summaries are also produced. The summaries are available to OMNR staff and the commercial fishing industry within four days after the end of the fishing week. Current Daily Catch Report summaries are available at the port observers station, from the conservation officers and from designated representatives of the Lake Erie Fish Packers and Processors Association.

For the eastern part of the lake, Daily Catch Reports are also generated weekly. However, the time required to collect the Daily Catch Report forms from the processors, coupled with the physical distance from the data processing center at Wheatley, increases the time between the end of the fishing week and the generation of summary information to about two weeks.

It is important to note that a number of checks on the accuracy of the harvest reports are possible. For example, the estimated dock side weights can be confirmed at any point between the dock and the plant. Truck loads can be checked and plant purchases verified.

Throughout the lake, major harbour facilities that receive large volumes of fish are monitored continuously. The daily harvest of every vessel is monitored at these facilities. These harbours account for more than ninety percent of the annual harvest on Lake Erie. Certain harbour facilities, however, are utilized periodically and/or receive low volumes of fish. These facilities are not monitored continuously. Rather, fishermen utilizing these harbours are required to leave their Daily Catch Report in a special drop box. The harvest at these ports is spot checked by random visits by the port observers/conservation officers. During these spot checks, the Daily Catch Report forms, which have been deposited in the drop boxes, are checked against actual landings.

As monitoring is a condition of licence, fishermen must comply with the monitoring requirements or risk losing their licence and quota. Self policing, does not remove this risk. However, self policing gives fishermen a greater element of control in managing their affairs and in dealing with the OMNR. Self policing has the following elements that contribute to a higher degree of compliance with regulations and conditions of licence:

1. A greater element of voluntary cooperation as opposed to compulsion,

2. A higher degree of assurance that all fishermen and processors follow the same rules,

3. Public awareness that harvests are within allowable limits,

4. Reduced legal costs for fishermen and the OMNR, and

5. Reduced management costs for the OMNR.

In bringing a greater voluntary aspect to compliance, fishermen feel that they are not always under suspicion. They also feel that mistakes, unless severe, will be treated as honest mistakes rather than as illegal fishing. Self policing has introduced a greater measure of respect for fishermen. They are treated as business people rather than simply resource exploiters. Self policing has been a source of pride in the west end of the lake.

Fishermen view the system as reasonably accurate, fair and that everyone is treated equally. Records are audited to assure the OMNR of compliance. The OMNR has realized lower enforcement costs and fishermen have saved on legal bills, fines and time lost from fishing. Self policing has also resulted in a high degree of compliance without a sense of authoritarianism. The compliance component is probably a good example of cost saving. For instance, if a fisherman is suspected of some infraction, a representative of the association can discuss the situation with that fisherman, resulting in compliance without the need for an enforcement action by the OMNR. Enforcement action is the next step if self-policing is unsuccessful. All parties concerned are reported to believe that they are getting more cost effective, accurate and timely catch reports than were obtained under the previous management regime.

INDIVIDUAL TRANSFERABLE QUOTAS: AN ASSESSMENT

FISH STOCKS AND HARVEST

Throughout the history of Lake Erie, the species composition of the commercial harvest fluctuated widely. In the years immediately preceding the introduction of individual transferable quotas, fish harvests fluctuated erratically and were generally regarded to be in a precarious condition. However, entering into 1980 the harvest of smelt was escalating and walleye began to recover. This may have been very fortuitous timing for the introduction of transferable quotas. That is, the recovery of the stocks may have reduced opposition to the management system.

The harvest of smelt increased to historically high levels prior to the introduction of individual transferable quotas in 1984 (Figure 9). This period was used as a basis for setting initial smelt quotas. Subsequently, the harvest of smelt declined. The decline cannot be attributed to a single cause. The introduction of exotic species (e.g. white perch, zebra mussels, quagga mussels, etc.), superimposed on declining phosphorous loading in Lake Erie, continue to alter the Lake Erie ecosystem. In addition, predation by expanded predator population (e.g. walleye and stocked lake trout and salmon) places pressure on smelt populations. There is no suggestion that smelt quotas have been abused.

Nevertheless, quotas have been reduced to bring the harvest into balance with the productive capacity of the resource and adjustments continue in response to recent rapid changes in the Lake Erie ecosystem.

The harvest of yellow perch, the predominant remaining native species, which had declined over the latter part of the 1970's, had begun to recover when the individual quota system was introduced. Yellow perch stocks remained strong under individual transferable quotas up until 1989. The annual harvests from 1980 to 1989 have been approximately ten million pounds (Figure 9). However, yellow perch harvests have declined. The decline since 1990 is considered to be the result of reduced recruitment of yellow perch after 1986. This too may be the result of a succession of changes in the Lake Erie ecosystem and it's fish community (McGregor 1992, pers. comm.).

Walleye, which had declined radically by 1960, was recovering in the 1980's. Interestingly, the harvest of walleye was restricted between 1970 and 1975, at which time a system of individual non-transferable quotas was introduced in 1976. Since the initiation of individual transferable quotas, the harvest of walleye has been in the range of ten million pounds (Figure 9). In 1993, walleye was second in volume and first in landed value of the Lake Erie harvest.

In reviewing the status of stocks since the introduction of individual transferable quotas, the initial quotas were probably set too high for smelt. Reduced quotas and harvests continue to addressed this. For perch, individual transferable quotas allowed the strong 1984 year class to be attenuated through a number of harvest years. This contributed to harvest income strength and stability. For walleye, individual transferable quotas continued to contribute to stability.

THE FISHING INDUSTRY

The introduction of individual transferable quotas brought major changes to the fishing industry's use of fish stocks, capital and labour. In the first year of operation, yellow perch and walleye harvests increased by 2.2 million pounds in the west end of the lake (Figure 9) and dockside earnings rose from $17.7 million to $25.8 million (Figure 10). As a result, west end fishermen's revenues increased by forty five percent. This phenomenon was one of the most persuasive arguments in favour of individual transferable quotas. In the east end of the lake, the harvest of smelt fell from 43 million pounds in 1982 to 16 million pounds in 1984 (Figure 9). The reduction in the harvest was due to a reduction of smelt stocks.

Initially, the major adjustment in the industry was a reduction in employment. According to the OMNR's Annual Statistical Report, the number of crew members employed on the vessels decreased from 915 in 1983 to 714 in 1984. (Figure 11). This represents a decrease of twenty two percent. However, based on the crew sharing system employed on Lake Erie, labour incomes increased. That is, the number of fishermen decreased and incomes to the remaining fishermen increased. Adjustment in employment is continuing. In 1993 the labour force was estimated at 500 (Figure 11). This represents a downward adjustment of forty five percent since 1983.

The reduction in labour has been paralleled by a reduction in the size of the fleet. Four vessels over 40 feet in length were eliminated in the first year, reducing the fleet from 162 large vessels in 1983 to 158 large vessels in 1984 (Figure 11). In 1985, 141 vessels over 40 feet in length reported fish landings in the Daily Catch Reports (OMNR 1994). In subsequent years, more significant rationalization of the fleet took place and in 1993 a total of 113 vessels over 40 feet in length reported fish landings in the Daily Catch Reports (OMNR 1994). This represents a reduction of thirty percent in the size of the fleet over 40 feet in length between 1983 and 1993. To the extent that the annual allowable harvest can be taken with fewer vessels than currently are in operation, further adjustment in the size of the fleet is possible.

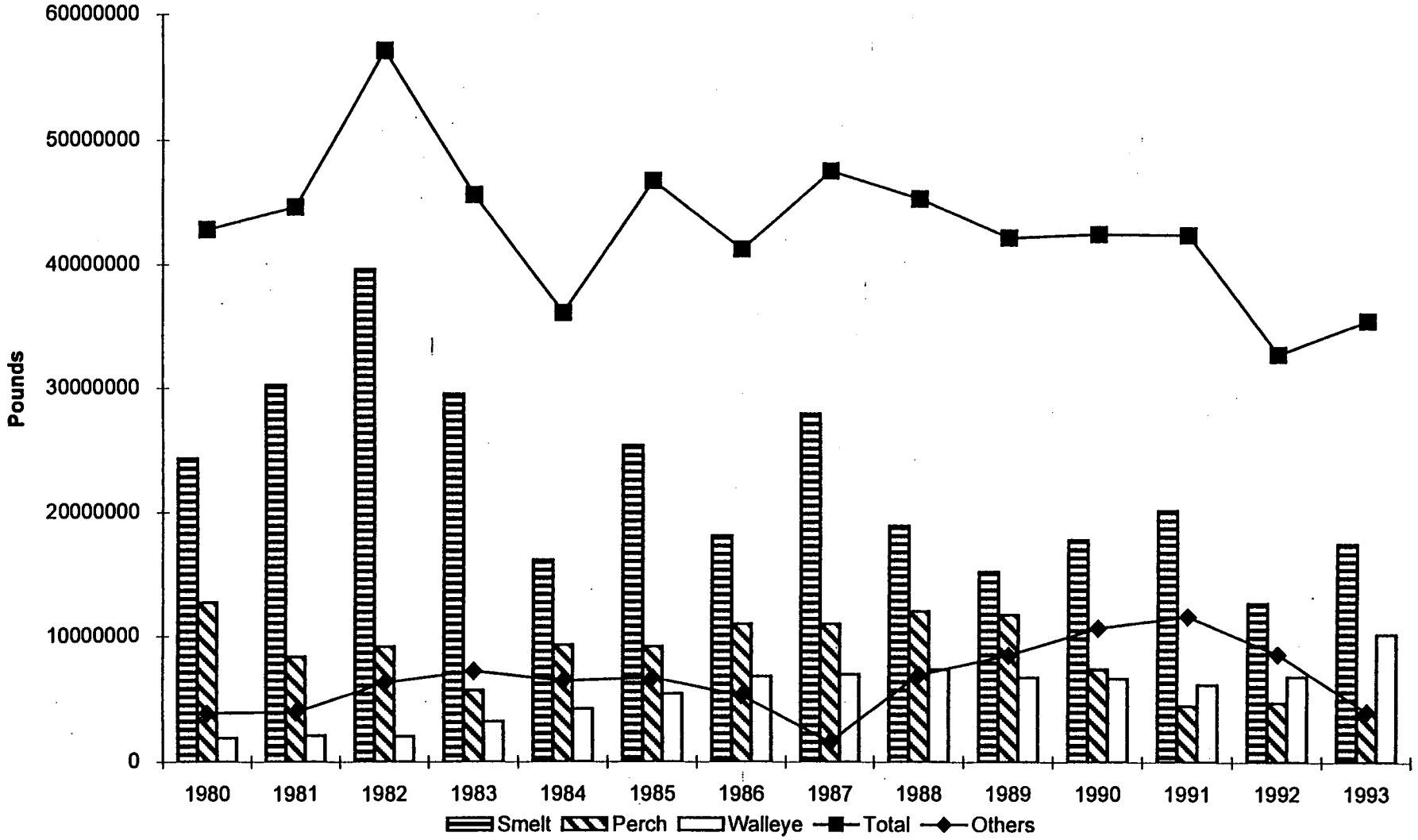
During the period 1980 to 1993, the value of the harvest grew from approximately fourteen million dollars to over twenty five million dollars in current dollars (Figure 10). During this same period, employment and the number of vessels over forty feet declined (Figure 11). To the extent that vessels and labour have been reduced, the value of the harvest has been shared by fewer vessels and fishermen. As a result, net incomes have risen. The individual transferable quota system of fisheries management permitted adjustments in the industry to accommodate cost saving initiatives and, thus, improved economic viability. The size of the fleet and the labour force, engaged in fishing is smaller than it has been for over seventy years (Figure 11). At the same time incomes are more stable and profits are higher. Individual transferable quotas provide evidence that net income can rise without an increase in the annual harvest.

To the extent that the quota adjustments may continue, it is possible that additional adjustments to the industry infrastructure will take place. Regardless of whether the quota adjustments are long term, temporary or recurring, it is apparent that fishermen must accept the risks of fluctuations in fish stocks. Individual transferable quotas, in and of themselves, will not solve the problem
of variation in fish stocks in a changing ecosystem. Fishermen's investment decisions must consider variation in harvests over time.

PROBLEMS YET TO BE RESOLVED

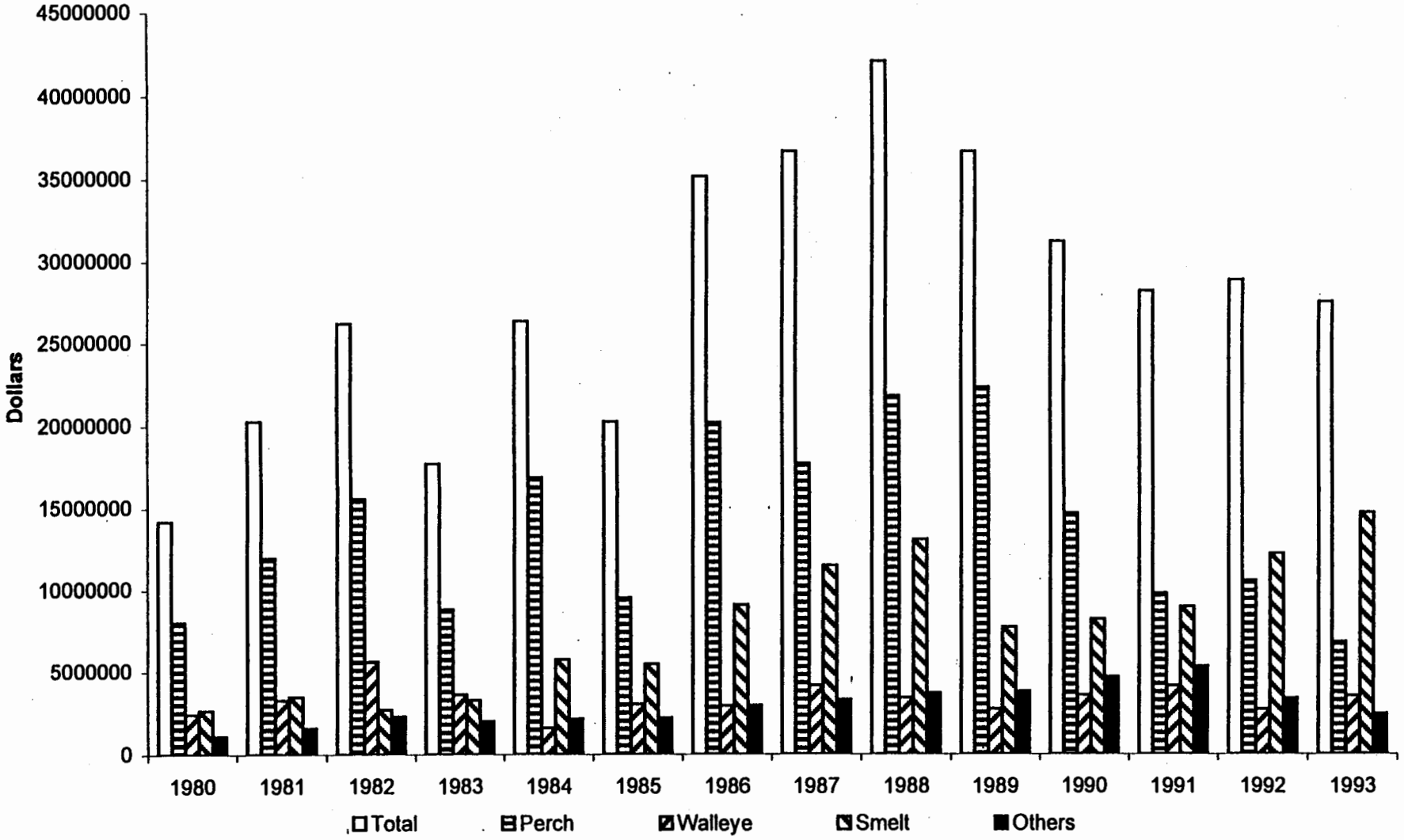
The introduction of individual transferable quotas may have solved some problems. However, unresolved problems remain. It must be stressed that these problems are not unique to the individual transferable quota system. Rather they are endemic to all management systems that attempt to control the harvest of fish. They are discussed in this report to highlight the need to resolve long standing problems and to note the advantage of individual transferable quotas over other management systems. Fishing reports, reporting of fishing effort

Figure 9: Lake Erie harvests of walleye, yellow perch and smelt: 1980 to 1993



Source: Annual Statistical Reports of OMNR

Figure 10: Lake Erie: landed value of walleye, yellow perch and smelt: 1980 to 1993



Source: Annual Statistical Reports of OMNR

and fishing locations, high grading, dumping of by-catch species and stock assessment have variously been reported as problems requiring further resolution.

FISHING REPORTS

It has been suggested that some fishermen have become processors in order to purchase fish from themselves and mislead the OMNR. This suggestion has largely
been discounted. Selling to one's own processing company does not avoid dock side
monitoring and if some small volume could be hidden in this way the extra revenue would hardly be worth the expense of investing in a processing facility or the risk of losing a licence.

It has also been suggested that fishermen use "secret sites" to land fish and avoid dock side monitoring. This suggestion has also been discounted. Fishermen are well aware of each others operations. Again, the risk of losing a licence is not considered to be worth the benefits of incorrectly reporting the harvest.

The OMNR believes that self policing produces much more accurate and verifiable reports than the monthly reports that were required prior to the advent of individual transferable quotas. In this regard, individual transferable quotas and the system of dock side monitoring is considered to be far superior than other management systems.

REPORTING OF FISHING EFFORT

A concern has been registered that some fishermen under-report the amount of net that is set to harvest their daily catch (Bedi 1988, pers. comm.). Such misreporting could bias the "catch per unit of fishing effort" data and may lead to overestimates of fish stock abundance. This, in turn, could lead to the annual allowable harvest being set at unsustainable high levels. Under reporting may benefit fishermen in the short run in terms of maintaining or increasing quotas. However, in the long run, such misreporting could result in declining fish populations. Once again, this problem, if it exists, is not unique to individual transferable quotas. On the contrary, because fishermen hold quasi-property rights in the commercial fisheries resource, they have a great deal at stake in the management of Lake Erie. As such, they are far more likely to report correctly.

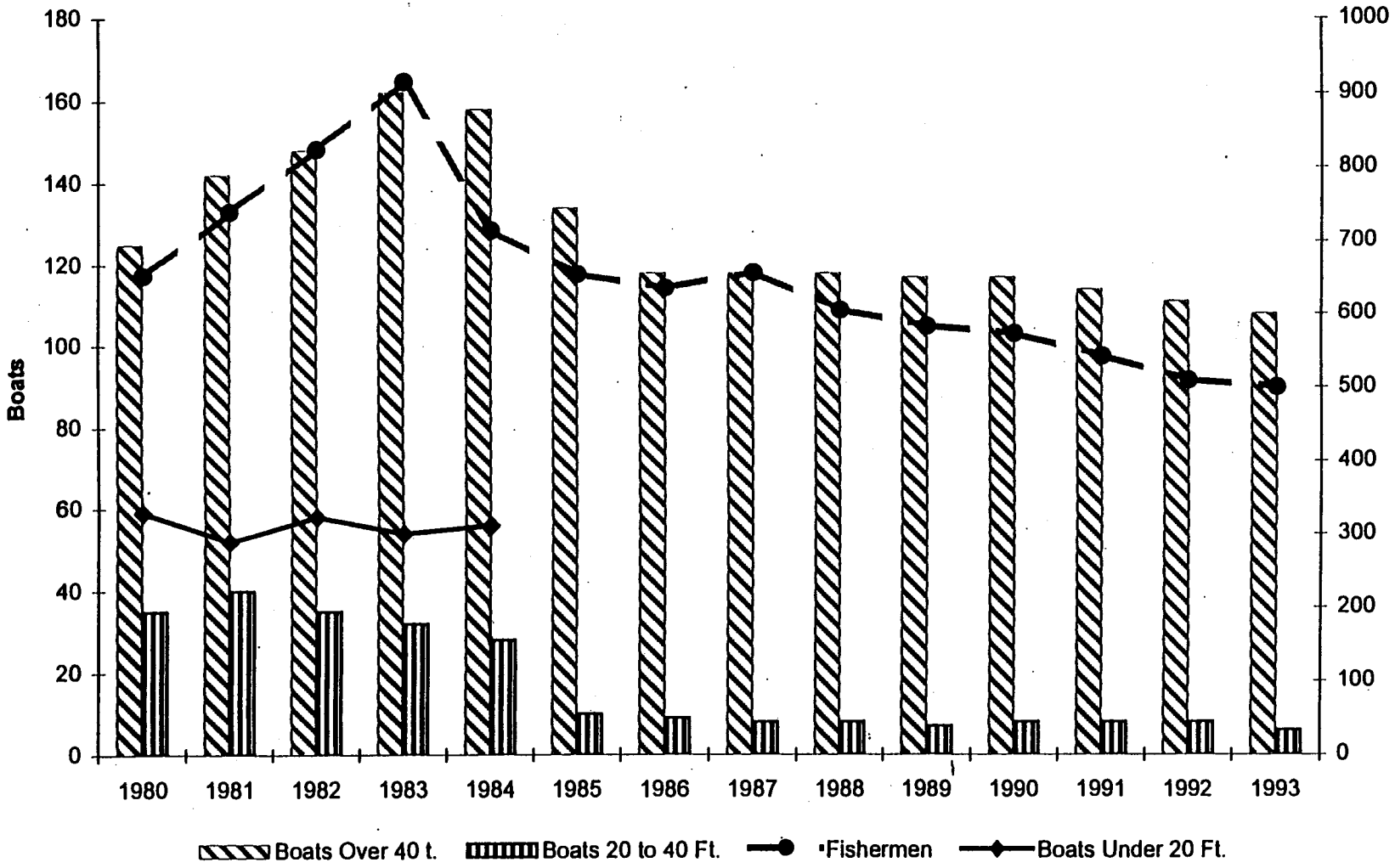
OMNR staff on Lake Erie have reason to question the accuracy of reporting fishing effort by some fishermen. However, catch per unit of effort data from the commercial fishery is only one of a number of indicators of stock abundance. Changes in abundance of major stocks on Lake Erie are corroborated by other indicators (e.g. OMNR index fishing, OMNR/Industry partnership programs).

There is also a concern as to the reporting of the location of the harvest. This practice could result in an overestimate of stock abundance in one area and an under estimate of abundance in another area. This may have a compounding effect on future quotas in the two areas. Mis-reporting the location of the harvest is considered to be an ongoing problem. However, the extent to which it occurs is difficult to quantify. Although independent indicators of stock abundance are available to provide checks on stock status derived from commercial reports, the accurate reporting of catch location is considered important by the OMNR and enforcement effort is directed at this issue routinely.

HIGH GRADING

If fishermen are certain to harvest their entire quota, there is an incentive to "dump" less valuable fish in favour of more valuable fish of the same species. Such high grading could result in an underestimation of the harvest. It could also provide biased information on the size and age classes represented in the fishery. This

Figure 11: Lake Erie vessels and employment: 1980 to 1993



Source: Annual Statistical Reports of OMNR

biasing could jeopardize future stocks and harvests in the sense that the annual allowable harvest could be in error. This, in turn, could have disastrous long term implications for fish stocks.

The problem of dumping low valued fish in favour of high valued fish of the same species has been addressed by separating quotas into sub-units by size of fish. For example, fishermen have had quotas for two categories of walleye, which are weighed and reported separately. This reduced the incentive to waste less valuable fish.

INCIDENTAL HARVEST (BY-CATCH)

By-catch refers to the incidental or unintended catch of a species. The unintentional catch of a species may lead to a catch in excess of a quota. Alternatively, by-catch may pertain to the harvest of a species not intended for commercial harvest (e.g. game fish).

By-catch is not unique to an individual transferable quota management system. However, it can be addressed under an individual transferable quotas management system. On Lake Erie, fishermen are required to turn over game fish caught as by-catch to the OMNR. Subsequently, the OMNR arranges for the disposition of the by-catch. For the incidental catch of commercial species in excess of their quota, fishermen are also required to turn the excess catch over to the OMNR for disposal. Revenue generated from the disposal of game fish caught as by-catch species is directed to general revenue. Ongoing attempts are being made to adjust the quotas of species which are encountered in the same gear to avoid this problem. This is being done with due consideration for the status of the stocks involved.

STOCK ASSESSMENT

The accuracy of stock assessment remains as important a problem for individual transferable quotas as it is for other management systems. Fishermen have more confidence in recent assessments, but the Lake Erie ecosystem continues to be subjected to changes, including the disruption caused by the introduction of exotic species and environmental changes that cannot always be predicted. Uncontrollable events that disturb the ecosystem and effect fish stock abundance could undermine confidence in the quota system, particularly if fishermen lose money investing in a quota for fish that do not materialize. This is a problem of expectations. Fish stocks, in "normal" circumstances, vary as a result of spawning success and natural predation, exclusive of human harvests. Fishermen and fishery managers may expect more stability and predictability than is possible in a fishery.

Accurate biological assessment is considered to be the linch-pin in calculating the annual allowable harvest and in establishing quotas. Given the investments in quotas, the expectations on the part of fishermen and the consequences of harvest failures, stock assessment must be accurate. Concern has been registered that, without adequate biological assessment, the individual transferable quota system cannot be considered superior to other systems of fisheries management (Henderson 1993, pers. comm.). Concern has also been registered that stock assessment is not currently adequate. There is uncertainty in establishing the allowable harvest and more emphasis must be placed on the establishment of confidence intervals around stock assessment estimates (Henderson 1993, pers. comm.).

Traditional parameters used in estimating the harvest are population abundance by age classes, growth, mortality, recruitment and fishing effort. Each of these variables should be evaluated independently in terms of uncertainty and risk (Henderson 1993, pers. comm.). Henderson emphasized that the effect of the quota on population size/mortality rate should be demonstrated.

It is agreed that accurate stock assessment is essential. However, it must be recognized that decisions are made daily with less than perfect information. In this regard, fisheries managers and fishermen must recognize the

uncertainty surrounding stock estimates and adjust their expectations to accommodate fluctuations in stocks and harvest. Regardless, in implementing the quota system, a much more reliable and accurate reporting system has been introduced. In this regard, changes in the fishery are easier to monitor than was ever possible in the pre-quota period.

SUMMARY AND CONCLUSIONS

During the history of Lake Erie, both the fishing industry and government experimented with management systems designed to protect fish stocks, incomes and investments. Destructive competition for the available harvest, habitat alterations and the introduction of exotic species, however, worked against the stable harvest of fish stocks and stability in the economic performance of the fishing industry. During the period 1960 to 1980, the integrity of fish stocks and the performance of the fishing industry became so untenable to both the Government of Ontario and fishermen that a new system of management was introduced. In 1984, an individual quota system of management, allocating a share of the harvest to fishermen, based on historic production, was initiated.

The initiation of individual transferable quotas on Lake Erie, coupled with self policing, is considered to have resulted in benefits to both the commercial fishing industry and the OMNR. The public cost of enforcement has declined. Similarly, fishermen's expenses for fisheries regulation infractions have declined. Of equal interest, there has been an improvement in the relationship and cooperation between the OMNR and the fishing industry (Harvey 1990, pers. com.).

The quota system has resulted in a larger degree of certainty and stability for fishermen in terms of planning investments and organizing fishing operations. Fishermen have defined shares of the harvest and the costs of labour and capital have been reduced commensurate with harvest shares. This is evidenced by the reduction in the size of the fleet from 162 vessels over forty feet in length in 1983 to 125 vessels in 1990 and 114 in 1993 (Figure 11). As a result, fishing operations are considered to be more viable and better able to adjust to variation in fish stocks and changes in markets and costs. Thus, the economic performance of the industry is considered to have improved.

There is a greater degree of control over the level of harvest than existed prior to the advent of the individual transferable quotas and the system of self policing. More effective control of the harvest provides the opportunity to spread out the harvest associated with strong year classes. For example, the harvest of yellow perch in the years from 1986 to 1990 (Figure 9) was greatly influenced by the 1984 year class. In the absence of an effective control of harvest, the contribution of the 1984 year class would have been concentrated in the first three years of the five year period resulting in escalated harvests and a corresponding decline in prices for yellow perch. Although the quota system is driven by the biology of the fish species, the attenuation of the harvest undoubtedly contributed to a stable supply as well as strong stable prices for yellow perch throughout the period.

Individual transferable quotas are of value in controlling the harvest. However, judging from the recent reduction in the harvest of yellow perch, it would appear that individual transferable quotas cannot be regarded as a panacea for protecting fish stocks. Obviously, individual transferable quotas cannot deal with uncontrollable events such as the disturbance of fish communities through the introduction of exotic species (Mills et al. 1993). On balance, however, individual transferable quotas have contributed to more stable perch and walleye harvests than open access and area licensing and have brought more realistic expectations to bear on smelt.

Lake Erie will likely always be subject to change in terms of fluctuations in stocks and harvests. In this regard, it is too early to judge the long term effect of individual transferable quotas on the stability of fish stocks. Any success achieved to date relating to stock stability may be undermined by changes that are

currently occurring in the Lake Erie ecosystem. However, at this point in time, it would appear that the circle has been closed on uncontrolled access and excessive fishing effort that contributed to the dissipation of fish stocks and the tragedy of the Lake Erie fishery.

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