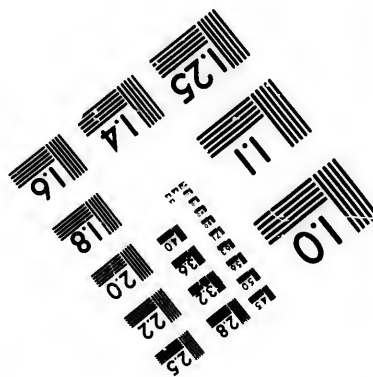
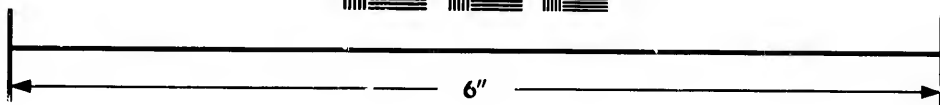
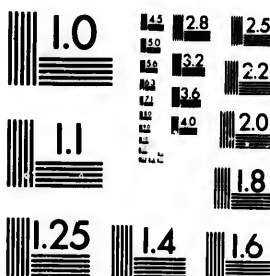


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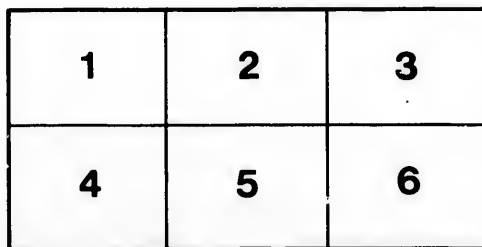
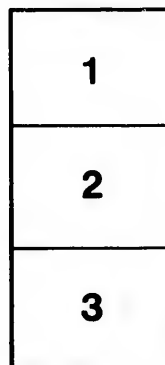
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## SPECIAL REPORTS

ON

I.—The use of Seines in Inland Waters

II.—A Marine Scientific Station for Canada

BY

PROFESSOR E. E. PRINCE

Commissioner of Fisheries

1894



## SPECIAL REPORTS.

No. I.—ON THE USE OF SEINES IN INLAND WATERS.

By PROFESSOR PRINCE, COMMISSIONER OF FISHERIES.

Among many measures that have been taken for the preservation of the fish wealth of our inland lakes and rivers, the establishment of close seasons, affording protection to breeding fish, the liberal stocking of waters with fry from the Government hatcheries, and the regulation of modes of fishing by mesh restrictions and the like, have proved of direct and substantial benefit. Without such regulations our vast fresh water fisheries would already have been wholly depleted. Canadian fishermen on the lakes readily recognize the value and utility of the fishery laws of the Dominion, and an eminent United States authority\* testified not long ago to "the greater prolificness of the Canadian waters at the present time in whitefish and trout" when comparing the north and south shores of Lake Ontario.

It cannot be denied that measures still remain to be taken to further aid in the recuperation of our fisheries. While protecting full grown fish when about to spawn it is forgotten that protection, too, is necessary for the fry, when newly hatched and during the first months of their existence. The destruction of very young and immature fish which were of little or no value to the fishermen, is a source of danger.

The fact needs no demonstration that our fisheries really ultimately depend upon the welfare and abundance of young fish. Anything detrimental to them in their early and defenceless stages affects injuriously the fisheries as a whole. If the young be injured or destroyed the supply of adult fish in the future will diminish or cease. Artificial fish-culture, moreover, being carried on upon an extensive scale and vast quantities of young fry deposited annually, these cannot adequately benefit the fisheries if the liberated schools are disturbed or devastated. Scientific observation has shown that the minute and defenceless fry of the greater number of valuable fishes, freshwater and marine, resort to comparatively shallow water during the first months of their existence. The surface of the sea in certain areas has been found to be alive with swarms of delicate young fish, and the shallow waters in our lakes and rivers are the favourite haunt of multitudes of young. This is so for many reasons. The light and warmth necessary for rapid growth are furnished there. At greater depths the water is cold and comparatively dark. Further, safety from the attacks of larger fish is better secured than in deeper water. Some fish are found to prefer shingly beaches, where pebbles abound, affording crevices for shelter when danger is near; others choose a smooth sandy bottom, especially in sheltered bays and creeks, over which they roam in search for minute food, chiefly infusorians, minute crustaceans, molluscs, &c. The schools of diminutive fish in such regions are of the most varied character including worthless as well as valuable species. A fine-meshed naturalist's seine, used in Lake Erie, captured in one haul, very small bass, lake herring, pike-perch or pickerel, and various kinds of suckers and shiners. At certain seasons the shores swarm with small lake herring in the post-larval stage, somewhat larger and more active than the delicate and helpless larval stage. Fishery Overseer Boismier (Detroit River Division) refers\* to the abundance of young fish in the shallows of Detroit River and Lake St. Clair. "It is stated," he says, "that millions of young fish are destroyed by parties seining for minnows in shallow bays." It is also said that

\*Dr. Hugh M. Smith, Bull. U. S. Fish Commission, 1890 p. 185.

\*Report of the Department 1890, App. G., p. 191.

spawn is at times dragged ashore by the seine; but such masses of spawn are probably dislodged by storms, and as a rule the seine will not interfere with spawn, unless in localities chosen by the various kinds of bass.

It is precisely such shallows as those here referred to, with beaches of sand or pebble, in which seining is carried on. The net is, as it were, thrown around the fish within a short distance of shore, and is pulled to land. Before being hauled in both ends are secured on shore, and the net forms a complete inclosure, capturing everything within its sweep and extending in some cases as much as 1,000 feet, with 12 feet depth in the middle, though the dimensions are often less than these. Captures in the seine are of a very varied nature, and as the meshes are loose, and not usually fully open, as in a fixed net, like a pound, many fish are entangled which are of no value for market purposes. Young fish, included in this mixed catch, are mostly injured, and may be thrown ashore as useless. Further, the constant use of seines, sweeping over the shallows, has a very unfavourable effect on the shoals of small fish. They are disturbed in their migratory movements and driven into deeper water, where they are exposed to the attacks of larger fish. Indirectly, as well as directly, the schools of fry are injuriously affected. Professor Ramsay Wright has referred\* to the capture of immature whitefish by herring seine nets, and pointed out that the surplus fish are used as manure when the market is glutted. Similarly, Dr. H. M. Smith,† in his report already referred to, speaks of ground where whitefish formerly spawned in considerable numbers and, where the young now appear to congregate at times, on which quantities are taken for bait, measuring  $1\frac{1}{2}$  to 3 inches long. The fishermen when using the seine can hardly know the extent of injury they inflict; for when very young, our valuable good fishes are transparent, minute, and almost invisible in the meshes of the net.

That valuable fry are thus disturbed, injured and destroyed, there can be no doubt. It is impossible to avoid this where seining is carried on. But the destruction of the young of inferior species, usually regarded as worthless, is most harmful. These small fishes, or minnows, are the favourite food of pike-perch or pickerel, salmon-trout and other predaceous fish. The abundance of these more valuable kinds depends largely on the abundance of smaller varieties on which they largely live. The term minnow applied to these small fishes is used indiscriminately and embraces nearly twenty species, including some of the more valuable food fishes.

As compared with the fixed pound net, inshore, through the meshes of which the very small fry mentioned readily pass without injury, or again, with the gill-net hanging with fully extended meshes in deeper water, the seine is by far the most injurious from the point of view here considered.

\*Rep. Ont. Game and Fish Comm., 1892, p. 469.

†Bull. U.S. Fish Comm., 1890, p. 210.

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## No. II.—A MARINE SCIENTIFIC STATION FOR CANADA.

By PROFESSOR PRINCE, COMMISSIONER OF FISHERIES.

At the request of the Minister of Marine and Fisheries the following report has been prepared embodying certain suggestions touching the foundation of a Marine Laboratory for the Dominion.

There is a growing feeling prevailing that our country, which in so many respects has taken a leading place among the nations in regard to fishery matters, especially in the administration of judicious fishery laws and regulations, and the accomplishment on an extensive scale of practical fishery objects such as artificial fish culture, should take a position of equality with other countries in the furtherance of marine and fresh water biological research. Proposals, indeed, have from time to time been made in this direction, and professors in our universities, as well as practical fishery authorities, have given strong expression to views in favor of a biological station for Canada, on the lines of such institutions in other countries. A period has now been reached, it may be justly claimed, when such a suggested scheme should assume practical shape.

Possessed, as the Dominion is, of perhaps the richest and most varied fisheries in the world, the exemplar to other countries in her elaborate system of fish propagation for the replenishment of the great lakes and rivers, and a pioneer in the hatching of that valuable crustacean, the lobster, it is not surprising that the necessity is now perceived for an institution devoted to the accurate investigation of fishery problems, the elucidation and final settlement of perplexing questions which have baffled practical men, the collection of exact observations on the food, habits, and life-history of fishes, and the accumulation in this way of useful scientific knowledge in order to promote the prosperity of our coast and inland fisheries.

There are few civilized countries which have not already established such institutions. That their value is appreciated is clear from the policy of Germany, which, notwithstanding her limited coast line, has several marine laboratories, and no sooner became possessed of Heligoland, so long a British possession, than a marine station was founded there by the German Government and equipped with all the appliances for aiding the fisheries of that empire.

Directly or indirectly under the auspices of the British Government, about half a dozen marine stations carry on valuable work on different parts of the English and Scotch coasts, at Plymouth, St. Andrews, Dunbar, Grimsby, Millport, and other places, while the splendidly equipped laboratories of the United States, France, Italy, Holland, New Zealand, Australia, and other lands are famous. These have made valuable contributions to our knowledge of fish and fisheries in various parts of the world. Why should the Dominion be unable to do her part in this great work? Is it because Canada offers less field, or has fewer difficult problems to solve in connection with her fisheries? On the contrary, it is no exaggeration to say that the work done in other countries could be far surpassed by Canada, and that our waters offer unparalleled opportunities for scientific research, with the certainty of abundant and valuable results. Prolific as our fisheries are, the infinitely varied character of our maritime resources has yet to be fully understood and developed, while legislation in regard to the fisheries would be no longer hampered by difficulties and drawbacks, were a body of scientifically ascertained knowledge available.

Sir William Dawson, Mr. J. F. Whiteaves, and their colleagues, by their investigations in the Gulf of St. Lawrence, and Professor Ganong and others by researches in New Brunswick waters, have shown what a promising field for investigation exists. But the fact that year after year professors and bands of students from the United States resort to Canadian shores to carry on marine studies, preferring our prolific waters to their own, clearly proves, if proof were needed, that a Marine Station in Canada would be able to accomplish great results



The late Professor Moseley, of Oxford, naturalist on the famous "Challenger" expedition, once declared his conviction that no fisheries could be carried on with adequate success and regulated with security unless a scientific knowledge of their conditions and character had been obtained by the researches of scientific observers. "I do not think," he declared, in London, March 31st, 1884, "that any investigation not of a strictly scientific character is of much value with regard to practical results. It is only by the most thorough scientific work that we shall ever arrive at the increasing, for example, of our supplies of oysters and lobsters." Professor Moseley had almost unequalled opportunities, during the cruise of H. M. S. 'Challenger,' for gaining an insight into the life of the sea in the most diverse regions of the globe, and it was clear to him that for the safety of the fishing industries themselves, and for the prosperity of those engaged in them, a thoroughly accurate knowledge of the conditions of life in the waters, the growth, spawning periods, and migrations of the more valuable fishes was of paramount importance. If it be the duty of Government to protect and foster the fisheries in all legitimate ways, it is equally the duty of Government to investigate the causes which render such protection necessary, and to establish sure and unquestionable grounds for action.

An opinion has prevailed to a lamentable extent that fishery questions are all purely practical, and the less that science interferes the better. But no greater error is possible. Year after year perplexing problems and difficulties have arisen in connection with the fisheries, and in order to get at the facts and causes involved, commissions of inquiry have been instituted. Such commissions have collected the views of various parties, and, on the opinions obtained, have often taken action. But opinions vary. There is hardly any unanimity, amongst those chiefly interested, upon any fishery question, and the views expressed are often so opposed to each other, that efficient action in the way of legislation has not been possible. Protective laws, regulations as to close seasons, restrictions as to traps, nets and methods of fishing, can never be satisfactorily framed if based merely upon opinions and the varied views of those interested. Men engaged in chemical industries, in engineering, farming, &c., have sought the help of science and received practical aid of the utmost value. Why should the fisheries not receive similar aid from science, and make progress under the reliable guidance of accurately ascertained knowledge? The migrations of fishes, the fluctuations observed in their abundance from season to season, their reduced numbers, or in some cases, total disappearance in certain areas, and their unexpected appearance or increased abundance in other waters, are at present largely matters of conjecture. But such movements, and such decrease or increase in the quantity of fish depend upon causes which can be discovered, and their discovery would place in the hands of fishermen the power to carry on their work to the best advantage and not by mere chance or luck. Observations on the abundance and nature of the food on the floor of the sea would no doubt be a certain guide to the movements of fishes, while changes of temperature at the sea bottom, and other conditions are of great importance. Professor McIntosh, a leading European fishery authority, has shown from laborious investigations conducted at St. Andrew's Marine Laboratory, Scotland, that with the progress of the year there is a regular sequence in the kinds of animals which people the waters of the sea in certain areas. These animals afford food for the fishes, young and adult, and that the abundance and character of the food directly affects the numbers and kind of fish frequenting certain waters needs no demonstration. Each month, indeed, seems to be characterized by the appearance of special forms of marine life. This fruitful field of investigation has never yet been entered upon in the waters of the Dominion. The first steps have yet to be taken in this and a host of other lines of study. The foundation of a marine station upon the coast would render possible the prosecution of such necessary researches. The individual efforts of naturalists can never lead to the rapid accumulation of facts necessary to a science of the Canadian fisheries. Only a properly equipped marine station can accomplish fruitful results. It would form a centre of operations whence systematic work could be carried on; where by appropriate appliances and instruments, with the

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skilled aid of officials, the results could be put into shape for the service of the public. Legislation has done much in regard to the fisheries, but it has often proceeded somewhat hazardingly and without a trustworthy basis of knowledge. Hence conflicting regulations, alterations and amendments have too frequently followed. Special forms of fishing apparatus have been encouraged, others discouraged or prohibited, while the meshes of the various nets have been altered, according to law, at different times. Such legislation may have worked harshly in many instances, though on the whole it has been admittedly beneficial, yet no adequate experiments have ever been carried on with the object of demonstrating for instance the actual effect of mesh regulations. On the one hand, it has been argued that the size of mesh has little effect upon the capture of particular sizes of fish, in the case of certain species; while on the other hand the opposite view has been just as strongly urged. It is patent that such disputed questions could readily be settled by experiments carried on at a scientific station and an unquestionable basis of proved facts provided for future legislative action. Scientific investigations carried on by competent experimenters, would decide, once and for all, these debatable matters. The comparative efficiency, destructiveness, and wastefulness of various methods of fishing, could be ascertained in the same way. Other work would fall within the scope of a marine station, all having a most direct bearing upon the practical and mercantile aspects of the fishing industries. The investigation of the resources of the various areas along the lengthy coast of the Dominion, the thorough examination of extensive regions of the sea bottom and the determination of fishes and special products, peculiar to these various regions, are calculated to place in the fisherman's hands precisely the information which will be most valuable to him. Such knowledge directs him to new and unsuspected grounds, saves him from fruitless trials of unproductive areas, and may even bring before him valuable fishes of whose value and abundance he was not aware. The deterioration of areas once productive, the partial or total disappearance of certain fish, these and other problems can only be solved by the accurate and systematic work carried on from some central station on the coast. The results of such investigation show the causes of deterioration and may lead in some cases to practical methods of restoration to former productiveness. The introduction of new species of great market value and the creation of new industries is one of the readiest and most apparent ways in which science is able to benefit the fisheries. The nature of the food, the conditions of breeding and embryonic life, the presence or absence of enemies and hurtful influences, in short, all the conditions influencing the welfare, growth, and increase of such transferred or newly introduced species, are matters for scientific investigation, preliminary to practical steps. The introduction of the European sole (*Solea vulgaris*) is one of the first experiments which would suggest itself, after the preliminary investigations had been completed. A trial has been made in the United States, but the results have not proved very satisfactory. No doubt many sandy areas, on our own coast, are well adapted for the experiment, and the English sole is now one of the most valuable of food fishes. The London market is being supplied from Norwegian and more distant waters, so inadequate is the supply obtainable in British waters. It is a species, like all the Pleuronectidae, extremely tenacious of life, and its value in the English markets is so high that the introduction of such a fish, if successful, would prove a source of wealth to the fishing population on our coasts. Soles could no doubt be conveyed alive to the London markets, for the voyage is little longer than that of the Norwegian boats, which at present carry on a highly remunerative British trade in this delicious and esteemed fish. But the experimental introduction of new fishes, ranking high in economic importance, is secondary to the full development of the fishing resources of our waters as they at present exist. There is every probability that the thorough and systematic investigation of the fauna of our Atlantic coast, carried on from such a Marine station as Canada ought to possess, would lead to the discovery of fishes of economic value at present existing in our waters though unrecognized and unappreciated. The anchovy has been recorded, though probably determined on insufficient grounds, on the Pacific coast of the Dominion. It is highly

probable therefore that this fish occurs in our Atlantic waters, and it is one of the most delicate and highly esteemed of our fishes. If so, a new and valuable industry would be readily opened up, just as in the smelt fishing recently developed in certain rivers in the Maritime Provinces. The value of the smelt was not appreciated until within the last few years and in such a river as the Miramichi the smelt fishery has risen to the position of a highly remunerative industry. From investigations pursued at the Plymouth Marine Laboratory it has been shown that on the south coast of England anchovies are plentifully captured in sprat and pilchard nets, and it has been pointed out by scientific workers at that laboratory that a regular fishery could be established. On the coasts of Holland, France, Spain and Italy, such an anchovy fishery has long been carried on with profit to the fishermen. The anchovy migrates and schools much after the fashion of the mackerel, and they are netted in a similar way, when coming into the shallow waters. Whether fishes of economic value such as the anchovy, the pilchard, the sprat &c., really inhabit our waters or not, cannot be decided in our present state of knowledge. At certain seasons vast schools of small fish, roughly classed as "Britt" or regarded as "Tinkers," invade particular portions of our littoral waters, and a thorough study of these smaller forms must yield important knowledge and throw light upon the productiveness and range of our fish supply. Recent fishery investigations have more and more clearly demonstrated that a knowledge of small fishes, whether small species i.e., distinct kinds, or merely the young of larger and familiar forms is of supreme value. And it is precisely of these smaller and often despised fishes that exact knowledge is most lacking. It is possible in a great degree to foretell the probable abundance or scarcity of fish in future seasons, from observations on the schools of young fish which make their appearance in certain areas. At present it is a matter of little interest to those whose living depends upon the prosperity of the fisheries, what the precise nature of these young fish may be, and their presence in the coastal waters has not been regarded as of much importance from a practical point of view. But it is not so. The studies of the scientific observer have proved the fallacy of this common opinion, and have established, beyond doubt, that these schools of fry directly and indirectly indicate a good or bad fishing season. Directly they do this because when these schools are carefully examined by competent authorities they often prove to be the fry of fish most valued as food, or again if not themselves the young of such fishes, they form a favourite food of esteemed kinds. In the warm summer months vast schools of minute fishes—one or two inches in length, occur off the Bay of Chaleur and further north. The local fishermen regard them as young mackerel, others as herring, others as cod and hake. As a matter of fact these important schools of small fry have never been studied by any observer, and of what kind of fish they really consist has never been decided. More than this, the work carried on in other countries has shown that we can never understand the fisheries, the conditions of their prosperity or decadence without a knowledge of the eggs and spawning grounds. Almost nothing is known of this great subject so far as Canadian waters are concerned. Nor can such studies be successfully carried on until a properly equipped basis of operations has been provided in a marine station where this work could be prosecuted. On the foundation of such a station these important problems would be attacked at once and much desired knowledge obtained.

Not only is a knowledge of the distribution and comparative abundance of the economic fishes in our waters needed, but the general conditions and the probabilities of success in stocking new waters, or it may be re-stocking depleted waters, require to be studied. The discovery of unnoticed or unknown species and the introduction of new and valued kinds are not only possible, but under scientific guidance may be matters of certainty. The capture of a new and valuable food fish, the tile fish, off the New England coast, in 1880, shows that useful kinds of fish may remain still to be discovered and that the treasures of our waters have not yet been fully made known by the operations of fishermen. Further, the extirpation of predatory kinds which destroy nets, food-fishes, and are a terror to the fisherman, would be a matter of study.\*

\* In 1892 myriads of voracious dogfish (*Acanthias*) appeared in the Bay of Fundy in the month of February.

A complete biological survey of the coastal waters of the Dominion is a great task, and could only be accomplished gradually. But such a work would fall within the operations of a marine station, and would be gradually pushed forward season by season until the physical conditions, the biological characteristics, the fauna and flora of every arc., wherein the fishing industry is prosecuted, are made known and are available for the guidance and information of those actively engaged in fishery pursuits. Other work of a highly practical nature would come within the scope of the proposed institution.

Methods of preserving and transporting fish, improved means of drying, salting, canning, and refrigeration—in short, all the modes suggested by science for conserving the best and most attractive elements of fish food, would be thoroughly tested, and new improvements, or novel and unsuspected methods made known. The growth within recent years of a vast industry which has proved a source of wealth to many districts, viz., the preservation of orchard fruits, is an indication of the success which may attend new methods of "putting up" economic products, and the preserving of fish in attractive marketable form is a line of industry in which very little progress has hitherto been made. The utilization of fish roe, livers, skins, and waste products, at present of comparatively small value, is a promising field there can be no doubt, if economical and ready methods be discovered of turning them to account. It remains to be seen how far existing modes can be improved, or new methods adopted, with a prospect of commercial success.

The preservation of fish on new plans is a most promising field, and one which could be without difficulty carried on experimentally in a marine station. No one acquainted with the incredibly rapid progress of the preserved fruit industry already referred to, the great strides which it has made in the Dominion, and on somewhat different lines in Great Britain, can deny that such methods, if applied to the preservation of fish, would mark a new era into the fisheries of our country. While the neatly packed products of the orchard and fruit garden find their way to the tables of all classes of the community in Britain, the United States, and other countries, and the canned lobsters and oysters prepared on our coasts are hardly less widely used, the roughly dried and salted fish of the Dominion are far less generally sought and used in our provincial cities and towns, and are unknown to a great part of the population in Britain. In appearance and comestible qualities, salt fish, dry and pickled, have not appeared to recommend themselves to English cooks and housekeepers. Yet the quality of our cod, haddock, mackerel and herring cannot be questioned—indeed it may be doubted whether the fish of any other waters are of equal excellence. Experiments leading to a superior and more attractive method of preparing and packing these fish would yield pecuniary returns more than proportionate to any extra trouble or expense in preparation. Such prepared fish would take possession of markets never yet reached by our fish merchants, and would prove much more lucrative than the coarsely prepared, and, to many, offensive, forms of cured fish, which at present are shipped to the South American, West Indian and other markets. Norway has made great advances in this direction and her attractively prepared fishery products, including many entirely novel foods, have already secured much favour in the British markets. The enterprise of Canadian merchants would not be lacking if experiments proved that new and superior methods of preserving fish could be readily applied in our own fisheries.

Science alone can afford sure ground for advance in the various lines of progress indicated in the foregoing remarks. The fisheries have largely stood aloof from scientific aid, or rather the means of scientific aid have been wanting, and its powerful influence in the way of prospering the fisheries has not been realized. But the benefits of fishery science are no longer matters of doubt, and all that is required is to afford means for pursuing exact scientific research, and for spreading amongst fishermen and others, actively engaged in the fisheries, the beneficial results of such researches and new knowledge.

It is important that a scientific fishery station should be centrally situated upon the coast, that the conditions of marine life should be favourable, so that

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materials for study would be at hand and obtained without difficulty or loss of time. Again, it should be within easy reach of areas in which important fisheries are carried on, that is to say, the fisheries in actual operation should be easy of access from such a station, in order that all the practical knowledge of the fishermen may be made available and suggestions or information conveyed from the scientific station to those engaged on the fishing grounds.

There are many points upon the Atlantic seaboard which might be recommended for such a marine station. The richness and varied character of the fauna in the more southerly shores of the Dominion cannot be lost sight of. To Passamaquoddy Bay and the prolific waters around Grand Manan and the Western Isles, scientific workers from the United States have been accustomed to resort season after season, and very valuable and substantial contributions to our knowledge of the sea's resources have been made by Canadian investigators in this area.

A location further north presents, however, many advantages. The lobster fishery, with the various perplexing and difficult questions connected therewith, is carried on upon the greatest scale there, and with a marine station in close proximity, the life-history, habits, migrations and breeding of that valuable crustacean could be thoroughly investigated. The mackerel fishery, however, is carried on at a most important period of the year in the more northerly waters, and the cod fishery, though not pursued to its fullest extent off Prince Edward Island, affords material for interesting and valuable investigations respecting the food, breeding, growth, and movements of the various members of the cod tribe, all of economic importance. Areas, with the most famous and prolific oyster beds extending over them, would be readily accessible from such a station; and the bays and inlets of the Quebec, and New Brunswick shores and north shore of Nova Scotia abound with smaller fishes, such as the smelt, capelin, etc., while the fry of various species occurring there require study in order to throw light upon the future development of the fishing industry. The fauna and flora may be less rich and varied than off the southern coast of New Brunswick; but that remains to be ascertained. Certainly points might be named in the northern area, bordering on the Gulf of St. Lawrence, which offer facilities most favourable for experiments on retaining young and immature lobsters in ponds until their defenceless stages are passed, and for repeating under strict scientific supervision, the work carried on with such apparent success in Norway by Captain Dannevig, whose achievements in rearing cod and other marine fishes to an advanced and robust stage are well known.

A marine station favourably situated and properly equipped has a great work before it in Canada. The lines along which that work would, without question, progress are infinitely varied, and no sketch, however full and comprehensive, can aim to do more than indicate their nature and direction. They all end in supremely practical results, and bear directly upon the welfare and prosperity of the great fishing industries. All who have been associated with fisheries in any way realize keenly the lack of accurate knowledge on the most vital and important points. Legislation has often been hazardous on account of this lack of ascertained fact and the existence of contradictory opinions. Primarily, a marine station would be a centre for investigation and research for the promotion and diffusion of knowledge. Without interfering with this first and most important work, such a station might be also a school for teaching and for scientific study. This latter line of work would enlist for it the sympathy and help in various ways of the universities, many professors and students from which might be expected to aid in the fishery investigation carried on. There is no field so fascinating and fruitful for the biologist as the sea, and distinguished zoologists and students would no doubt desire, as volunteer workers, to help in the investigations, viewing the fine opportunities for research as amply repaying them for their labour. In this way, directly and indirectly, fishery science would gain and the fisheries of the Dominion receive that light and knowledge which in various directions is greatly needed. No doubt pure scientific research, that is research with no direct practical end in view, must be carried on by private rather than public support, and the work of marine stations, like those in Scotland and elsewhere, must have sole regard to practical questions and utilitarian ends.

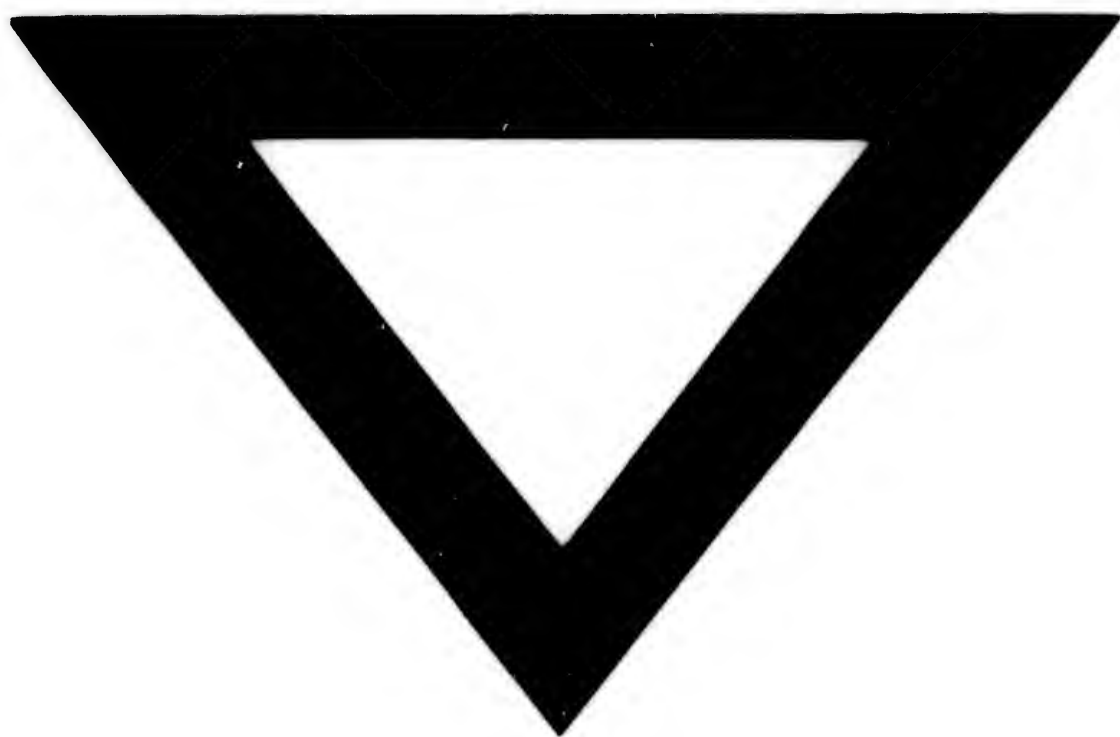
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In other countries the existence of marine stations has proved beneficial and has helped in wise and serviceable legislation without the risk of vexatious restrictions. They have shown in numberless instances that common opinion was wholly untrustworthy and that the evidence of those practically connected with the fishing industry was frequently far astray, and that commonly expressed views were the reverse of actual facts. Especially has this been the case with respect to the spawning and growth of marine food fishes. Government marine stations could no doubt rely for much aid upon certain of the cruisers engaged in the Fisheries Protection Service, but the main work of the station being of a delicate and precise nature must be carried on in the rooms of the laboratory. Apart from the work of collecting and making observations on the food, migrations and distribution of fishes, and the modes of capture, the more important results can be obtained only by laborious and prolonged work, with the aid of the instruments and books provided in the laboratory itself.

It is not too much to anticipate that the benefits resulting from the establishment of a marine station at some central point, but as indicated, would make obvious the necessity of others. The vast extent of coast and the varying character of the littoral waters would imply such a development of this work. Certainly a more northern and a more southern marine station in the future would promote the great work of thorough investigation. The value and extent of the lake fisheries, in a similar way, would call for an inland station, in order that the conditions of life in these vast inland seas might be better understood. Certainly the practical benefits of a more trustworthy knowledge of our marine and fresh water fisheries can alone lead to their prosperity and growth in the future. Holland has established a floating marine station which can be moved season by season from one point of the coast to another, and with one permanent marine station as a central institution, such subsidiary stations, migratory or otherwise, might be found useful as secondary adjuncts in a work so extensive.





## RINE AND FISHERIES.

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in the Atlantic seaboard which might be recommended the richness and varied character of the fauna in the Dominion cannot be lost sight of. To Passamaquoddy and Grand Manan and the Western Isles, scientific expeditions have been accustomed to resort season after season, and their contributions to our knowledge of the sea's fauna are Canadian investigators in this area.

It presents, however, many advantages. The lobster fishery, and the difficult questions connected therewith, is carried on in large scale there, and with a marine station in close proximity to the spawning and breeding of that valuable crustacean could be carried on. The mackerel fishery, however, is carried on at a most extensive extent in the more northerly waters, and the cod fishery, at the most extensive extent off Prince Edward Island, affords material for investigations respecting the food, breeding, growth, and habits of members of the cod tribe, all of economic importance. The oyster beds extending over them, would be of great value; and the bays and inlets of the Quebec, and New Brunswick, and the shores of Nova Scotia abound with smaller fishes, such as the fry of various species occurring there require attention for the future development of the fishing industry. The fishery is so rich and varied than off the southern coast of Nova Scotia that it is to be ascertained. Certainly points might be named on the Gulf of St. Lawrence, which offer facilities for research on retaining young and immature lobsters in ponds, and for repeating under strict scientific supervision with such apparent success in Norway by experiments in rearing cod and other marine fishes to which is now well known.

A station properly situated and properly equipped has a great work to do along which that work would, without question, and no sketch, however full and comprehensive, can give an idea of their nature and direction. They all end in supremely depending upon the welfare and prosperity of the great Dominion. We have been associated with fisheries in any way realize the importance of knowledge on the most vital and important points. It is a serious account of this lack of ascertained fact and opinion. Primarily, a marine station would be a base for research for the promotion and diffusion of knowledge. The first and most important work, such a station might be used for scientific study. This latter line of work would be carried on in various ways of the universities, many professors would be expected to aid in the fishery investigation carried on, and it would be so fruitful for the biologist as the sea, and distant waters would no doubt desire, as volunteer workers, to be engaged in the fine opportunities for research as amply realized. In this way, directly and indirectly, fishery science in the Dominion receive that light and knowledge greatly needed. No doubt pure scientific research, with a practical end in view, must be carried on by private stations, like those in Scotland, and the work of marine stations, like those in Scotland, regard to practical questions and utilitarian ends.

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