

CANADA • Inland Waters Directorate  
Social Science Series  
# 2

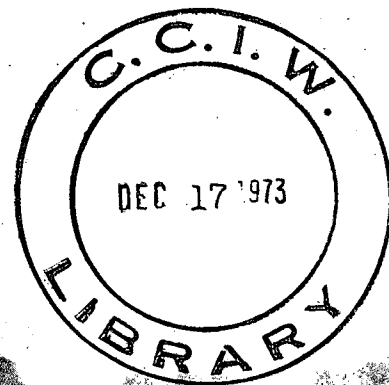


Environment  
Canada

Environnement  
Canada

## The View from Water Street

W. A. Black

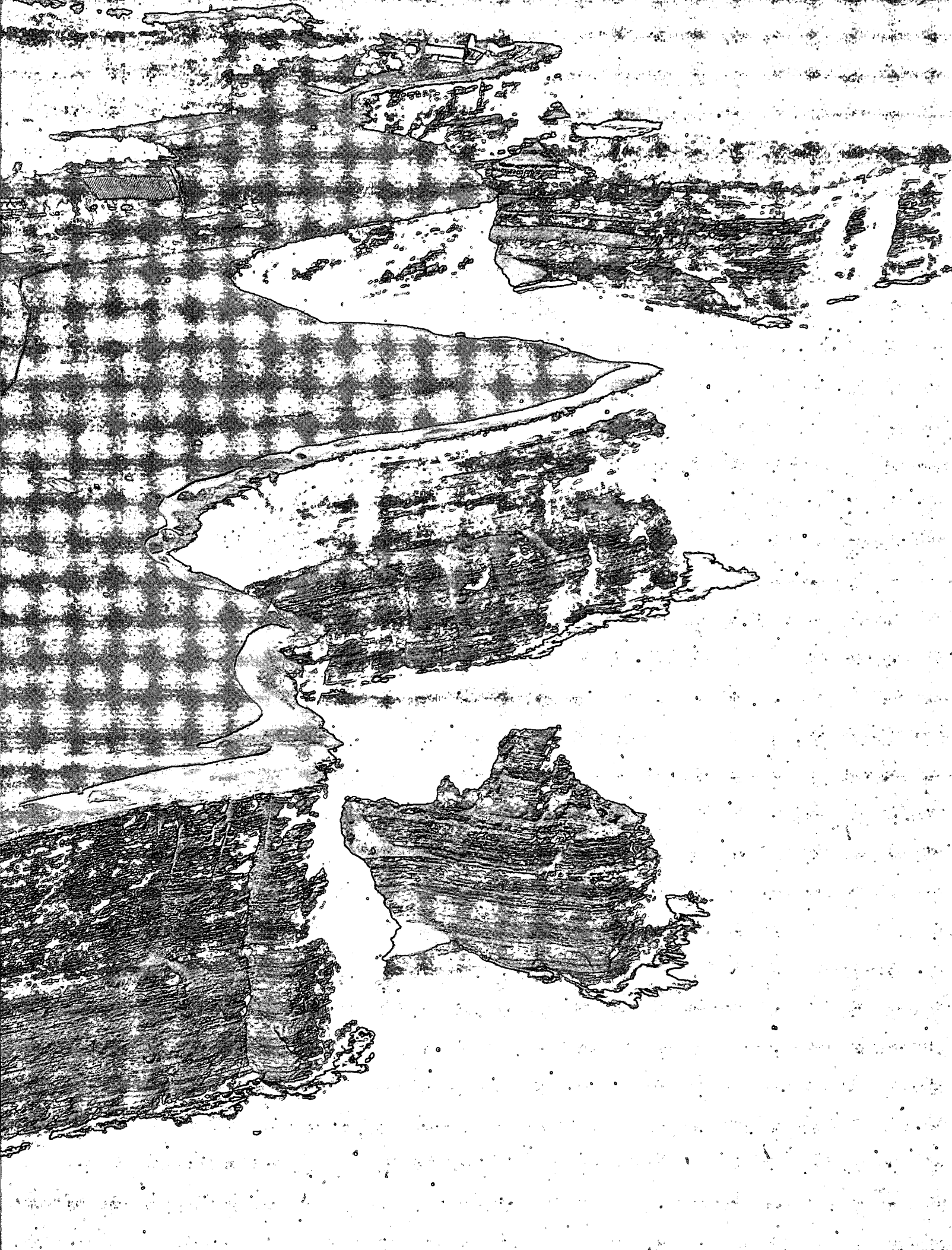


GB  
707  
C336  
no. 2  
c.1

SOCIAL SCIENCE SERIES NO. 2

(Résumé en français)

**THE VIEW FROM WATER STREET**





Environment  
Canada

Environnement  
Canada

# **The View from Water Street\***

**W. A. Black\*\***

\*Adapted from a paper published in Marine Technology Society Preprints, Marine Technology Society, 7<sup>th</sup> Annual Conference, Washington, D.C., pp. 585-599, August 16-18, 1971.

\*\*Now with Lands Directorate, Dept. of the Environment.

## **SOCIAL SCIENCE SERIES NO. 2**

*(Résumé en français)*

**INLAND WATERS DIRECTORATE,  
WATER PLANNING AND MANAGEMENT BRANCH,  
OTTAWA, CANADA, 1973.**

©  
Information Canada  
Ottawa, 1973

Cat. No.: En 36-507/2

CONTRACT #02KXKL327-3-8060  
THORN PRESS LIMITED

# Contents

iii

	Page
Abstract . . . . .	v
Résumé . . . . .	v
The Setting . . . . .	1
Creeping Deterioration of the Ecology . . . . .	2
Economic Progress Increases the Pace of Change . . . . .	9
The Basis for Environmental Concern . . . . .	14
Sea Ice – An Indicator of a Restrictive Environment . . . . .	19
The City's Role in Estuarine Contamination . . . . .	21
Can the Effects of Massive Pollutants be Measured? . . . . .	25
Polluting the Sea with Waste . . . . .	26
Purifying Microorganisms are Overburdened . . . . .	27
Economic Concern over Polluted Water . . . . .	28
Nature's Share in Environmental Destruction . . . . .	30
The Need for Coastal-Zone Planning . . . . .	31
Man's Choice – Folly or Wisdom . . . . .	36
Conclusions . . . . .	40
References . . . . .	41

Photographs on pages 3 and 18 courtesy Public Archives of Canada; all other photographs courtesy Information Canada – Photothèque.

## Abstract

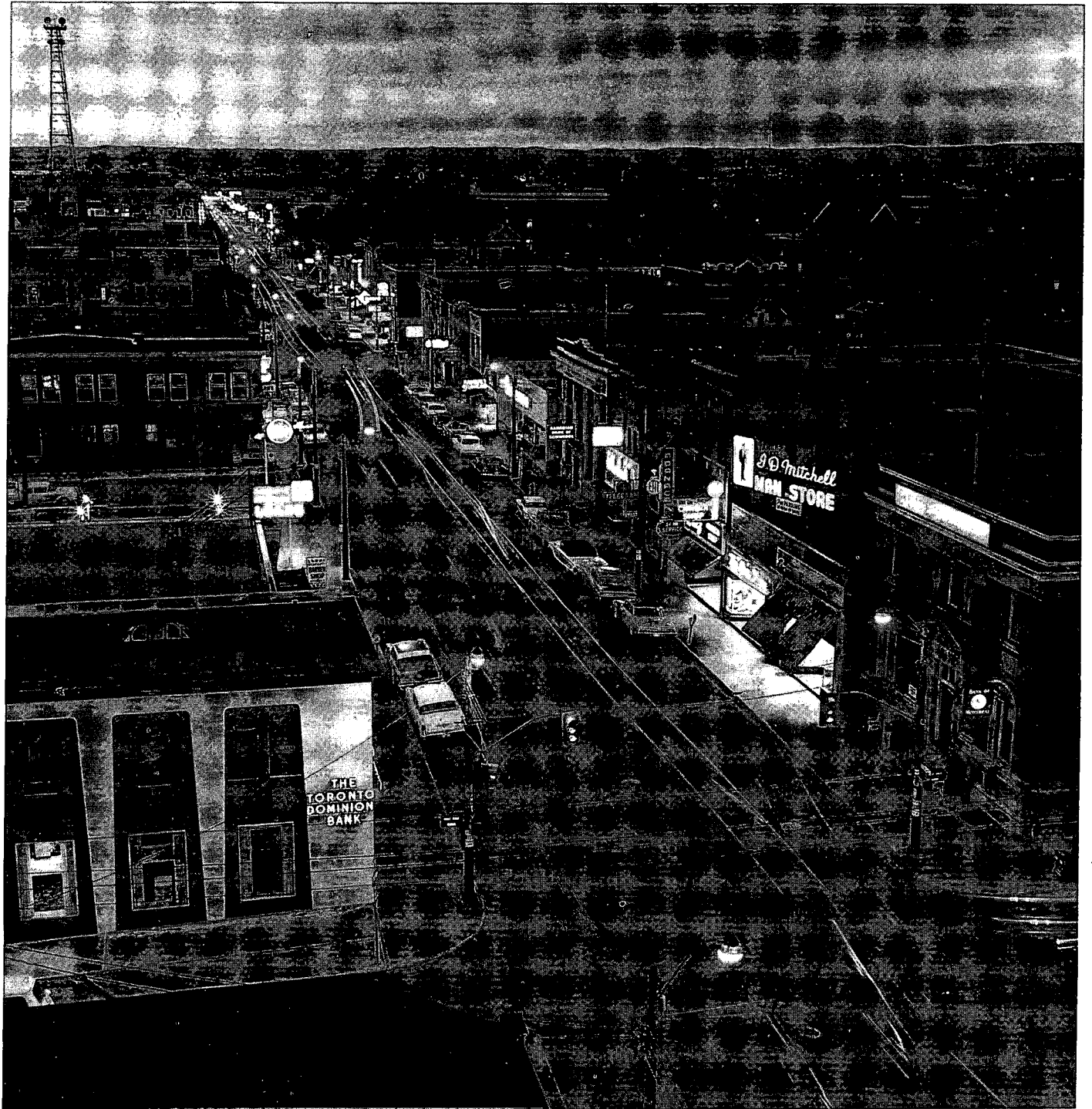
The Atlantic region provides the setting for an account of the evolution of coastal and estuarine environments. The development of the relationship of man to his environment is traced through the growth of a hypothetical city and is viewed from the vantage point of Water Street, the commercial, financial and political hub of the city and the centre of decision-making. The study outlines step by step the changes which man has brought about in his environment as he progressed from small rural beginnings to the post-industrial urban society. It traces the development of man's capacity to change his environment, the consequences of such changes and the way in which man has unwittingly been contributing to his own destruction because of the changes which he has wrought in his environment. The stability and quality of the environment and man's economic welfare are threatened or have already become seriously compromised to the point where comprehensive management of the coastal zone is now an urgent need.

## Résumé

v

La région Atlantique fournit un milieu propice pour une étude portant sur l'évolution de l'environnement dans le cas d'un littoral ou d'un estuaire. Le déroulement de l'influence de l'homme sur son environnement peut être retracé au moyen de l'histoire du développement d'une ville hypothétique. On l'aperçoit de la rue Water, le centre commercial, financier et politique de la ville, ainsi que le centre de décisions journalières. Cet historique peut démontrer, pas à pas, les changements que l'homme a apporté à son environnement, partant d'un modeste commencement rural et évoluant vers un monde urbain post-industriel. L'historique montre aussi la possibilité qu'a l'homme de modifier son environnement, les conséquences résultant de telles modifications et l'inconscience de l'homme faisant qu'il peut contribuer à sa propre destruction par les changements dont il est responsable dans son environnement. La stabilité et la qualité de l'environnement en même temps que le bien-être économique de l'homme sont menacés sinon déjà sérieusement compromis, et cela au point que des mesures administratives d'ensemble concernant la zone côtière deviennent maintenant un besoin urgent.

Interrelationships of present and past development of the estuary and coastal resources are viewed from the vantage point of Water Street, main thoroughfare of a hypothetical coast city.





It is the purpose of this paper to trace the interrelationships of the present and past development of the estuary and coastal resources, particularly those of the Atlantic region. This development is viewed through the growth of a hypothetical city and its hinterland from the vantage point of Water Street, its main thoroughfare. In the past, the emphasis has been on the exploitive use of water and land; more recently, the emphasis has been redirected towards the commercial and industrial expansion of urban and regional growth. This development has altered the natural characteristics of the hinterland and the coastal zone in ways that have severely affected the ecological and marine environments.

Since water quality is a primary consideration in future commercial and industrial use and in the location of industry (Economic Commission for Europe, 1967), the management of this resource becomes urgent. The misuse of land and water has contributed to resource exhaustion and has threatened the environment in ways of which man was often unaware. The role of water can be evaluated only within the total littoral-resource system that is slowly but persistently being altered. Because of these changes, and before further alterations involving major construction occur, there must be a clear understanding of both the socio-economic and the physical-biotic consequences to man. The pressing need to meet water-quality standards of future users and the impelling need to safeguard the biotic health of the marine environment demand environmental management procedures for estuarine and littoral resources.

In any theoretical consideration of land use, one must consider the stage of development of the people as well as the individual's motivation, interests or ambitions, and even those of the group. Thus, different people at different times use the environmental resources with differing degrees of intensity. With advancing technology and intensified occupancy

of the area, specific sites gradually reach a higher and more intensive level of use.

These changes in the growth of a city or in the use of estuarine and coastal resources are evident around the shores of the Atlantic region. In some areas, man's presence may be no more than a shack in a V-shaped cleft in a cliff where a brook tumbles into the sea; in others it is a city occupying estuarine flats with a tidal zone taken over by an infrastructure indicative of marine commercial activities. Characteristics of the city's function emphasize the importance of the sea to the city's growth, to its hinterland, and to the surrounding regional economy. In the process of this development, estuarine environmental quality has been greatly affected because of a near-total, though unconscious, disregard of the resource needs of succeeding generations.

To meet the demands and requirements of increasing social and economic activity, the natural qualities of both the water and the land have been altered (Cronin, 1967).<sup>1</sup> Alterations have been brought about through dredging, deepening, filling and construction operations in the harbour; industrial and domestic wastes are discharged into the bay; structures and facilities erected around the shore affect the quality of the water and land, urban neighbourhoods, and the future use of littoral resources.

Environmental quality and space are primary parameters which affect the uses of basic resources; environmental quality is particularly important for fishing, recreation, farming and residential purposes, whereas space, location and adjacency to markets are of critical concern for the industrial and commercial developer. The littoral as an economic asset varies with the different owners and users of the resources; it is in competition with other resources for decisive

---

<sup>1</sup>This publication contains an extensive bibliography.

## Creeping Deterioration of the Ecology

action and capital outlay. For thinking people, environmental deterioration, in terms of aesthetic values, is one of the most critical problems; it is one of the most difficult to measure in financial terms.

Because man has reached the stage where he is in a position to alter his environment drastically, it is urgent that he develop an understanding of the economic exploitation of the ecological and marine environment, the role of bacterial and chemical processes on marine resources, and the linkages in the food chain between marine microorganisms and man.

Such an understanding must provide a concept of humility about man's place in the life-structure of the environment; it must assist him to develop environmental management techniques in keeping with a wise and judicious use of marine resources. People must change their attitude from a dominating laissez-faire use of environmental resources to a concept of environmental stewardship.

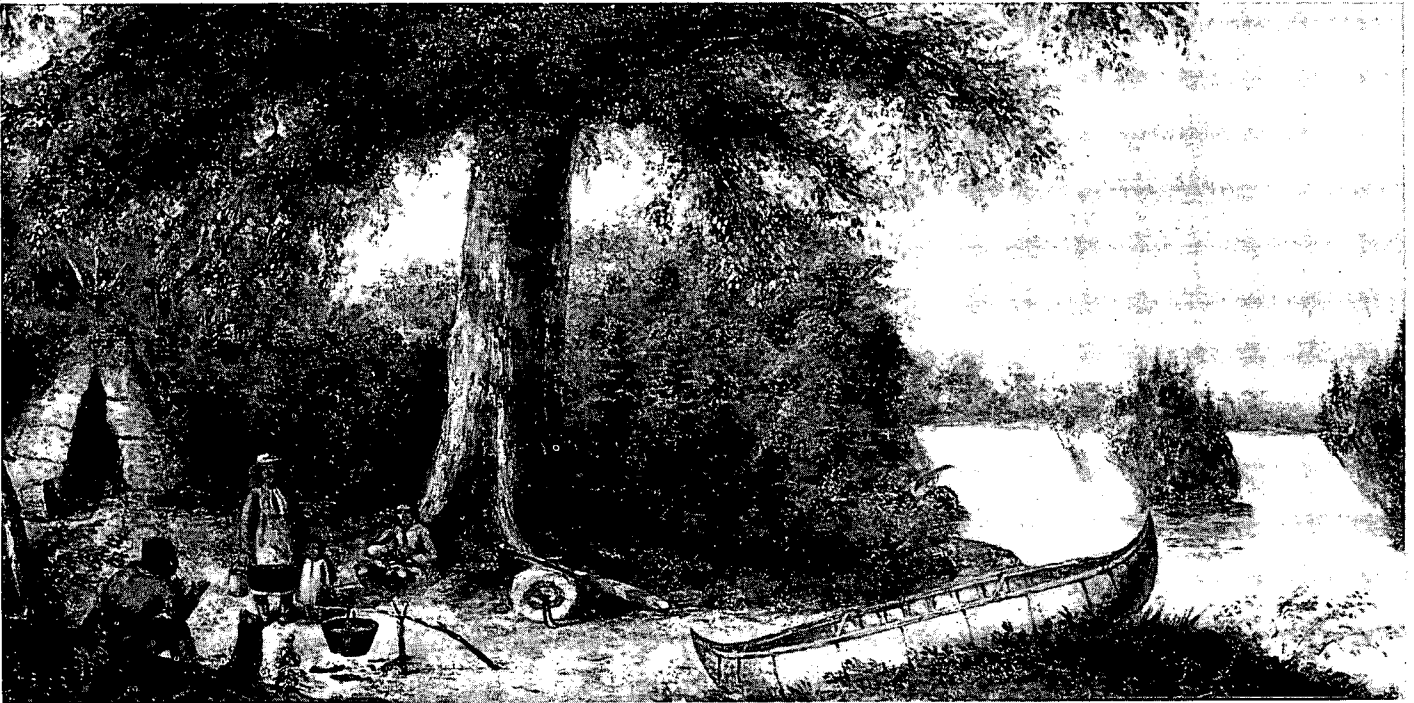
The primary obstacle, according to Lorenz (1968) is man's attitude. Because of his pride, man fails to recognize causal determination of his own behaviour as a manifestation of natural law. Thus there is a widening gulf between urban man and the elements of the environment which are basic to his existence. There is a need for him to understand the consequences of his acts in relation to his environment.

It is possible to trace the utilization of the shore zone from the time of its exploitation by primitive man to the present time. Any bay along the coast may be taken at random as representing this evolution. Certain factors remain constant, or relatively so, throughout time and place, such as the rise and fall of the tide, the downhill flow of rivers, the onset of winter icefields, the advancement of open seas in spring, the melting of winter snows, the spring runoff, the spring and fall migration of birds and the dramatic changes in the annual cycle of the seasons.

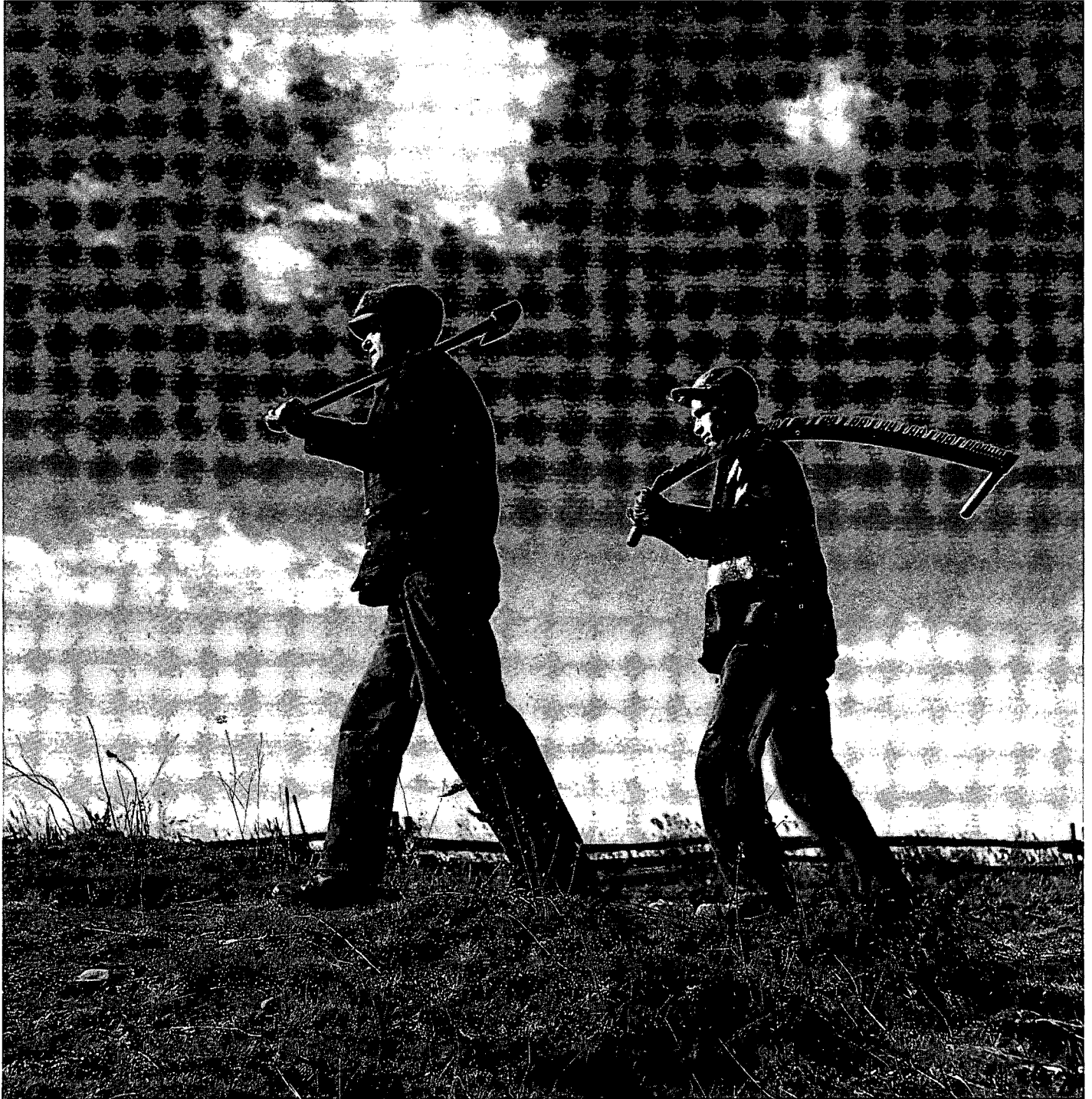
Aboriginal man was familiar with such phenomena, but his uses of the environmental resources were limited. He hunted the abundant game and fowl of the marshes. He dug up shellfish from the tidal zone. In the forests of the hinterland he sought game and wood for his camp. In the spring and summer he caught the sun-dried fresh and salt-water fish for winter use. His lodges were pitched on the sod above the storm beach, and his canoes drawn up on the beach were readily accessible to open water and were generally confined to use in the estuaries or in the streams. In winter, ice fishing could be carried out safely through the ice cover of the estuaries; there was no urgent need to move to the edge of the shorefast ice where massive, slowly-drifting icefields ground past the solid shorefast ice cover. Only those engaged in the March and April sealing hunted the shifting icefields when thousands of seals appeared on the ice floes to have their young. Seals provided red meat, clothing, and covering for lodges. Occasional trips were made from the mainland across the icefields to adjacent islands. No attempt was made to alter the physical configuration of the estuary in any way; it simply wasn't necessary.

In the course of time a new people with advanced technology and with the ability to alter the outline of selected areas of the shore, occupied the land. The climax forest was cleared from the rich alluvial soils of the adjacent hinterland to provide farms for

Aboriginal man's use of the rich environmental resources was limited; no attempt was made to alter the configuration of the estuary in any way.



A new people with advanced technology occupied the land, used and developed the abundant resources of the estuary, the valley and the hinterland.



domestic livestock and cultivated crops. In other areas the salt-water marches were drained by a regular network of dykes and ditches to restrain the salt water so that the wild marsh grasses could be systematically harvested or pastured. As commerce was largely water-borne, wooden piers and warehouses were built along the shoreline.

With advancing time and an expansion of settlement in the hinterland and the growth of the community at the townsite, the physical environment had become greatly altered from its original appearance. The shoreline had become a maze of rough, wooden piers supported by wooden piles jutting irregularly into the bay to accommodate the draft of wooden ships berthing at the wharves. The street by the shore, often called Water Street, became the main thoroughfare. Between it and the water rose a maze of irregular warehouses, ship chandlers, lumber yards, shipbuilding yards and the like. Although lumber carried by the wooden ships provided the main item of commerce for foreign markets, salt fish, pork, beef and wheat also provided important articles in the colonial trade.

So far there had been no attempt to change the outline of the bay although there were locations where the land had become sufficiently valuable that short retaining walls were built and the old tidal zone was filled in above the range of high water. The wooden ships ran over the bar at high tide and went out with the ebb flow. First oxen, and later horses, supplemented by an intensive use of human labour, provided the main motive power for moving the products of commerce between the warehouses and the ships tied up at the wharves.

Similarly, in the hinterland, intensive use of human labour supplemented oxen-power and horse-power. Oxen and horses depended on hays and coarse grain from the hinterland and marsh meadows. The marshes provided permanent hays and the fringes of

the marshes still provided an excellent habitat for various types of game birds. The fisheries were basically family inshore operations, but the merchants on Water Street were the backbone of the schooner banks fisheries. There was usually major exporter or fish buyer in each port, town, and village; all were engaged in the salt-fish trade.

In the early days of the seaport towns, sewers did not exist, so that runoff from passing storms ran down the streets, cutting gulleys and carrying sediment to be discharged into the bay. Later, with the installation of storm sewers, the runoff was diffused along the bay usually at the ends of streets running at right angles to the shore. Sanitary waste usually went into backhouses or outdoor pits and was absorbed by the ground or neutralized by microorganisms; along the wharves such waste went directly into the bay.

With the growth of industrialization, the marsh meadows became speculative because of some nearby financial development. Continued urban growth made this land more desirable for real estate development. Because of the poor substrata of the meadow lands, or because of the high water table that affected construction, it became necessary to dredge and deepen channel to provide fill for raising the surface of the marshland. The first major alteration in the configuration of the shoreline began to take place. Retaining walls were extended along the shore; the old tidal zone near the town's heart was filled in; it had now become valuable property.

For some time it had been necessary to concentrate storm-water outfalls at convenient points along the bay; storm water, however, was unpolluted. With the introduction of the water closet and later the flush toilet, it was possible for sanitary wastes to be discharged into storm sewers. There was no separation of sewage and storm-water carriers. Such construction was expensive and did not seem necessary.



As the town expanded beyond its original site, the appearance of the physical environment changed; the shoreline became an irregular maze of rough, wooden piers that accommodated the wooden fishing boats and ships berthing at the wharves.



Water for fighting fires had been drawn from some convenient deep point but the town, composed of wooden row-housing, was extremely vulnerable to fire. It was more than likely that one or more fires had swept the lumber yards or the housing on Water Street. Usually one of the benefits of a fire was the installation of a water and sewage system. Thus, at a fairly early stage, underground pipe was laid to carry harbour water to hydrants, the power being provided by a steam engine, first drawn by horses and later installed down at the harbour.

Drinking water had at first come from relatively shallow, dug or cribbed wells and later from drilled wells; if the underlying rock was near the surface, the fresh water was drawn from a dammed stream or an impounded pond or lake at an elevation higher than that of the town. The laying of a domestic waterline, which removed the dependence on backyard wells, introduced water in abundance into urban residences and this in turn prompted the need for water purification; soon chlorination became required treatment.

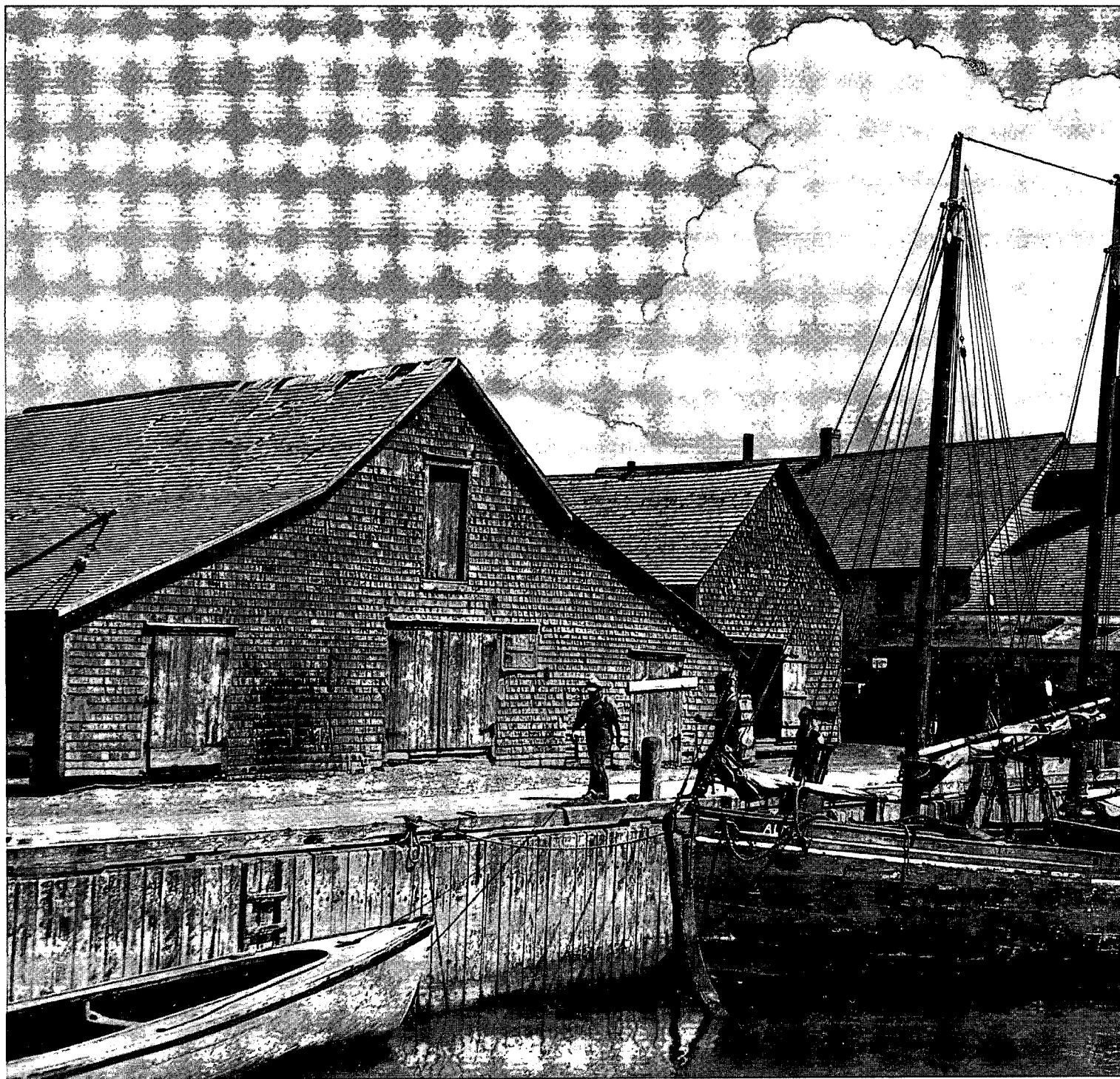
In time laws were enacted that required both storm and sanitary sewers in residential areas. Storm sewers controlled heavy surface runoff and basement flooding; in fact storm sewers promoted pollution control. The installation of waterworks in a town was considered a major indication of growth by all progressive and forward-looking people.

In any event, waste treatment from the various urban subdivisions was at best a secondary consideration in the scale of municipal concern; waste collection was a rather rustic type of operation. No attempt at any sort of rationalization of the shoreline was considered — it was in fact a notion far beyond the horizon of urban politicians and administrators of the period. Planners were unknown. Foul odours swept the town, particularly when the tide was out, but were most obnoxious down on Water Street; the

odours were tolerated because they were just as much a part of a growing town as were the growing pains of youth. The town had become a city.

Motive power had passed from the horse to the steam engine and then to the internal combustion engine, but electric power output derived from hydro and thermal power plants grew steadily. The waterfront lumber yards, shipyards, ship chandlers and allied services were now replaced by general and specialized service stores and parking lots. The maze of wooden warehouses was being replaced by brick and steel-reinforced concrete structures; the waterfront was an irregular maze of jutting buildings which greatly altered the shoreline of the bay; moreover, frequent dredging had brought deep water to the retaining walls. In the course of time the ship channel had been straightened and deepened, a ferry service which once crossed the bay was replaced by a bridge, and the harbour now provided accommodation for the arrival of scheduled and non-scheduled ships that tied up at the dredged-out basin by the wharves.

The production and marketing of codfish was the basic concern of the merchants on Water Street; it governed the location of settlements; it dominated the economics of the Atlantic region and was the basis of regional prosperity.





## Economic Progress Increases the Pace of Change

9



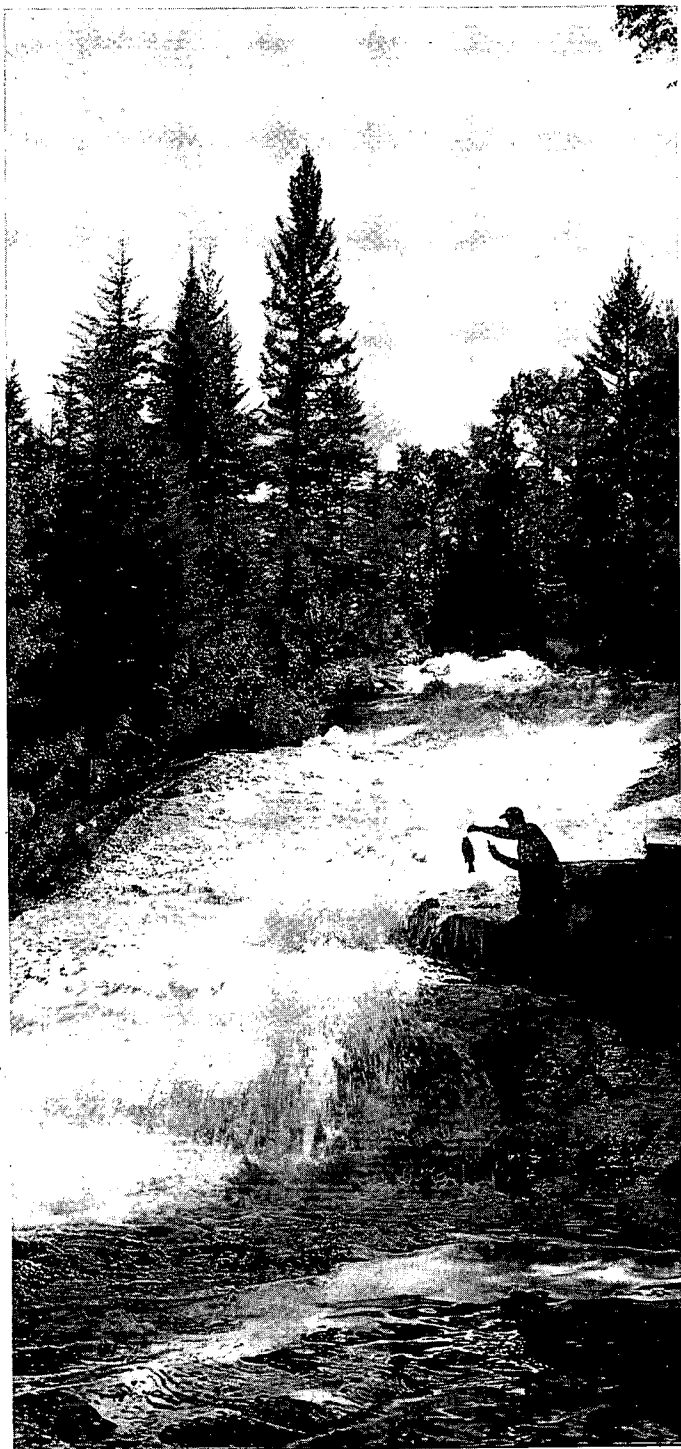
The cod fisheries were the basis of economic development and exerted a strong influence on the location of settlements in the Atlantic region from Cape Cod to Labrador, but the industry was slow to feel the technological revolution that was affecting other industries. Cod dominated the fisheries of the fishing nations; it dominated the economies of the inshore and banks fisheries; moreover, the pursuit of cod induced a way of life that was individualistic, independent and slow to change. Until the beginning of this century, cod was the supreme currency of the fishing ports and the source of economic well-being of the inshore and offshore fishermen. The production and marketing of salt codfish was the basic concern of the merchants on Water Street.

New innovations had transformed the New England fishing industry by the 1930's; by the 1950's the Newfoundland industry was undergoing change. National and international forces had brought about the application of scientific methods in the catching and processing phases of the industry. Modern refrigeration, cold storage and retail marketing outlets accelerated the demand for fresh and frozen products.

To meet consumer demands, the number of species of shellfish and finfish had increased to forty or more; ships and gear utilizing new techniques had developed; new processing plants which prepared a wide variety of products for the domestic and international markets had emerged; even the curing of salted codfish had become concentrated in plant operations. In this process the lobster had emerged as the most valuable species in the Atlantic region. Because of the rich, productive offshore waters, the fishery resources had become the object of intensive utilization and, in step, the port city had become the regional centre of a diversified fishing industry.

Prior to and following World War II, progress had wrought other changes. The primeval forest had

Recreation has emerged as a dynamic new industry; many visitors seek the solitude of the forests and streams — many others the roar and tumble of the surf at the seashore.



disappeared, foreign market requirements had changed, and radically new technology to exploit the earth's resources had appeared. The wooden sailing ships and the sawn-lumber trade had passed away; pulpwood plants that depended on the smaller-diameter conifers for sustained operations appeared; most lumber mills had become small operations dependent on the second-growth and third-growth stock and were scattered throughout the hinterland. General agriculture, dominant since pioneer days, was giving way to intensive, commercial farming. Most of the local processing industries had been replaced by agencies controlled from head-offices in distant industrial cities; branches and offices of national and international corporations intruded into the domain of native business organizations. The city had become a regional distribution centre which provided a wide variety of services.

The growing strength of the market economy was a new factor; it was having a deterministic effect on the villages and towns of the hinterland and on the ports along the estuaries. Many towns and villages were declining; the cities were beginning to show the effects of retarded development; the countryside reflected characteristics associated with sustained and continuous farm abandonment. Only those towns providing manifold services and performing regional functions were holding their own.

The marshlands were reverting again to aquatic marshes; dense thickets of alder with a sprinkling of balsam and small spruce were taking over fields that had formerly been worked. Old wooden waterfront structures were often in a state of disrepair or were crumbling by the shore, their full usefulness having long since passed.

The port city had fared better; streamlining of the harbour as a multi-use attraction was beginning. It was recognized that the port's commercial role had changed. In the process, the city had expanded well

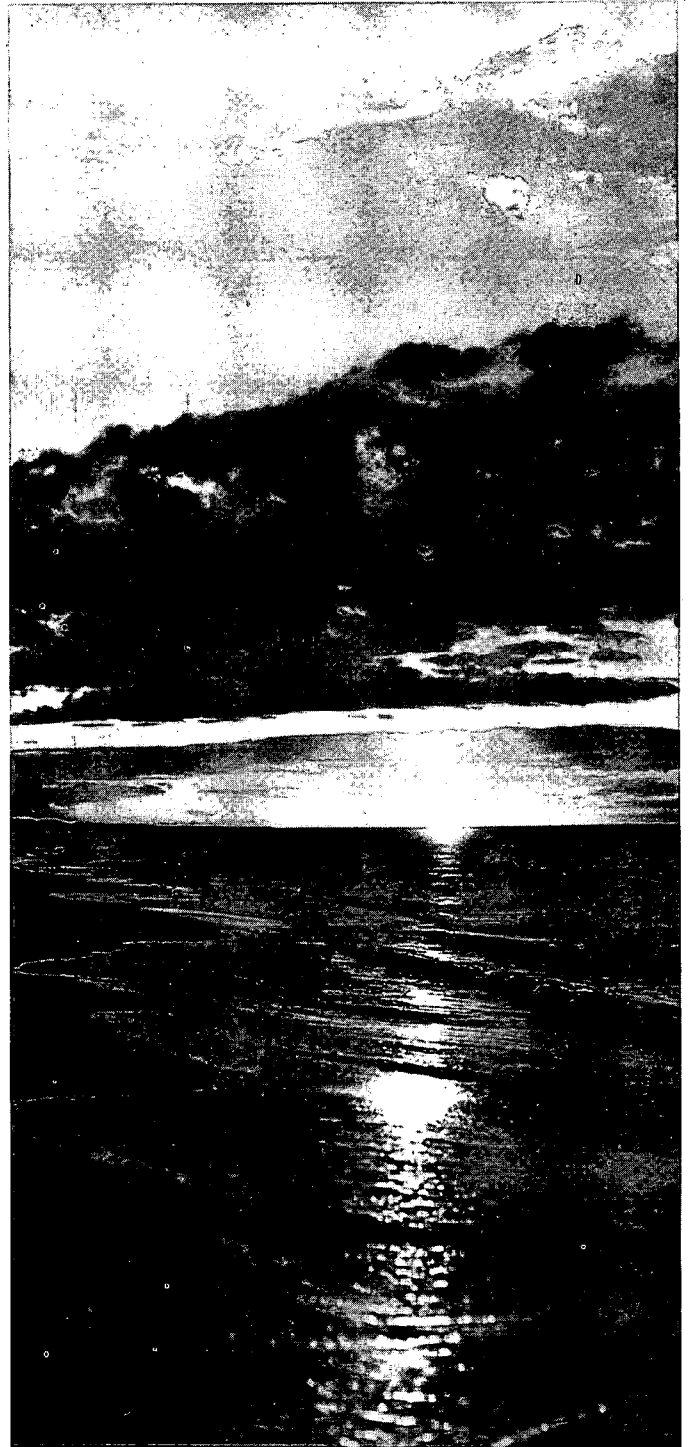
The seashore has always attracted man, provided it is maintained as a healthy, viable, environmental asset.

beyond its original town-site and, as a result, the network of storm and sewer lines was regularly expanded into an underground maze of pipes which discharged domestic and industrial effluent into the bay at many points.

Meanwhile recreation, a dynamic new industry making increasing demands on the service sector and contributing significantly to the economy of the Atlantic region, developed. Recreation, aided by the enhanced performance of the automobile, improved highways, and the continued viability and unrestricted credit of the North American economies, has been mainly oriented to the sea. Probably many of the visitors, originating from towns and cities dispersed across Ontario, Quebec, and the New England and Middle Atlantic states, had come to see the birth-places of their forefathers; others from the mega-urban centres had come to seek the solitude of forest and stream, or the roar and tumble of the surf at the seashore.

The visitor's arrival was marked by that ubiquitous identifier – the out-of-province licence plate; less obvious were the private acquisitions of sea-shore and lake-shore properties; Water Street had become the focal point of their business transactions. Camping facilities and roadside parks were evidence of the visitor's requirements in the hinterland. The fragmented estuarine coast had become an attractive and speculative resource; it possessed a stimulating and invigorating summer climate which contrasted sharply with the oppressive humidity, high temperatures, and the smog-filled air of North American industrial cities. The sea shore has always attracted man; it will continue to attract an ever-increasing number of people provided it is maintained as a viable, environmental asset (Farlow, Klashman and Hohman, 1969).<sup>2</sup>

To promote regional growth, new industries that used chemical processes were established in the city;

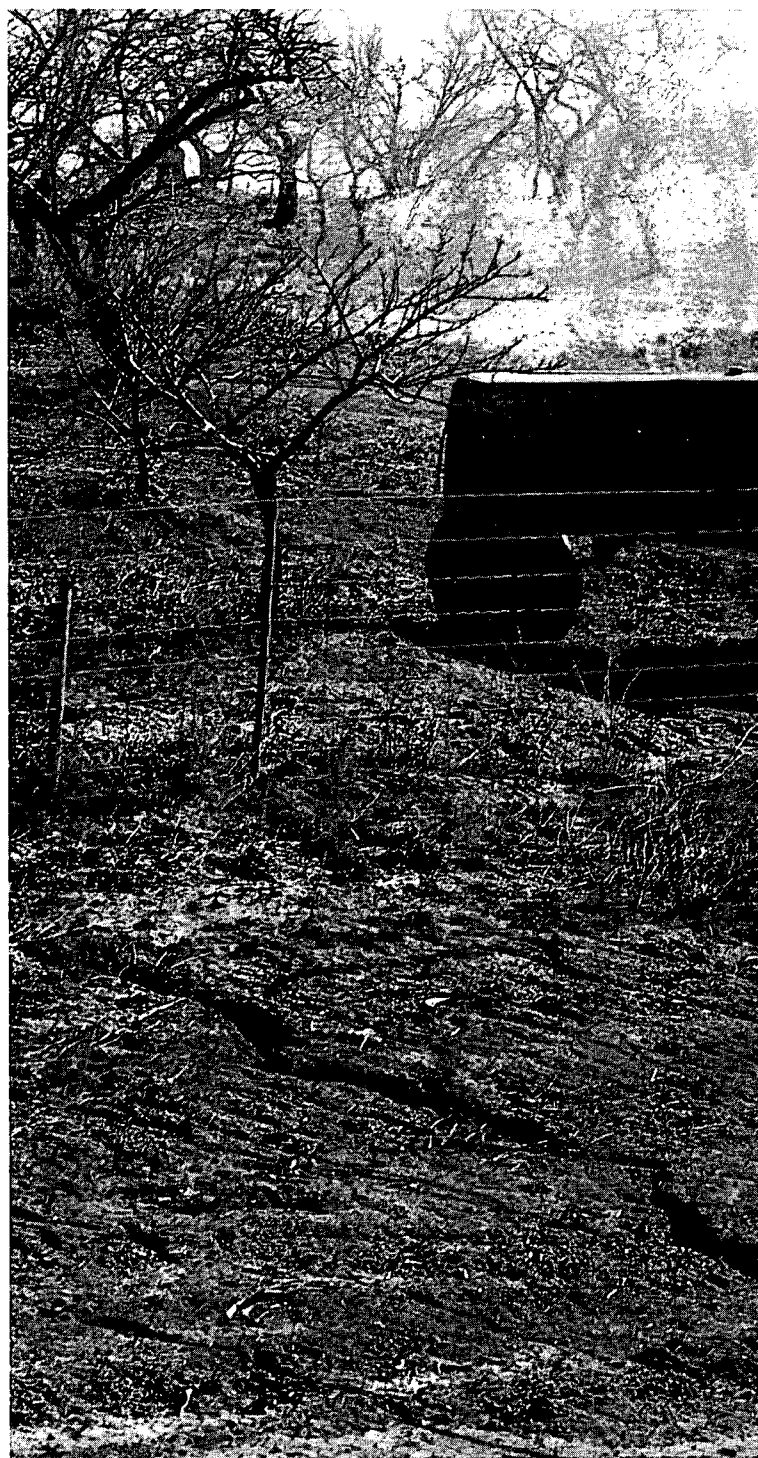


these industries introduced a new component to the sewage and runoff discharging into the bay. At the same time an array of chemical compounds was being carried in solution by feeder streams flowing into the estuary and thence into the shallow waters of the coast: pesticides used in the hinterland to control forest enemies; fungicides to control crop and plant diseases;<sup>3</sup> insecticides to control pests; weed killers to control undesirable plants; road salt to reduce accidents on icy roads and streets; phosphatic fertilizers to provide lush crops; phosphorus used in washing detergents to maintain human cleanliness; and soil nutrients from urban land development to provide new residential areas.

The effluent from the pulp mill was an important additive to the chemicals being discharged into the estuary. The dispersal of these chemicals into the streams and estuary fluctuated greatly from season to season and even from day to day as the discharge was usually manipulated by man. Moreover, these chemicals produced toxic residues which seriously affected marine life in the salt water and affected the quality of the physical environment and the wildlife of the land; other, such as phosphates, stimulated excessive marine growth, particularly among algae. The main burden of the waste was absorbed by the estuary. The prolific inshore fisheries and the abundant resources, which prompted the first settlement, had become seriously compromised to spur both fishery and recreational development.

<sup>2</sup>The significance of this may be gained by the fact that the U.S. Bureau of Census projections show that even with the advent of modern transportation and communication facilities, 75 per cent of the United States' population is expected to reside in counties along the sea coasts and Great Lakes by the year 2000. Two of these, the Great Lakes and the Northeastern United States mega-urban regions, with some 70 million or more population, are within a one to two day car drive from the Atlantic Provinces.

<sup>3</sup>Campbellton Tribune, N.B., "N.B. Environment in Danger Warns Conservationists," August 5, 1970. Quotes G.G. Shaw of Conservation Council of New Brunswick, "Agricultural interests are particularly large users of chemicals, employing at least 50 different ones. Of these only a few whose long-term effects on the environment are known."

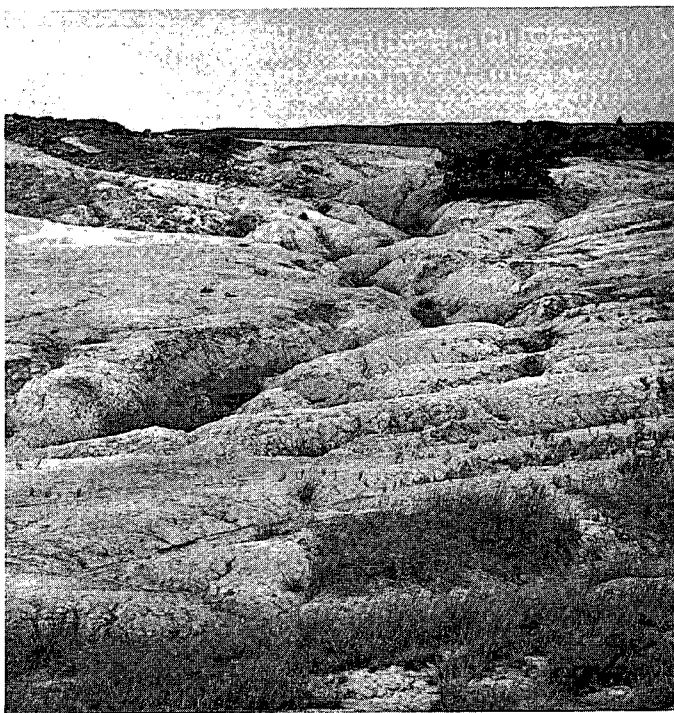
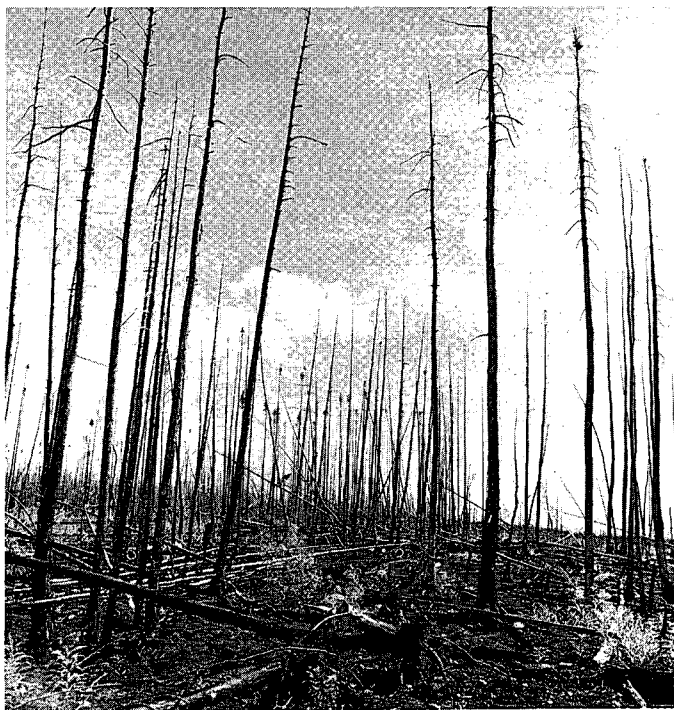




Pesticides to save valuable crops, and soil nutrients from farm lands, carried in the runoff water after heavy rains, swelled the volume of pollutants pouring into an overburdened estuary.



Forest fires and severe soil erosion are stark reminders of the depleting stores of environmental resources.



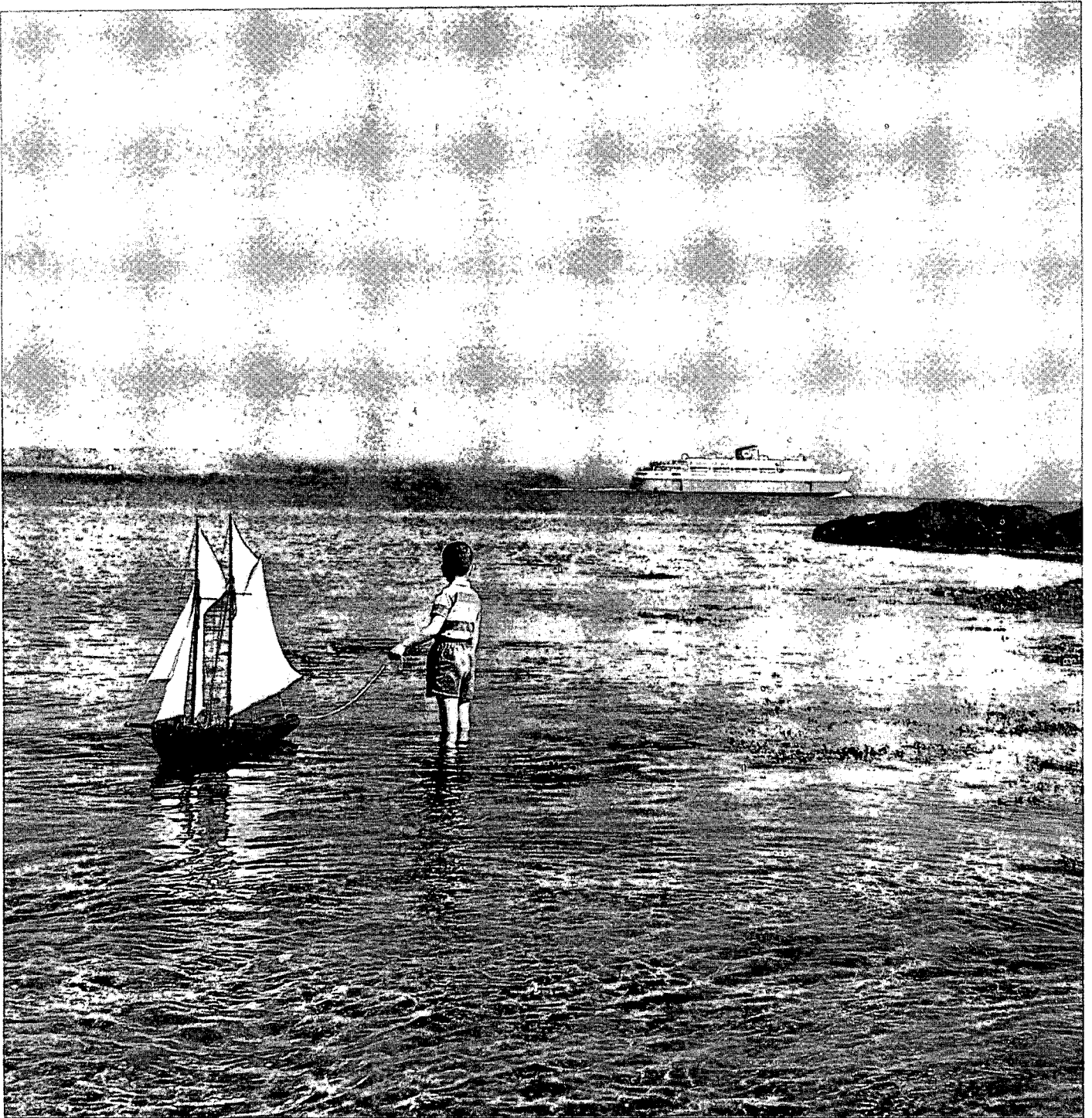
## The Basis for Environmental Concern

The first evidence of economic damage had become visible at an earlier date. There was the reduction of the large flocks of water birds that used the marshes. There were streams that salmon no longer ascended, and extensive areas of land, formerly covered by primeval forests, subjected to severe erosion. In recent times, the commercial damage by polluted water first became evident among the marine filter-feeders — the shellfish which are destroyed because of the change in the chemical balance of the water flowing over their shallow habitats. They and other marine biota acted as scavengers of mineral and bacterial contaminants introduced from untreated industrial and domestic wastes of the city and other up-river towns. The intake of intestinal bacteria added additional costs and handling to make oysters acceptable for human consumption.

Attempts to control the mosquito scourge with insecticides had failed; the mosquito remained as lethal as before. The streams, particularly the head-water brooks, had become intermittent or their waters had become unfit to drink; oil slicks, sanitary and industrial wastes, and debris of the harbour had long since made the bay waters unfit for bathing or growing shellfish. Individual responsibility for controlling domestic and industrial wastes had long been forfeited to the communities of the valley; no one assumed responsibility; no one questioned. Water Street was silent. Thus it emerged that the shallow estuarine environments, rather than the deep seas, have suffered most severely from man's lack of restraint.

The separation of sewage and storm-water systems was slowly gaining ground in order not to overburden the storm sewers. Sewage treatment was usually non-existent; it was still in the future. Chlorination of water resulted from the concern for the health of the population. Planners, politicians and the populace as a whole had become alerted to the dangers of pollution.

Man's actions as they affect his environment are never solely private or personal, but affect the living conditions of others as well as the hopes of generations to come.



The family unit, geared to a dominating interest in a few children, almost all of whom survived to maturity, was in sharp contrast to the large families of a half century or more earlier, many of whom died in infancy. Parents were taking a new interest in the future prospects of their children; they were becoming concerned about the deteriorating environment because man's actions are not solely private or personal affairs, but affect present-day lives and the hopes of generations to come. The politicians and planners were no longer the initiators of ideas concerning what ought to be done in the neighbourhood; committed citizens' organizations and informed individuals were on the alert, striving to participate in decision-making concerning environmental alterations undertaken by developers, promoters and speculators.

The influence of these restraints in urban neighbourhoods is highly variable. Thus, given the existence of a new market to spur industrialization and urban growth, lax zoning laws, favourable tax subsidies, and supporting socio-economic institutional structures favouring development, further alterations of the shoreline, the sea-bed, and the marsh flats will be demanded by various individuals and pressure groups.

Land development schemes and dredging operations in the harbour will seriously impair circulation, flushing, and exchange characteristics of the bay, intensify runoff, and increase effluent discharge. Consequently, the resulting effect is to intensify the degradation of the estuarine environment; the polluted water passing over the bar, in turn fouls the water for an undetermined distance up and down the coast. In addition, the environments of the shell fisheries, the estuarine and near-shore marine nurseries, and marine microorganisms, are likely to be seriously jeopardized. Effluents from the extensive residential, commercial and industrial areas of the port city will place an intolerable strain on the marine balance as

already indicated by massive die-outs of fish, barren underwater grounds, severely diminished commercial fish production, and closures of fishing areas. In addition to this, the development of recreational facilities by the shore has long since ceased.

Increasing population and commercial and industrial development discharge an increasing annual volume of waste into the sea. It can be expected that, with increasing population and continuing industrial growth, nuclear power plants, now an economic reality, will provide an increasing proportion of the electricity required in the future. Utilizing boiling-water reactors which require large supplies of cooling water, these plants discharge warm water into the bay.<sup>4</sup> The adverse effects on microorganisms, migrating fish, local shellfish, and nearby fish population, the decomposition of organic matter, oxygen content and the entire physical-biological ecosystems, particularly within the estuary, can only be conjectured. The effects are no longer localized, no longer restricted to an isolated section of the estuary or to a single species; the continuing existence of the total marine biota is threatened.

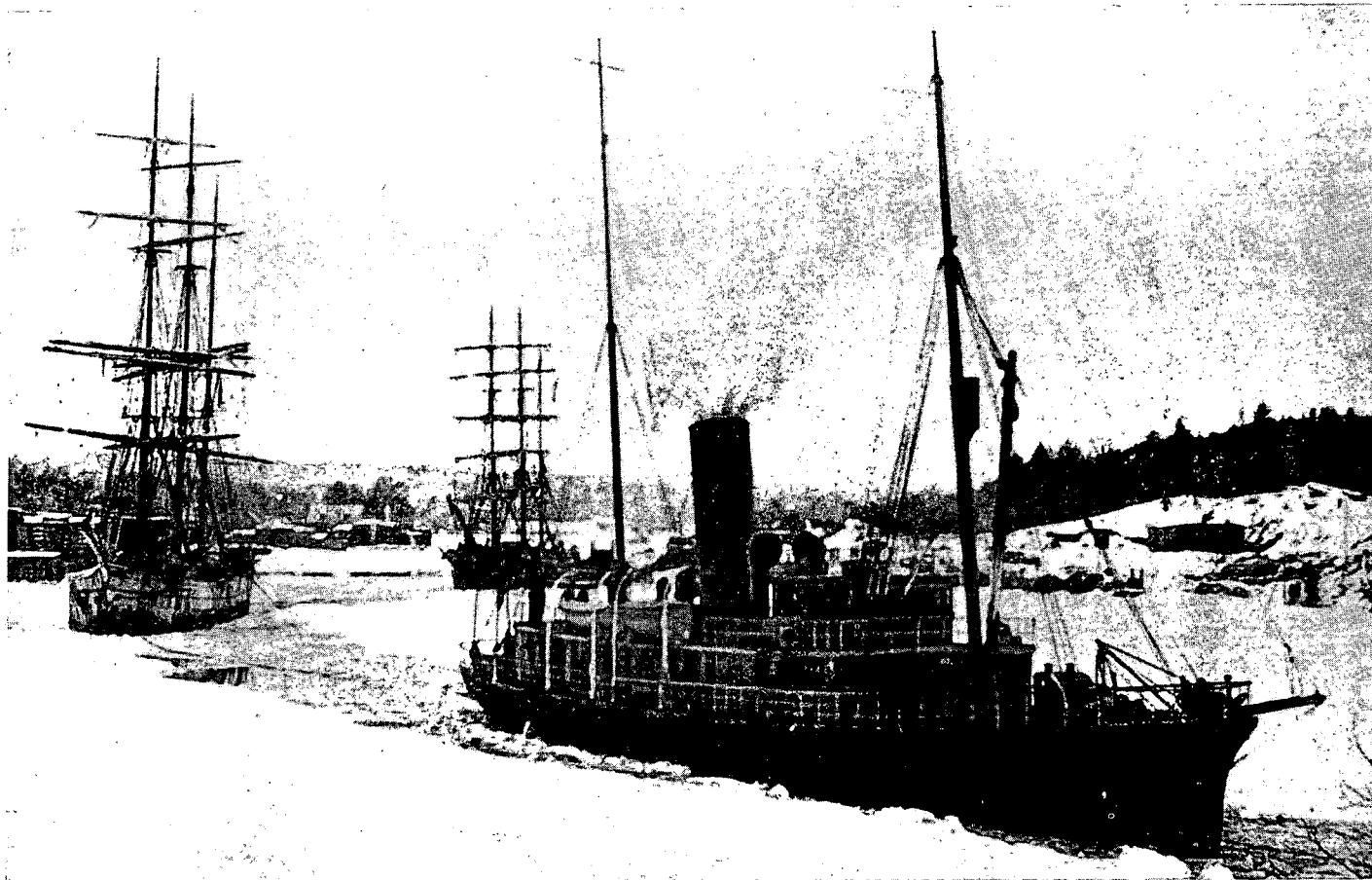
---

<sup>4</sup>Research to determine how the warm water may be turned into an economic asset is required. It is estimated that by 1980, one-third of nuclear-power reactors in the United States will be located on estuaries. The development of commercial thermionic converter reactors to convert atomic energy directly into electric power may limit the use of the present type of boiling-water reactor.



Committed individuals and citizens' organizations strive to participate in decision-making concerning environmental alterations undertaken by developers, promoters and speculators that directly affect them.





## Sea Ice—An Indicator of a Restrictive Environment

Ice-congested waters impose an isolation on the region; towns and villages become blocked in the estuaries and economic activities are severely restricted. The ice problem is a perennial one in much of the Atlantic region, varying only in degree from winter to winter.

The socio-economic and technological forces that were altering the landscape of the hinterland and the town-site and seriously threatening the marine environment of the estuary had little impact on the icefields that extended over the southern Gulf in winter. The icefields imposed an isolation on the region; towns and villages became locked up in the estuaries; fishing boats were drawn up on the beaches; the difficulties of maintaining efficient ferry services were compounded and heavy snowfalls congested roads and highways.

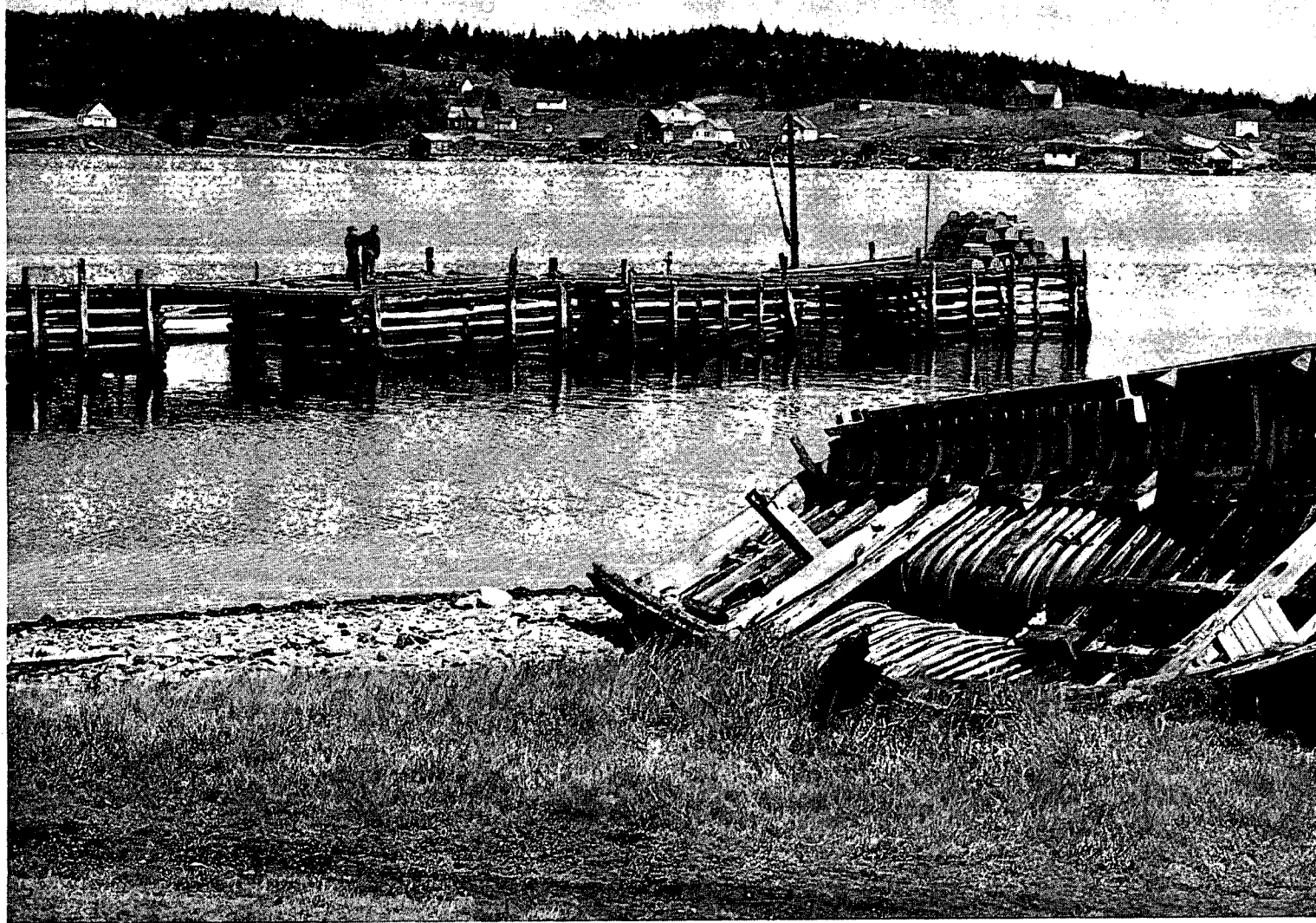
Undoubtedly winter icefields have contributed to the retarded economic development of the region. The extent to which the ice cover limits man's activities in the southern Gulf varied considerably from winter to winter. The winter of 1958 was one of the mildest on record, whereas 1961 was one of the most severe (Black, 1961); such extremes indicate the potential for future severe ice conditions. Their effect on man's activities has not been measured.

Restrictions imposed by climate extend over land and water in the form of low air temperatures, frozen land and ice-covered waters. These restrictions severely limit man's activities. Kristjansson (1969) notes the development of a polar-air circulation pattern, resembling that of 1900-1928 that is bringing the icefields down on Iceland. The extension of such circulations southward to include the Gulf of St. Lawrence region would increase the severity of winter ice conditions and would make it more difficult to cope with the complex socio-economic problems associated with regional and urban rehabilitation.

The ice-covered seas of winter are indicative of a cold water environment limiting both the exchange of oxygen and the intake of solar energy; it restricts man's economic activities mainly to the summer months and affects both the quality and quantity of marine resources for man's use.

To this restrictive environment has been added a new dimension — pollution. The added effects of complex chemical and bacterial wastes on the marine biota of this restrictive environment is already affecting economic activity; continuing build-up of contaminants intensifies future damage. Man's activities associated with the fisheries and the recreational industries are the most likely to be affected by the degradation of environmental resources. As both are seasonal industries largely confined to summer months, they are seriously limited in attracting capital investments for development purposes.

Shores and beaches fronting the city on the estuary have too often become strewn with the wreckage of man's use.



## The City's Role in Estuarine Contamination

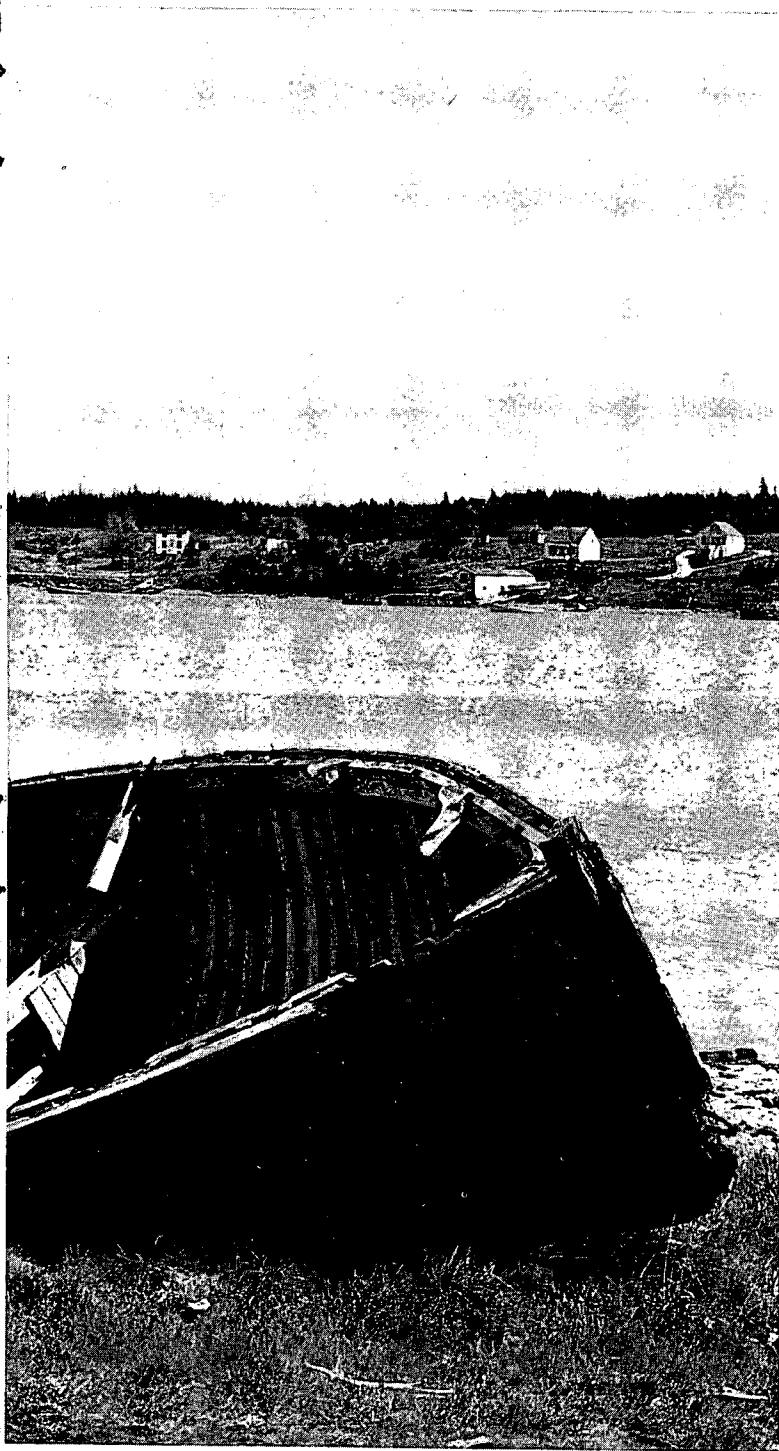
21

The hypothetical city on the estuary has been afflicted by urban sprawl; highly specialized agriculture has fanned out between intervening urban subdivisions to occupy the marsh flats and the alluvial soils of the valley. The various sewage disposal systems of the subdivisions are overburdened. The mud-coloured rivers and streams, swelled by the annual spring freshet and periodically by heavy rains, contain excessive quantities of soil nutrients from farm lands that, together with the nutrient content from the domestic wastes of the city, pour into an estuary already overburdened with organic and chemical nutrients. Septic conditions have developed from time to time in the estuary. The bed of the estuary is covered by a deposition of domestic and industrial waste together with increased sediment resulting from accelerated runoff from scarred land (Farlow, Klashman and Hohman, 1969)<sup>5</sup>. The water is turbid and oily; its surface is marked by oil-slicks, floating algae, and drifting refuse; and its shores and beaches are oil-coated or rust-coated, or strewn with bottles, cans and trash, residuals of man's use.

It is now probable that land values have become so depressed that low-income groups occupy urban slums in the old city's core, behind Water Street; the families of the well-to-do hasten to cottages at headwater lakes in summer. Moreover, this massive outfall is carried out to sea, the aesthetic value of the coast has been seriously impaired, and the economic value of catches from the shallow inshore fisheries has severely declined. Thus, like cancer, the effects of pollution spread along the sea-shore, infecting bays

---

<sup>5</sup>"Each year the City of New York barges over four million cubic yards of sewage to a point 90 feet deep and thirteen miles off the entrance of New York Harbour and has been doing so since before the last world war. Preliminary studies by the U.S. Bureau of Sports Fishermen and Wildlife indicate that ten to twenty square miles around the specified centre of the dump ground is virtually devoid of bottom-dwelling invertebrates. An additional two miles beyond this barren area (must be travelled) to find healthy benthal populations."





and estuaries, and reducing and constricting human activities. This haphazard development of the city and the surrounding valley, together with a disregard for the other facets of the environment has, by development activities, accelerated the process of eutrophication or the aging process of the hypothetical estuary.

It is not known in what ways the alteration of the bay, the reshaping of the harbour and the expanding city have affected the estuary in terms of water circulation, thermal structure, salinity-fresh water ratio, organo-chemical reactions, bacterial action and their combined impact upon marine-life propagation and the food cycle. Moreover, monitoring technology suitable for measuring organic and chemical wastes in the estuaries and the shallow waters of the Shelf has not been developed with an appreciation of the characteristics to be measured (Wastler and Berkson, 1969). Baseline data and estuarine models to further estuarine research are lacking; there is no mass transport research on the dispersion, transport, and chemical actions of wastes, in salt water or their effect on environmental and biotic quality from estuary to estuary, along the coast, or out to sea. Because of the great variation in estuarine waters, it is extremely difficult to develop pollution criteria for such waters because the waste content of the estuary is neither qualitatively nor quantitatively known (Gunnerson, Brown and Smith, 1969); moreover, it is difficult to define desirable water quality standards without effluent standards. There are no studies to measure ice cover – pollution relationships, or the relationships between these and the marine biota-systems; there is little information available on the interrelationships within the biota-systems.

Estuaries are rich biological areas and are the greatest marine producing areas of the ocean and most readily accessible to man; nevertheless, estuaries remain the least understood parts of the ocean. Wastler and de Guerrers (1968)<sup>6</sup> point out:

“The ecological systems of the continental shelf are closely related to those of the estuaries which ajoin them . . . More than half, and probably as much as two-thirds of the over 4.5 billion pounds of fishery products harvested by U.S. fishermen annually, is derived from animals dependent for their existence, during some part of their existence, during some part of their life cycles, on clean coastal waters.” p. 222.

Because of expanding population and industrial activity, these are the areas where water contamination is greatest and will continue to worsen in the future. Thus it becomes urgent to forecast the waste output from human activities of future populations.

The contamination of the estuary is due not only to the effluents discharged by villages, towns and cities; the estuarine environment, together with feeder streams and rivers, is greatly affected by surface runoff which carries pesticides and herbicides used in the hinterland. Ruggles (1970) notes that recent aerial spraying of forests in New Brunswick to combat the spruce budworm resulted in the deaths of massive numbers of fish in the sprayed areas, in some cases, several years in succession. Mortality of young salmon in the branches of the Miramichi River – the world's greatest nursery for young salmon – ranged from 50 to 98 per cent.

The Atlantic salmon of the Maritimes is the most popular in the world; it probably accounts for 80 per cent of the sport fishing catch in the Atlantic region. Elson (1969) notes that the tourist dollar, attracted by the New Brunswick salmon, has been estimated to amount annually to 10 million dollars in New

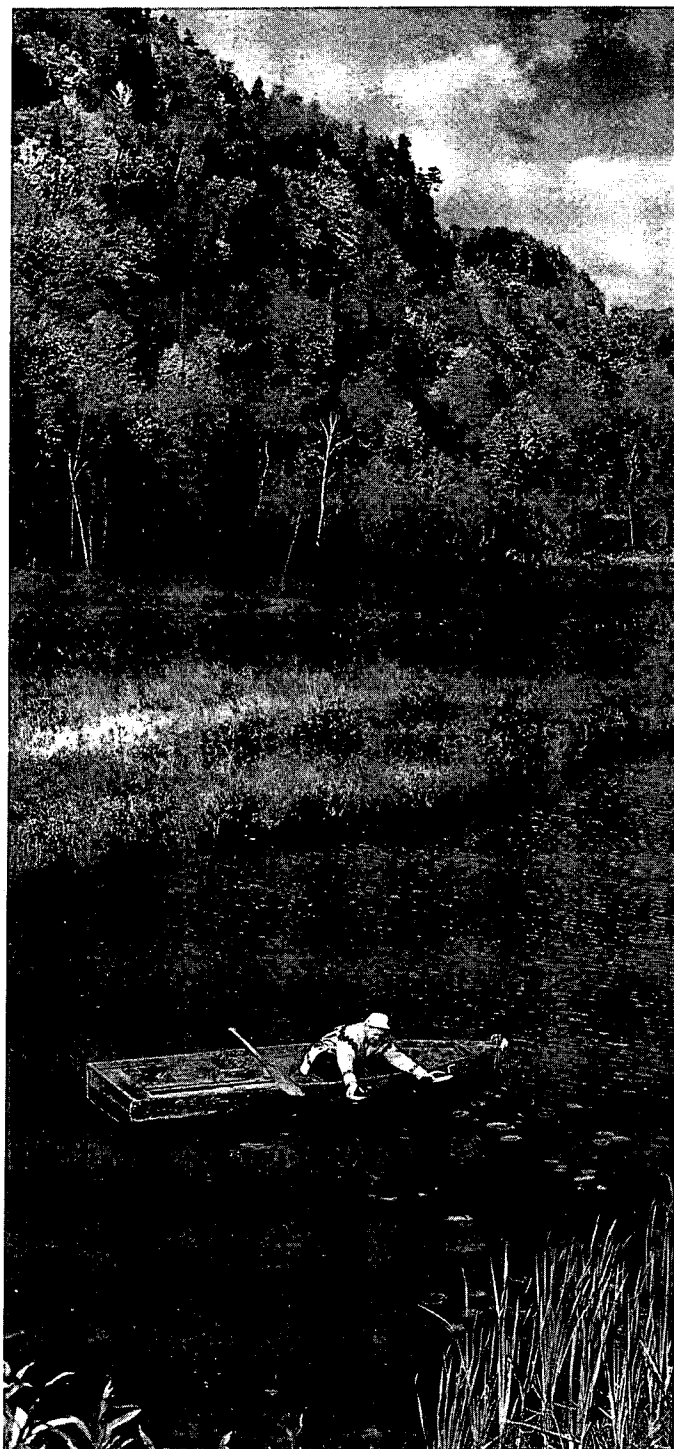
---

<sup>6</sup>This publication “National Estuarine Inventory – Handbook of Descriptors” provides a compilation of the available information on the coastal zones of the United States.

The estuaries are the richest biological areas of the ocean, and are the most readily accessible to man.

Brunswick and probably twice that amount in the Atlantic Provinces as a whole.

Some 3,800 tons of pesticide chemicals (Shaw, 1970), used to save the valuable forests, have brought about near-destruction of the salmon, trout and other freshwater fish in the past decade. In Prince Edward Island, trout and other freshwater fish are either scarce or non-existent in the brooks and streams that flow through the rich agricultural areas of the province (Ruggles, 1970). This condition has resulted from sprays used to control pests and fungal growth on crops. In other cases, sewage from towns and villages has polluted the waters, so that few streams remain unaffected. An important aspect of runoff research is that neither research techniques employing a net-structure for measuring runoff characteristics nor the technology for controlling sediment, chemical, and surface runoff has been developed.



Environmental quality, in aesthetic terms one of the most valuable assets, is also one of the most difficult to measure in financial terms.





## Can the Effects of Massive Pollutants be Measured?

Chemical, sanitary, and biological concentrations are important parameters for determining recreational, fishing, and coastal-zone use; however, the data most essential for this purpose are lacking. Because of the complexity of the characteristics involved, it is not known how to estimate partial socio-economic losses from pollution or how to equate development costs with gains. It is difficult to measure such losses with any degree of accuracy in terms of public welfare, that is, with respect to income losses, employment and migration, commercial development opportunities, aesthetic values, recreational values and the effects of these on human health, attitudes and responses.

Tarzwell (1969) notes that wastes have assumed such a staggering proportion in several of the largest American cities that the cities cannot pay the cost of treatment. In the estuary, the accumulated waste outfall from sewers makes excessive demands on oxygen; the oxygen depletion which ensues is considered one of the most serious problems of estuarine water quality (Gulf University research Corp., 1969).

Marine dredging in harbours and estuaries has always been oriented to the requirements of marine transport, not to the propagation of marine flora and fauna. Gallagher and Hogan (1969) have noted that in certain areas, dredging and filling is almost 100 per cent destructive to the biological ecosystem and may be irreversible. Thus, it is extremely difficult to measure socio-economic costs resulting from the impact of pollution.

Marine productivity is an exceedingly difficult aspect of the marine environment to define. Little is known of how to interpret physical and biota data on the marine environment in terms of commercial fish production, how to express basic primary productivity in terms of socio-economic theory (Russell, 1969) or how to intensively and scientifically prosecute offshore aqua-farming in a restricted environ-

ment. Little is known of what the industrial mix should be in a restrictive environment or how Water Street should respond to the socio-economic problems of the city and its hinterland.

## Polluting the Sea with Waste

To the wastes discharged from the hypothetical city must be added those of the scores of isolated homes, villages, towns and cities bordering the shores of the estuaries or located upstream on tributaries draining to the estuaries, and the discharge carried by feeder streams from surface runoff. It is only then that the extent of waste discharged into the marine environment can be seen in its true proportions.

Since settlement first began, raw sewage has been discharged into all the harbours on both sides of Northumberland Strait. The larger towns and cities may have upwards of six outfalls, the smaller towns one or two, and small neighbourhoods may have none. There is, in effect, an acute shortage of sewers and effluent-treatment installations. Concerning Shediac Bay, which is typical of the communities of the Atlantic region Williams (1970)<sup>7</sup> notes that some of the small neighbourhoods may discharge their waste directly into storm sewers, others into open drainage ditches, and still others onto the beach. Most septic tanks are poorly designed, disposal fields inadequate, and the facilities badly maintained. Some communities lack storm sewers; others, maintain sanitary sewers in a bad state of repair.

To the residential waste load carried by the bay is added the load, from recreational facilities such as trailer camps, playgrounds, beaches and summer cottages. Finally, Williams notes, the groundwater has been polluted to the point where a variety of waterborne diseases of epidemic proportion are possible. The Montreal Engineering Co. (1969) found that 43 per cent of the regional population of the Maritime Provinces is served by public sewers without any treatment facilities and that only 5.5 per cent of the population is connected to public sewers with treatment facilities. Thus the remaining population, 51.5 per cent, is served by septic tanks, storm sewers, drainage ditches and backhouses.<sup>8</sup>

---

<sup>8</sup>Recently, communities such as Newcastle, Chatham, Summerside, Charlottetown, Pictou, New Glasgow, Souris, Shediac have become part of a growing list of communities concerned about the contaminated waters around them; they are examining the cost of curbing pollution.

<sup>7</sup>Chairman, Greater Shediac Sewage Commission.

## Purifying Microorganisms are Overburdened

Fortunately, the sea has an inherent self-purifying quality which enables it to destroy foreign bacteria, including intestinal bacteria from human excrement. Mitchell (1969) has demonstrated that the native marine microflora is directly involved in the destruction of the intestinal bacteria, *Eschericia coli*, in sea water. Mitchell, quoting Metcalf and Stiles, notes that the rate of decline of enteric viruses in estuarine waters is determined by the density of local populations of marine microorganism or microflora. The survival rate of these viruses is prolonged in polluted water. Enteric viruses, such as typhoid fever and infectious hepatitis, are carried in sewage effluents to shellfish beds in the sea. There, the viruses are concentrated in the shellfish which, when consumed by man, are responsible for numerous outbreaks of disease. A greater understanding of the processes underlying the destruction and protection of enteric bacteria and viruses in the sea is required.

Shellfish strain out bacteria and microorganisms which constitute their food. At the same time they have the facility of cleansing themselves and purifying the water. Medcof (1961) notes that the effectiveness of shellfish in controlling excessive bacterial populations varies according to the physical and chemical conditions of the estuary and the health of the shellfish population. Although toxicity in shellfish is related to the biological community, oysters have been found to carry undesirable chemicals concentrated in the water in which they live. Bader (1969) notes, however, that mineral scavenging or the complex process of organo-mineral interaction is little understood. The end-product of industrial, domestic and agricultural wastes in the estuarine and the near-shore, and their interactions, are not known, nor is the role of trace elements in marine life understood.

Any physical, chemical or bacteriological alteration affecting the estuary, the shore zone, the hinterland, or a work of major proportions such as a

causeway, must be viewed not only in terms of man's socio-economic activities, but also in terms of the effects, both harmful or otherwise, such alterations may have on littoral and ecological resources.

The danger of uncoordinated estuarine and littoral development can only hasten the elimination of desirable water, land, and ecological uses of the estuary; their loss can only be measured as a massive expense of long-term environmental deterioration and resource exhaustion. An indication of the enormity of this problem in the United States may be gained from the massive cost of the treatment of soil erosion, which is one aspect of environmental deterioration:

"Preliminary estimates are that 595 million acres of eroding land contribute flood damage and sediment to about 45 million acres of farmland and property in small watersheds. The treatment of about half of the impaired watershed lands would not be physically or economically feasible under existing economic conditions. Of the rest — about 297 million acres — . . . protective measures seem to be warranted in the near future . . . On the basis of 1957 prices the cost of such treatment would approximate 6 billion dollars" (Weinberger and Ford, 1958).

Pollution is the creeping paralysis of the oyster industry. As a direct result of contamination by domestic sewage, about one fifth of the clam beds and one quarter of the usable oyster beds have been closed.

## Economic Concern over Polluted Water

Because shellfish may be the carriers of infectious bacteria, the degradation of water due to domestic sewage has resulted in the closure of shellfish beds in the Maritimes. The number of areas closed to fishermen has grown from about 48 in 1940 to about 183 in 1970 (Department of Fisheries and Forestry, 1970). Of these shellfish closures, Prince Edward Island accounts for 50, New Brunswick 42, and Nova Scotia 91. The closures affect 25 to 50 miles of Prince Edward Island's coastline and about 100 to 200 miles of Nova Scotia's coastline.

Ruggles (1970) notes that some 25 per cent of the oyster beds are closed because of contamination by sewage and effluents and over one fifth of the usable clam beds are closed. As the amount of untreated sewage dumped into the estuaries continues to rise, the remaining shellfish beds seem destined to become polluted. The axiom "once polluted, always polluted" becomes a truism unless the villages, towns and cities establish waste treatment facilities. The amount of financial losses to fishermen through pollution is not known. Medcof (1961) described the pollution problem in the following terms:

"Pollution is the creeping paralysis of the oyster industry. It may not be many years before we have no clean water. So far efforts to halt this trend have been unsuccessful . . . all oyster men should be alert to and should make special efforts to oppose pollution in (their) areas before it becomes firmly established. Too often nothing is done until pollution is an accomplished fact. This is a matter of great concern to the whole oyster industry and to the provincial and federal governments." pp. 143-144.

Shellfish closures seriously affect the economic activity of fishermen. In addition to the restrictions imposed by pollution-control measures, commercial fishermen are seriously handicapped by increasing



operational costs, starfish depredations on oyster populations, and oyster diseases. To protect the health of oyster consumers, the Minister of National Health and Welfare through Order-in-Council conducts intensive sanitary and bacterial surveys to define the clean-water areas that are free of detectable pollution. From these investigations, the Department recommends to the Department of the Environment the areas to be closed or re-opened; the latter Department administers the areas to ensure that oysters marketed by the industry are taken from uncontaminated environments.

The creeping paralysis of pollution is not limited solely to the shellfish industry; it contains a serious economic threat to the future operations of fish processing plants. Most fishing communities occupy protected harbours within the estuaries into which domestic and industrial effluents are discharged, and which provide the best location for fish processing plants. These plants must use water having the same quality as drinking water in order to maintain the rigorous sanitary controls demanded by both industry and government.

The amount of water required varies with the size of the plant; a small plant may use up to 200,000 gallons a day, an intermediate-size plant 500,000 gallons, whereas the requirements of the largest plants may exceed one million gallons a day. Demands of this magnitude could not be satisfied from available sources of pure fresh water and plants have had to turn to sea water to meet operational requirements.

As urban outfalls are extended seaward, polluted water is thereby extended seaward; moreover, the suspended material is transported in all directions by surface currents and prevailing winds, thus jeopardizing the supply of clean sea water available at reasonable piping distance and cost, for plant operations; it is a cause for grave concern in the business offices down on Water Street. This potential threat

hangs over an industry whose annual production, from some 500 processing plants in the Maritime provinces, is as high as 125 million dollars (Sou'Wester, 1970). Almost all of this production is exported.

## Nature's Share in Environmental Destruction

The degradation of the environment cannot be laid entirely at man's doorstep; the ravages of nature are equally devastating in upsetting the ecological environment. From 1955 to about 1960, Maritime oysters suffered a devastating attack from an unknown oyster disease epidemic such that commercial production dropped from 11 million pounds in 1950 to 3 million pounds in 1958 (Medcof, 1961). Disease outbreaks killed over 95 per cent of the oyster population; six years later, about two per cent which had survived were disease-resistant. This virus has not yet been identified and indicates another serious aspect of the introduction of oysters into a new environment where biological checks are lacking, albeit into a northern outlier of the oyster's optimum environment of the southern Atlantic seaboard. When waters over shallow scallop beds in Northumberland Strait reach temperatures of 68.0 to 74.3°F mortality among scallops may reach up to 80 per cent (Dickie and Medcof, 1963). Such lethal temperatures have occurred at irregular intervals, particularly during July and August; less extreme temperatures cause debility among scallops, making them subject to various environmental predators.

On the physical side, waves and ice action under storm stress have caused severe damage to the exposed sandstones and unconsolidated sediments which form the bluffs, cliffs, headlands and shores of the coast. The average annual amount of retreat of the erosional face of Egmont Bay from 1935 to 1958 was 3.14 feet with a range of from 0.6 to 9.0 feet; in the same period the average annual amount of shore retreat for Bedeque Bay was 3.85 feet, with a range from 0.8 to 12.7 feet (Forward, 1960).

How does one assess the value of the national estate lost in perpetuity? Fair market value is inadequate to measure such destruction. The debris from such action is deposited in shallows, bars, beaches and spits behind which aquatic plants, weeds, and organic debris collect. The recreational value of

such areas is substantially reduced, partly because of the foul odour of decaying vegetable matter. No research has been undertaken to determine the areas which should be retained for socio-economic development or the areas to be reserved for wildlife and natural development. No priorities or guidelines have been set.

## The Need for Coastal-Zone Planning

31

Knowledge and understanding of the physical, chemical, and organic processes of the marine ecological systems are required to develop appropriate administrative and caretaking measures to maintain the physical and biotic health of the estuary. Thus, for want of research, there is a general lack of technical data, an essential requirement for administrative regulatory control. A well-planned program, directed toward the prevention of pollution, assumes techniques to measure and manage waste, water quality, critical aspects of the marine biota system, water quality requirements for the various water users, and changes in the life-structure of the estuary. Present research is highly fragmented, probably much is duplicated; much is uncoordinated and devoid of direction through a lack of national and regional priorities. Furthermore, there is no national society to sponsor associate societies engaged in research on the primary segments of the coastal-zone environment.

At the present time neither scientists nor planners can forecast whether or not a major project bears the seed of ecological disaster, nor can they predict the long-term ill effects of a given pollutant on any particular marine organism. Research to this end has rarely been undertaken on a scale designed to produce definitive answers. This is understandable as pollution is a new parameter to consider in future environmental evaluation studies.

Tarzwell (1969) notes that, because of the great variation in quality of estuarine water, traditional surveys or spot checks do not provide a satisfactory basis on which to undertake research, nor do they indicate the water quality required by the various users, nor determine the treatment necessary. An approach based on sustained monitoring of the marine environment on a continuing basis is proposed. Only on such a basis can basic principles having wide application be developed.

Integrated environmental planning and management of the coastal zone is essential; it involves a total approach — an integration of physical, ecological, technological, legal and jurisdictional, management and administrative segments. Some aspects may have international implications. Without such an approach there would be a tendency towards the development of one resource at the expense of another, a situation that arises as towns and cities of the Atlantic region look to industrialization for the improvement of their economic status.

The great social and economic importance of the estuaries in terms of fisheries, recreation, industrialization and urban development indicates the need for a public agency with the power to coordinate resource management programs in the interest of land use, water quality, marine ecology and human use. The nature of such an agency deserves early study as it would be concerned with matters of municipal, provincial and federal jurisdictions; moreover, it suggests a regional-metropolitan system concept and should operate under guidelines formulated by and in cooperation with the federal authority.

Management of the coastal zone would require a sustained and continuing back-up of administrators, specialists, local committees and associations; it would require the support of the business community on Water Street, and especially, political representation to ensure that administrative and political decisions are in the public interest. Some of the responsibilities would be: the planning of waste treatment facilities according to present population and anticipated future growth; the establishing of fresh- and salt-water quality criteria for the various water users; control of industrial and sanitary waste disposal; the sanction, control and approval of estuarine and river alterations; control of the use of chemicals in the environment.

Integrated planning and management of the coastal zone is essential. Towns and cities look to industrialization to improve their economic status and this growth pattern, accompanied by a corresponding growth in population, leads inevitably to an increase in the volume of waste discharged into the sea from residential, commercial and industrial development.





A well-planned development program directed toward the prevention of pollution assumes techniques to measure and manage waste, water quality, critical aspects of the marine biota system, water quality requirements for the various water users, and changes in the life-structure of the estuary.



In addition to environmental quality controls, other responsibilities might be: the planning of land-use development, coastal and estuarine zoning, and renewable resources rehabilitation; integration of regional transportation requirements of the area; formulation of integrated regional plans in line with fiscal resources of the region, and so on.

Through public agencies, involving local, provincial and federal authorities, it may be possible to formulate and regulate littoral development in a coordinated fashion and thereby minimize environmental damage to future resources, and still provide for the future requirements of man. As coastal-zone planning is related to public funds invested by federal, provincial and municipal agencies, all become involved in the administrative and regulatory control of the coastal zone; moreover, the province becomes a basic planning regional concept.

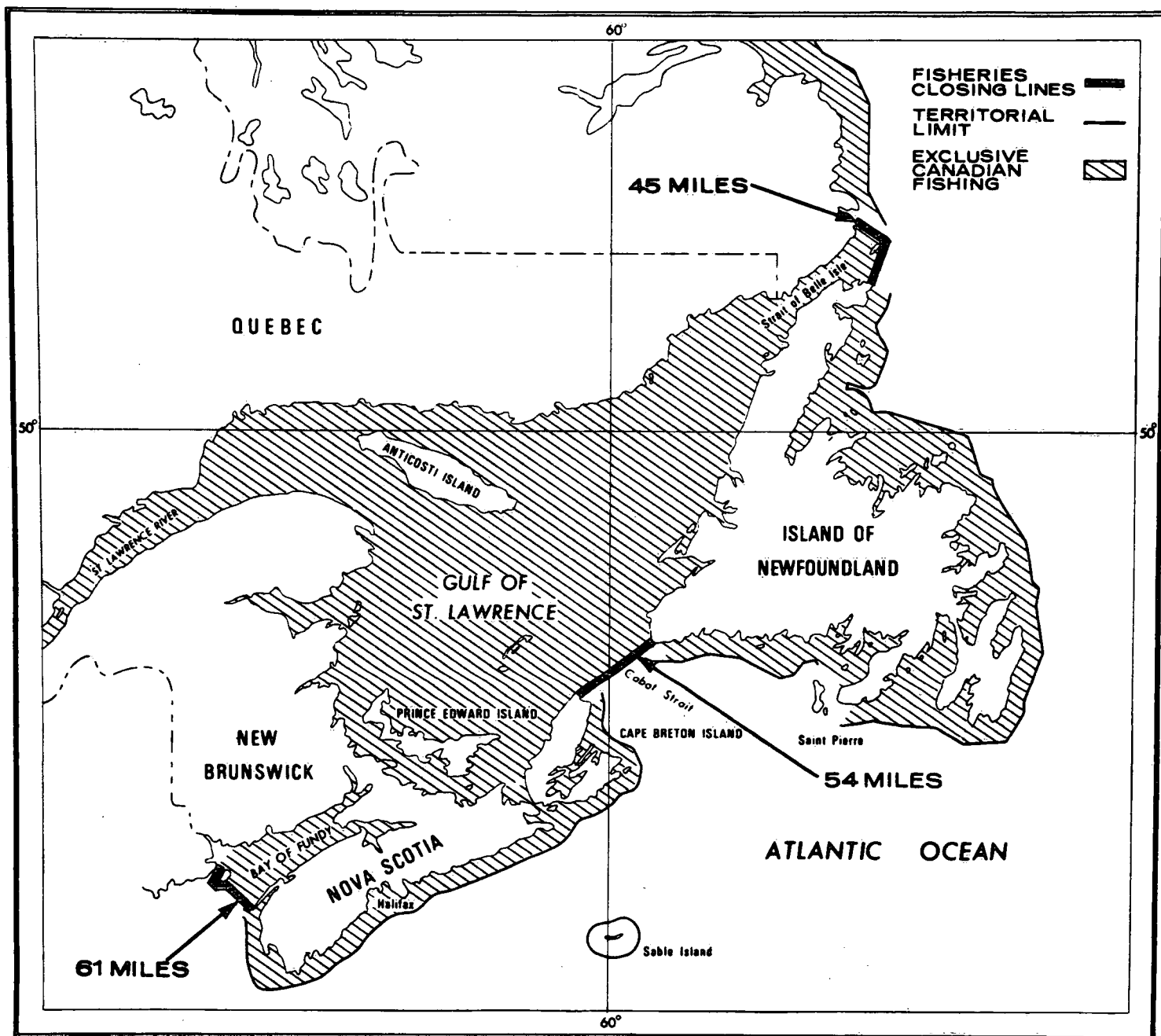
The lack of an adequate definition of the coastal zone poses a major problem for politicians and planners. Peacock, Superintendent of the Moravian Mission, Nain, Labrador (in personal communication) points out that, in the boundary dispute between the Dominion of Canada and the Colony of Newfoundland, the scriptural definition of 'coast' was an important consideration, for example, Mark VII: 31, "And again departing from the coasts of Tyre and Sidon, He came unto the Sea of Galilee, through the midst of the coasts of Decapolis," and others. In the final award, made to Newfoundland in 1927, the 'coast' of Labrador included the areas drained by streams and rivers which rose in the interior and flowed eastward to the Atlantic Ocean. Based on this decision, the land segment of the coast zone was thus defined to include the headwater areas of river basins.

The seaward side of the definition is perhaps more elusive: Canada has accepted the substance of the Geneva Convention, 1958, on the definition of the Continental Shelf, that is, the coastal state has

exclusive sovereign rights for the purpose of exploring and exploiting the natural resources of the seabed. Griffin (1969) points out that a subsequent decision (in the North Sea Continental Shelf Cases) by the International Court of Justice held these rights in respect to the Continental Shelf.

"constitute a natural prolongation of the coastal state's land territory into and under the sea . . . , by virtue of its sovereignty over the land, and as an extension of it in an exercise of sovereign rights for the purpose of exploring the seabed and exploiting its natural resources".

The recent application by Canada of the fisheries closing-lines concept has as its basic objective to regulate and manage the Canadian fisheries more effectively and to bring the contiguous seas within Canadian jurisdiction (territorial Sea and Fishing Zones Act (1964)). It seems clear that as the coastal state asserts its power to protect its legitimate interests in its territorial seas a clearer legal managerial and operational definition of the coast zone must emerge.



SOURCE: FISHERIES OF CANADA

ENVIRONMENT CANADA

## Man's Choice — Folly or Wisdom

One cannot wait for the results of long-term research to take action. Much is already known about the effects of specific polluting agents in fresh and salt waters, the exhaustion of natural resources and the need for recreational areas for man's use. Specific aspects of these areas require urgent administrative and political action. There are, to name a few, the treatment and disposal of industrial and municipal wastes, the need for clean water for domestic, recreational and industrial use, the control of industrial smog, and the reclamation of wasted land. Because environmental decay is present in numerous forms, the attack on pollution requires concerted action on a number of different fronts. In this regard, the Canada Water Act (1970) is viewed as waging the anti-pollution battle in non-coastal waters. The Act is based on comprehensive regional planning and management by municipal, provincial and federal agencies acting cooperatively.

The sea resources are perhaps more vulnerable than the land resources. Intensive fishing pressures have reduced groundfish stock to an alarming point; fleets of a dozen nations fishing cod are primarily responsible for the declining catches of the inshore Labrador and Newfoundland fishermen<sup>9</sup>.

Maximum sustainable yield for cod over the Grand Banks is thought to have been passed in 1968; others believe the catch is within 10 or 20 per cent of the maximum sustainable yield. Redfish appear to be within 15 per cent of the maximum sustainable yield. Severe depletion of haddock stocks brought the first application of an international agreement (1969); fishing haddock on the Georges and Browns Banks was banned during March and April. The International

Commission for the Northwest Atlantic Fisheries has recommended a closed season for red and silver hake in the southern part of the Convention area. The current volume of landings on Canada's east coast is so close to the maximum sustainable yield that increased demand would most likely aggravate the supply shortage; future increase appears to rest with species previously not fully exploited.

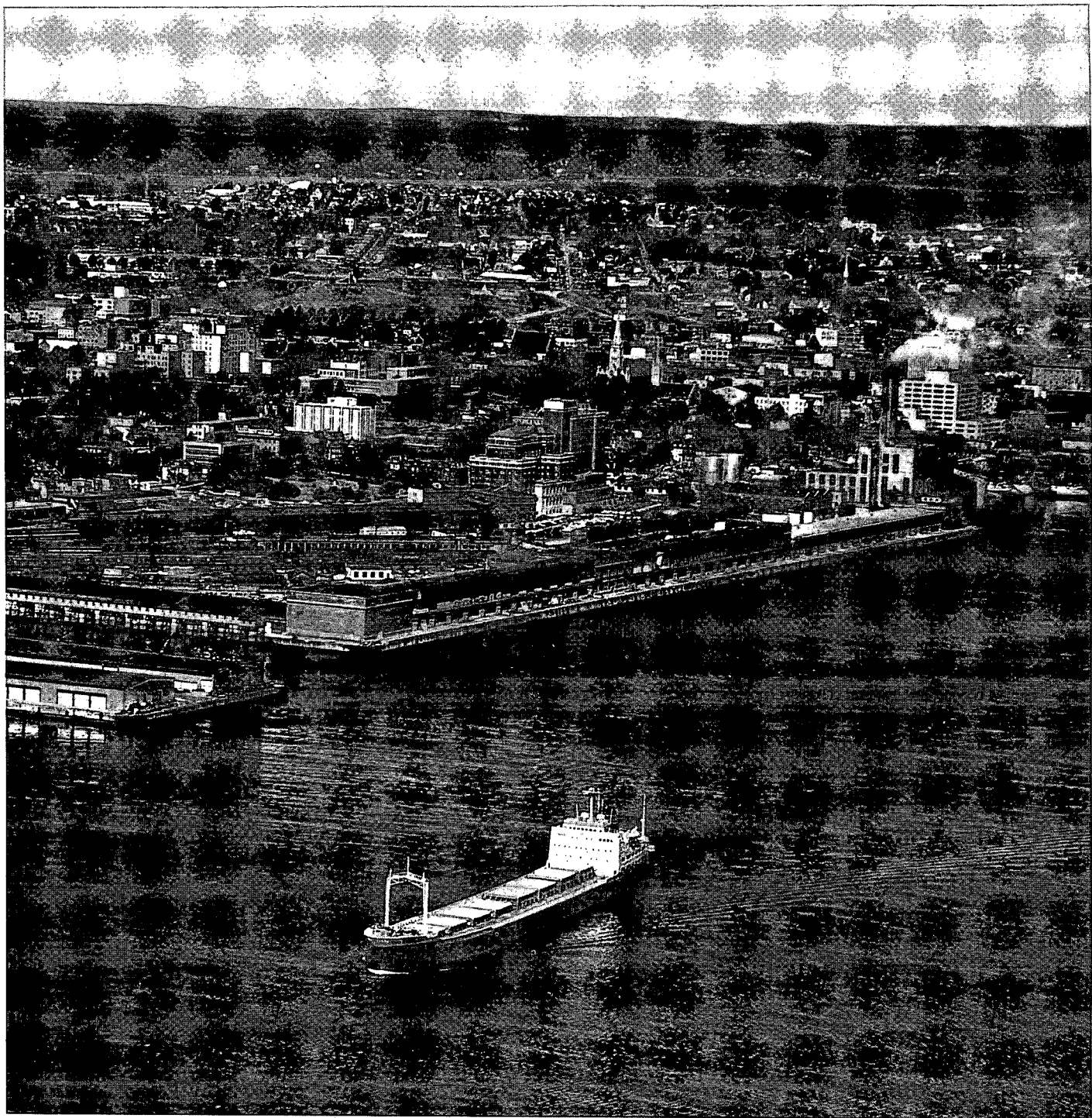
In the pelagic fisheries, high seas fishing fleets have increased the catch of Atlantic Salmon to a point that is causing national concern for stocks which originate in streams of the Atlantic Provinces and New England; Canada has recommended that fishing for salmon outside national fishing limits be prohibited. Evidence that herring catches had reached the maximum sustainable yield in the Bay of Fundy resulted in an immediate freeze (May 1970) on the catching capacity of Canada's Atlantic herring-fishing fleet; future potential is promising if utilization is shifted from livestock feeds to human consumption.

The swordfishery was closed to American and Canadian fishermen (1971) because of severe mercury contamination. In the shell fisheries the landings of lobster and scallops are considered close to the maximum consistent with conservation of the stocks; it is one of inflexible supply. The closing of oyster and clam beds, resulting from polluted waters, continues; few beds have been re-opened. The rapid expansion of the recently developed queen crab and pink shrimp fisheries carries the warning that fishing output must be related to the availability of the resource.

An examination of catches of the Atlantic Provinces from 1949 to 1968, by species, reveals a familiar pattern in the pursuit of new commercial species — a rapid rise in landings, followed by a plateau of variable duration, followed in turn by a decline that may taper off to economic insignificance.

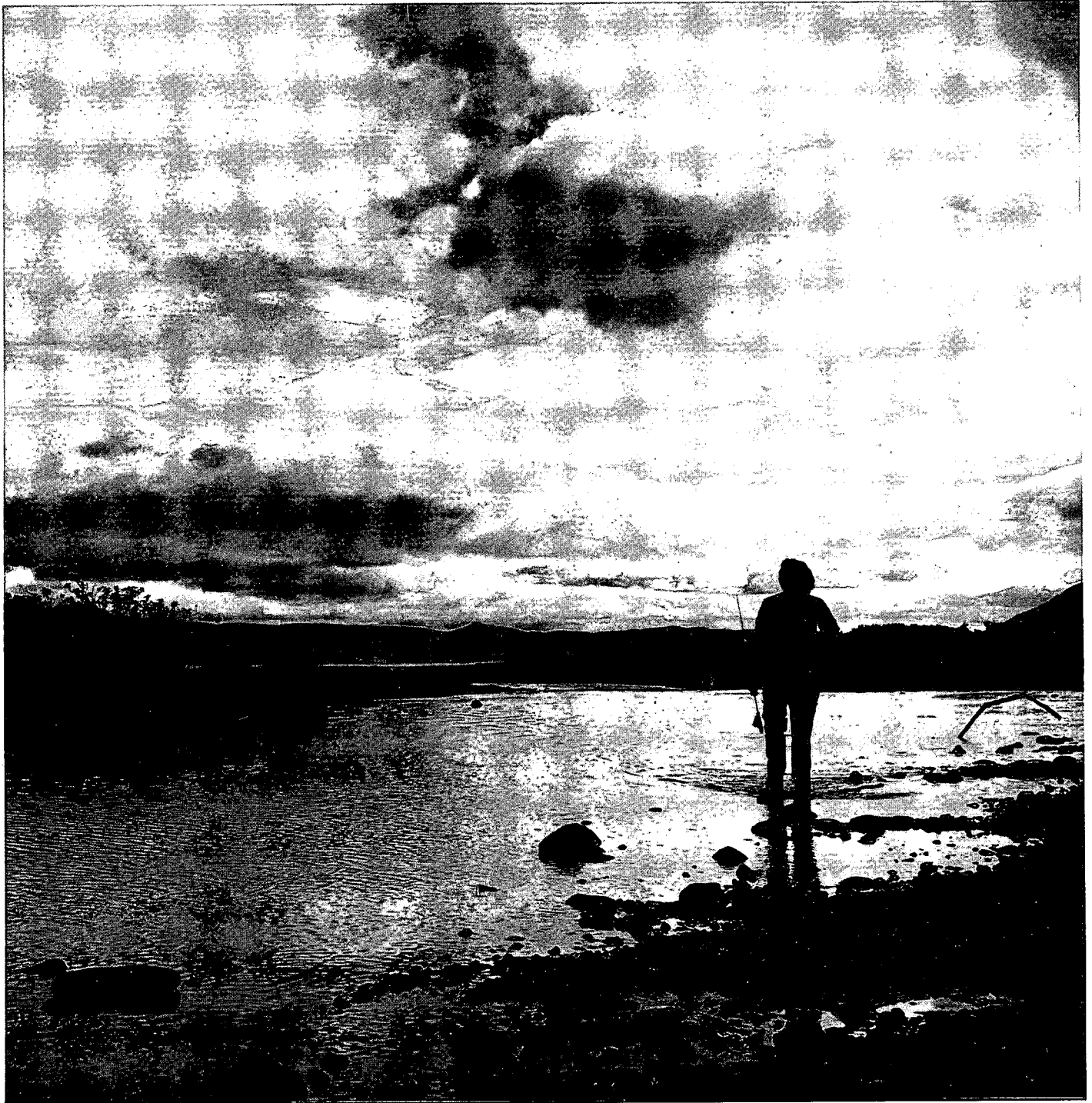
<sup>9</sup>The total foreign catch taken over Canada's Continental shelf in 1969 was 14 times that of 1958. The Labrador and Newfoundland inshore fishermen's catch has been cut roughly in half since the 1950's; over-fishing has occurred in important areas off Newfoundland and Labrador and entire species are in danger of extinction. "Fisheries of Canada" Vol. 23, No. 3, p. 21, February, 1971.

No one could foresee that events set in motion by the needs of the growing city – and beyond it a host of national and international commitments, would give rise to serious environmental problems.





Environmental concern is a new force to be reckoned with in regional planning and development; it is concerned with environmental quality and the quality of human life.





Hon. Jack Davis notes that the protection of the marine resources from water-borne pollution will come under the anti-pollution provisions of the amended Territorial Sea and Fishing Zones Act. As the problems of environmental deterioration and exhaustion have reached global proportions, does it not follow that the next step is cooperation and coordination among nations at the international level to put the global house in order?

The viewpoint inherent in this study is that there was no conscious direction shaping the growth of the city; there was no vision of the future city and its hinterland as the dwelling place of man. No one could foresee that events set in motion by the needs of the growing city, and beyond it, national and international requirements, would give rise to serious environmental problems. Resources unlimited was the accepted view — land was abundant and the seas teemed with an inexhaustible supply of fish. The socio-economic forces operating in society were not understood; the city sprawled and the sea and land resources dwindled.

People have become aware that government programs to alleviate poverty and distress and to direct urban and economic growth have produced disappointing and ineffective results. According to Forrester (1971), man does not have the mental skill to interpret the dynamic behaviour of complex social systems of which he is a part; man must resort to the use of models. Given a stated set of assumptions and using realistic models of his social system, he can use the computer to trace the consequences without doubt or error. Although man will be confronted by the tug of vested interests, social stress, and economic, political and environmental pressures, the use of models must become a powerful aid in future decision and policy making and in the future management of his resources.

The history of resource utilization in this region

and on this continent has been marked by a ruthless exploitation of environmental resources for the affluent element of society and for economic growth. Three authors who discuss clearly and lucidly the interrelationships and the consequences of environmental deterioration are Wright (1932), Whitaker (1946) and Vogt (1948).

In recent years informed individuals and groups concerned about the visibly deteriorating environment have been questioning the concepts and values of continuous economic growth. An annual growth rate of 5 per cent compounded for 100 years would increase the GNP 250 times. A new humanity, which rejects the laissez-faire concept of the use of resources, has emerged; it is concerned primarily with the quality of human life and with environmental quality and stewardship.

Modern technology is viewed as a tool that may be used for the good or ill of mankind. Whether it be the deepening of a navigational channel in an estuary, the extension of an arterial road through an urban residential area, or the use of chemicals on pests in the hinterland, the importance of controlling technology is recognized.

Confronting planners and administrators of the future is that perennial dilemma of how to maintain the unique qualities of the marine and littoral environments, and, at the same time, raise economic expectations in such areas where widespread inequalities of education, income, and opportunities exist. Researchers, planners and politicians of the future will be confronted by the task of treating the interrelationships of the hinterland, the shore zone and the off-shore environments as a unified entity in the interests of society.

Environmental concern has emerged as a powerful force to be reckoned with; its impact on the planning

## Conclusions

process, on regional and national economic development seems destined to become increasingly significant in future decision-making. The recognition of causal determination of human behaviour, which Lorenz suggests is urgent, may be the operational concept of environmental management of Water Street at the century's end.

It has been noted that much of the research in the Atlantic region has been highly fragmented, probably much is duplicated; much is uncoordinated and devoid of direction through a lack of regional and national priorities. Much of the information noted in this paper may be grouped into several broad areas for research, planning and political action.

- A. A water management program, to include both salt and fresh water resources assumes technical skills and the managerial capacity to measure and manage wastes and water quality, to determine and to apply water quality requirements for domestic and industrial uses, to assure environmental protection and to maintain the health of all ecosystems, and to provide support for the development of monitoring systems on a continuing basis so that basic principles, applying to both water and land environments, may be developed.
- B. The land segment cannot be divorced from the water segment of the coastal zone; thus, there is a pressing need for coastal and estuarine zoning for present and future use of the shore-zone, the inshore waters, and the hinterland, rehabilitation and management of renewable resources of the zone, and the determination of the industrial-mix to meet the socio-economic aspirations of the people of the Atlantic region.
- C. The great social and economic importance of manufacturing and commercial services, the use of renewable resources of the region such as farming, fisheries, forestry and recreation, and the distribution of towns and cities in the Atlantic region indicate the need for a coastal-zone management agency. The agency should be oriented toward a metropolitan-system concept thereby assuring political representation, and thus administrative and political decisions in the interests of the public welfare.

The coastal zone, because of the special relationships of land, sea and air, is an ecological entity. It is a unique combination of physical resources on one side and a unique combination of cultural opportunities on the other. Man's access to the oceans and to their resources takes place in the zone. Management of the oceans and development of their resources can begin only from the land-water interface. This fact presents man with the most critical constraint in coastal development; it presents him also with his most challenging opportunity.

The coastal zone is faced with special problems; its seaward side is a common-property resource and its landward side a complexity of private-property units. Common-property and private-property concepts co-exist in the zone but provide no common bond on socio-economic grounds. Water Street is the undisputed guardian of the concept of private property. The area is confronted by serious social, economic, political and institutional conflicts among private and public users. Each, contending for the many diverse resources of the zone, contributes to a multiple-use concept which in itself tends to conceal the underlying conflicts.

Without adequate policies, the oceanic environment, the coastal zone of estuary, beach and shore, and the hinterland of lake, river and forest, cannot be maintained as viable environmental assets. Past mistakes may be excused on the grounds that Water Street did not comprehend the significance of the processes at work — but today man is better informed. An ever-expanding body of knowledge testifies to the far-reaching extent of environmental degradation. Thus, to be successful, policies designed for the management and use of coastal resources must call upon the combined efforts of an interested body of people — in particular the analytical skill of the researcher, the awareness of the concerned citizen, the guidance of the policy-maker and the business acumen of Water Street.

In recent years informed individuals and groups concerned about the visibly-deteriorating environment have been questioning the concepts and values of unrestricted economic growth. A new humanity which rejects the laissez-faire concept of the use of resources has emerged, a humanity concerned primarily with the quality of life and with environmental stewardship. There is a deep-rooted awareness that the concept of unrestricted economic growth is, or seems to be, in conflict with concern for the environment and the quality of life. The need for a rapport between the two concepts in realistic terms is recognized.

## References

- Bader, R.G. 1969. "Mineral Scavenging and Marine Pollution," Civil Engineering in the Oceans (II), ASCE Conference, Miami Beach, Fla., pp. 1-9, Dec. 10-12.
- Bible. Authorized King James Version.
- Black, W.A. 1961. "Gulf of St. Lawrence Ice Survey, Winter, 1961," Geographical Branch, Department of Mines and Technical Surveys, Geog. Paper No. 32, Ottawa.
- "Canada Water Act." 1970. 18-19 Elizabeth II, C. 52, Queen's Printer, Ottawa.
- Cronin, L.E. 1967. "The Role of Man in Estuarine Processes," Am. Assoc. for Advancement of Science. Pub. No. 83, Washington, D.C.
- Department of Fisheries and Forestry, 1970. "Sub-Committee Report to the Interdepartmental Shellfish Committee," Ottawa, App. XI, March 11-12.
- Dickie, L.M., and J.C. Medcof, 1963. "Causes of Mass Mortalities of Scallops in the Southwestern Gulf of St. Lawrence," J. Fish. Res. Bd of Canada, Vol. 20, No. 2, pp. 451-482, Ottawa.
- Economic Commission for Europe, 1967. Criteria for Location of Industrial Plants, E/ECE/652, United Nations, New York, p. 13.
- Elson, P.F. 1969. "Threat of Industrialization to Canada's Atlantic Salmon," Fisheries of Canada, Vol. 22, No. 5, November.
- Farlow, J.S., L.M. Klashman, and M.S. Hohman, 1969. "Water Pollution in the Continental Shelf," Proceedings Civil Engineering in the Oceans (II), ASCE Conference, Miami Beach, Fla., pp. 1233-1239, Dec. 10-12.
- Forrester, Jay W. 1971. "Counterintuitive Behaviour of Social Systems," Technology Review, pp. 52-68, January.
- Forward, C.N. 1960. "Shoreline Changes in Egmont Bay and Bedeque Bay, Prince Edward Island," Geographical Branch, Department of Mines and Technical Surveys, Geog. Paper No. 26, Ottawa.
- Gallagher, T.P., and J.E. Hogan, 1969. III "Water Quality Considerations in Estuarine Development," Proceedings Civil Engineering in the Oceans (II), ASCE Conference, Miami Beach, Fla., pp. 230-245, Dec. 10-12.
- Griffin, Wm.L. 1969. "Nature and Bases of Jurisdiction in Ocean Space". Marine Geodesy - A Practical View. A Second Symposium on Marine Geodesy (Sponsored by Marine Technology Society), pp. 275-289, Nov. 3-5.
- Gulf University Research Corp. 1969. "Case Studies of Estuarine Sedimentation and Its Relation to Pollution of the Estuarine Environment," for Water Pollution Control Administration, Washington, D.C.
- Gunnerson, C.G., R.P. Brown, and D.D. Smith, 1969. "Marine Disposal of Solid Wastes," Proceedings Civil Engineering in the Oceans (II), ASCE Conference, Miami Beach, Fla., pp. 249-267, Dec. 10-12.
- Kristjansson, Leo. 1969. "The Ice Drifts Back to Iceland," New Scientist, Vol. 41, No. 639, p. 508, March 6.
- Kristol, Irving, 1967. "The Quality of Life," Task, Ontario Department of Labour, Vol. 2, No. 3, pp. 15-18, Toronto.
- Lorenz, Konrad, 1968. "On Aggression" (Translated by Marjorie Latzke), pp. 189-202, Methuen & Co., London.

Medcof, J.C. 1961. "Oyster Farming in the Maritimes," Fisheries Research Board of Canada, Bull. No. 131, Ottawa.

Mitchell, R. 1969. "Biological Control of Intestinal Bacteria and Viruses," Proceedings Civil Engineering in the Oceans (II), ASCE Conference, Miami Beach, Fla., pp. 1241-1249, Dec. 10-12.

Montreal Engineering Co., 1969. "Maritime Provinces Water Resources Study, Stage 1, App. X Waste Disposal," for Atlantic Development Board, p. iv, January.

Ruggles, C.P. 1970. "Atlantic Salmon in Danger: Excerpt." Globe and Mail, Toronto, July 31.

Russell, C.S. 1969. "Application of Mathematical Economics in Marine Resources Research," The Law of the Sea: National Policy Recommendations, Proceedings Fourth Annual Conference of the Law of the Sea Institute (Ed. Lewis M. Alexander), University of Rhode Island, Kingston, R.I., pp. 517-527, June 23-26.

Shaw, G.G. 1970. "N.B. Environment in Danger Warns Conservationists," Campbellton Tribune, N.B., August 5, 1970. (Refers to report prepared by Shaw for the Conservation Council of New Brunswick).

(Sou' Wester, 1970) Editorial, "Water Pollution Hits Fish-Processing Industry," The Sou' Wester, Yarmouth, N.S., August 15.

Tarzwel, C.M. 1969. "Waste Management in the Marine Environment," Proceedings Civil Engineering in the Oceans (II), ASCE Conference, Miami Beach, Fla., pp. 477-485, Dec. 10-12.

Territorial Sea and Fishing Zones Act (1964) 13 Elizabeth II, C. 22, Queen's Printer, Ottawa, (as amended).

Wastler, T.A., and H. Berkson, 1969. "Water Quality Monitoring for Pollution Control on the Continental Shelf," Proceedings Civil Engineering in the Oceans (II), ASCE Conference, Miami Beach, Fla., pp. 249-267, Dec. 10-12.

Wastler, T.A., and L.C. de Guerrers, 1968. "National Estuarine Inventory - Handbook of Descriptors," U.S. Department of the Interior, Washington, D.C.

Weinberger, M.L., and E.C. Ford, 1958. "Protecting Watersheds - Ways and Whys," Land the Yearbook of Agriculture, 1958, p. 361, U.S. Department of Agriculture, Washington, D.C. 1958.

Whitaker, J.R. 1946. The Life and Death of the Land. Peabody Press, Nashville, Tenn.

Williams, J.L. 1970. "Project to Eliminate Pollution from Shediac Bay Given Approval," Telegraph-Journal, Saint John, N.B., July 15.

Wright, F.L. 1932. The Disappearing City, Stratford Press Inc., New York, N.Y.

Vogt, W. 1948. Road to Survival, Sloane Associates Inc., New York, N.Y.

Environment Canada Library, Burlington



3 9055 1017 3259 1