

A PROPOSED BIOLOGICAL SURVEY OF NEW YORK STATE.*

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In 1835, upon the motion of Charles P. Clinch, a representative from New York City, the Assembly passed a resolution directing the Secretary of State to report to the legislature at its next session the most feasible method of obtaining a complete geological survey of the state, including a scientific account of the rocks and soils, a list of mineralogical, zoological, and botanical productions, and the collection and preservation of specimens of the same, with an estimate of the expense of the undertaking. The report was submitted in January 1836, by John A. Dix, then secretary of state, and the act of April 15, 1836, authorized the project, the Assembly unanimously voting an appropriation of \$104,000.00 for the enterprise. In 1842, the expenditure of the additional sum of \$26,000.00 was authorized. Governor Marcy arranged the plan of the survey and distributed the several departments of the work among a corps of specialists. The report of the survey was published between 1842 and 1854 in seventeen huge quarto volumes with numerous plates, many of them being colored, under the title of the Natural History of New York. Five volumes were devoted to zoology, two to botany, one to mineralogy, four to geology, and five to agriculture. The survey has since been continued along geological and paleontological lines by James Hall and assistants, and by his successor John M. Clarke, the reports up to the present time filling eight large quartos and many octavos. The various specimens collected were used in part to constitute the state museum, some part of the remainder being distributed among the collegiate institutions of the state.

In the survey of 1836, many things which we now recognize as of vast scientific and economic importance received no attention whatever and it is largely to remedy this deficiency and to make our knowledge of the animals and plants of the state more extensive and complete that a new survey is proposed.

In the original survey the larger animal forms from the mam-

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mals down to the crustaceans were collected, identified, and described but the lower invertebrates were ignored. We have since come to appreciate the great importance of worms and entomostracans, for example, as food for fishes, and of protozoans in the sanitation of drinking water. The breeding habits and economic value of mammals, birds, reptiles, fishes, mollusks, insects and crustaceans were not investigated, but now we recognize the importance of these various animals as sources of food or clothing, or as beneficent or harmful agents in agriculture, horticulture, or fish-culture, in the rearing of domestic animals and in hygiene.

The botanical work of the survey was mainly the collection and description of the higher plants, the fungi, lichens, and algae not being taken into account. The importance of these forms in furnishing material for many of the strictly scientific problems of biology renders it highly desirable that systematic efforts be made to increase our knowledge of these plants, their distribution, mode of life and economic effects in agriculture, gardening, forestry, fish-culture, and the management of water supplies.

Since the establishment of the office of state botanist in 1867 and of state entomologist in 1882 reports have annually been made by these officers showing that much valuable work has been accomplished, by the former in noting newly discovered species and especially in describing and illustrating the edible and poisonous fungi of the state, and by the latter in investigations mainly upon insects of economic importance.

Then, too, lists containing more or less descriptive matter have been published by the state museum or are in preparation on the mammals, birds, fishes, reptiles and batrachians, mollusks, and crustaceans, but the most of these need revision and amplification, and cannot be made complete until more material has been collected and extensive observations made. The lower plants and animals have as yet received practically no attention; our knowledge of the higher forms is exceedingly incomplete, and of the great majority of aquatic organisms we know little or nothing.

Since the completion of our state survey important work of the kind contemplated has been accomplished in other countries and states by individuals working independently, or under the auspices of institutions, or for government purposes. Reference

will be made in the present instance only to what has been done in the investigation of inland waters. In a paper published by Professor H. B. Ward in *Science* a few years ago he showed that the most of the countries of Western Europe have each one or more permanent laboratories for the study of fresh-water organisms. Nearly twenty years ago Professor Fritsch, of the University of Prague, established a laboratory on the Black Lake, a small body of water in the Bohemian forest. Previous to this time various investigators had worked in temporary quarters both in the United States and abroad, but no one before Fritsch seems to have had a building especially constructed for the purpose. A similar laboratory is in operation in Finland, and another near Moscow in Russia. Hungary has a station at Lake Balaton, one of the largest bodies of fresh-water in Europe. In France there is a lacustrine laboratory near Clermont-Ferrand. The most famous of all such laboratories is at Lake Ploen in Holstein under the direction of Dr. Zacharias. Each year since its establishment in 1891 a volume of researches has been published by the station and its position has now become sufficiently well assured to warrant the publication of a journal to be issued at regular intervals and to be devoted exclusively to limnobiology. Germany has also two other stations of lesser renown and one has been established in England. The most famous investigator of the biology of fresh water is unquestionably Professor Forel, of the University of Lausanne. His studies of Lake Geneva, three volumes of which have already appeared, furnish a guide to such work in all its branches.

In the United States permanent or summer stations are maintained on Lake Mendota, in Wisconsin; at Chautauqua Lake, in New York State; on Gull Lake, in Minnesota; on Lake Erie at Sandusky and at Put-in-Bay in Ohio; at Turkey Lake, in Indiana; and at Havana, in Illinois. Some of these stations are mainly for teaching, as that at Chautauqua Lake; others are for research exclusively, as the station of the United States Fish Commission at Put-in-Bay, Ohio; and others for both teaching and investigation, as those maintained by the Universities of Ohio, Indiana, Illinois, and Wisconsin, while Massachusetts has a laboratory at Lawrence devoted solely to the study of filtration and the biology of drinking water. In Illinois, Indiana, Michigan, Minnesota and Connecticut biological surveys are in progress

at the present time. In New York no systematic examination of the inland waters have ever been made. It is highly probable that a biological survey of New York will yield most valuable scientific results. Its surface is more diversified than that of any other state in the Union. Its area is over 49,000 square miles. Its borders in part are outlined by the shores of two of the Great Lakes, by one of the largest rivers in the world, and by the Atlantic Ocean. Within its limits are lakes and ponds of every description, fresh-water, brackish water and saline; a unique system of glacial lakes whose fauna is thought to have an intimate relation to that of the sea with which the lakes were at one time connected; shallow lakes and lakes so deep that they are popularly reputed to have no bottom; lakes situated at high as well as lakes at low altitudes; lakes with and lakes without outlets; lakes whose various waters are of widely different chemical composition; isolated lakes and lakes connected in chains or systems; lakes fed by rivers or smaller streams as well as lakes whose water comes from springs. Its rivers are almost as varied as its lakes. Some of the systems empty into the Great Lakes while others flow to the sea. The great tidal Hudson offers every degree of salinity. In the Niagara River with its falls and gorge, organisms live under conditions scarcely paralleled in the world. Mineral springs in great variety offer nearly unexplored fields for investigation. A great canal which traverses the state from east to west furnishes a habitat unlike that found anywhere else in the United States. Immense swamps and marshes thousands of acres in extent, harbor organisms concerning which there is much to be learned. The islands in the Great Lakes, in the inland lakes, and in the ocean offer inviting fields for exploration.

Its surface extending 300 miles from north to south and 326 miles from east to west presents altitudes from sea-level to over 5000 feet, including many of the highest peaks east of the Rocky Mountains. There are two mountain regions, one in the north-eastern and one in the south-eastern part of the state. Caves and subterranean passages in considerable number are to be found whose biological conditions are unknown. The condition of the land varies from that of the thickly populated cities to that of the unexplored forests; land which has been occupied and settled for nearly three centuries and land which has but recently been cleared by the settler. Every variety of soil is represented,

sand, clay, and rock, and the climatic conditions are such that in certain parts of the state plants and animals flourish which are characteristic of the flora and fauna of the Carolinas. No fewer than three life zones, as they are called, are represented in New York, the boreal, the transition and the upper austral, each zone being one of the seven transcontinental belts characterized by a natural grouping or distribution of plants and animals. In respect to number of such zones New York is surpassed by but two of the states east of the Rocky Mountains, viz: North and South Carolina; most states having not more than two zones. While the transition zone occupies the greater part of the state, the boreal is represented in the Adirondacks, the Catskills, and in the high lands of the south-western section. The austral zone sends a long arm up the valley of the Hudson River to Lake George, while another extension from the Mississippi Valley region reaches from Buffalo to Syracuse extending back from the shores of Lake Ontario for a distance of about 30 miles. The extent and variety of our fauna and flora then are unusual.

It is therefore proposed that a survey be inaugurated in accordance with the following tentative suggestions:

Its object shall be (a) to study the biology of the fauna and flora of the state, especially of the aquatic organisms, including their structure, habits, food, distribution, variations, adaptations, ecological relations and economic importance; (b) to investigate such sanitary problems of a biological nature as may arise concerning the lake and river waters used by the cities, villages, and towns of the state; (c) to study lakes with reference to the propagation of fish.

In its organization the survey should properly be under the control of the State Division of Science, and the members of the survey should be equipped by training and experience to serve in field, museum and laboratory; the regular staff performing the most of the work, specialists being engaged only for the purpose of monographing certain groups of organisms or for some particular service of like nature. If the survey could be recruited from the faculties of the universities and colleges of the state, competent investigators would be enlisted, a wider interest in the work aroused, and much expense saved for apparatus, field equipment, books, etc. The most important work would fall to the field parties, and each of these ought to be in charge of a

biologist of sufficiently wide interests and attainments to be able to direct investigation along both botanical and zoological lines, that is, to supervise the study of the special problems assigned to his assistants while he at the same time keeps the general work of the party progressing. As assistants it would seem desirable to engage as far as feasible, the instructors and advanced students in biology in the colleges and universities, as well as competent high school teachers. Many would be glad of the opportunity to do the work required in return for the experience gained. The field work would necessarily include the collection, not only of biological facts and specimens, but of physiographic, chemical, and meteorological data as well.

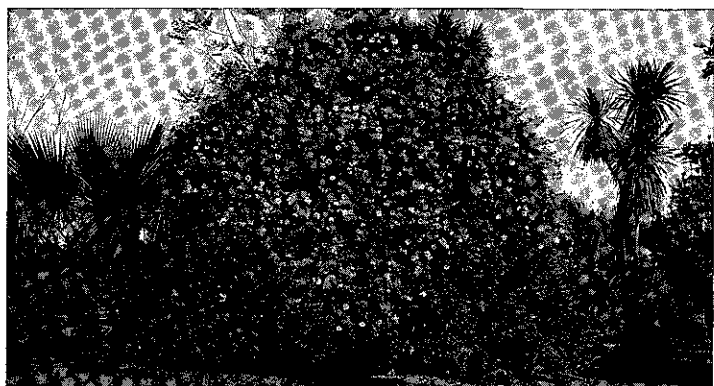
The material collected, not only specimens, but also notes, drawings, and photographs, should belong to the State Museum and should be added to that already deposited there, and all interesting specimens should be displayed in proper exhibition cases. In addition to the skins of birds and mammals, and the bodies of animals which are seen in conventional museums, there should be collected as many things as possible that show facts about the habits and mode of life of organisms such as specimens of male, female, and young of each kind of animal, the larval forms, eggs, egg-cases and nests, parasitic and pathological conditions, examples of the depredations committed by noxious forms, the vegetative and the reproductive stages of plants in cases where these are unlike or markedly different, as in many algae and fungi. If any material can be obtained in sufficient quantity small collections, with the specimens properly named, should be distributed to the schools throughout the state for use in teaching the biological sciences. If injurious forms, like the gipsy moth in its various stages for example, could be made generally known, especially in the lower schools, much harm to the state at large could probably be avoided by putting people on their guard against an invasion of pests which is certain to come within a short time.

The reports of the survey should be published in suitable form using the best class of illustrations where any at all are required. These publications should be distributed liberally throughout the state, especially to schools, and the district schools and those in small towns ought to be remembered in the distribution. Groups of popular interest should be treated in such manner as to attract the general reader, and the identification of species made as easy

as possible by the use of analytical keys in which technical terms are avoided to as great an extent as is consistent with accuracy.

The cost of the survey would depend upon the nature and extent of the work undertaken. In Illinois the annual expense at present is about \$10,000, and in Minnesota it is estimated at \$10,000 to \$20,000. In each of these states the work is in the hands of a staff of trained investigators who are paid for their services.

It is now fifty to sixty years since the different biological branches of the original Natural History survey were completed. In that time not only has the territory covered undergone great changes due to settlement of the land, destruction of the forests, drying up and filling in of water courses, extension of agricultural and manufacturing operations, increase of population of cities, towns and villages, but our knowledge of plants and animals has also grown. With increasing knowledge a multitude of problems has arisen in morphology, physiology, distribution, variation, adaption and evolution, and the scientific point of view with respect to organic nature has changed entirely from the position it occupied at the time the survey was made. The object of the proposed survey is not so much merely to make additions to the list of plants and animals known to live within the borders of the state as it is to increase our knowledge of the habits and the biological and economic importance of these organisms. It is most essential therefore, that if the state of New York wishes to retain a leading position in educational and scientific matters it should do more than it is now doing in the study of its fauna and flora.



A SOUTHERN CALIFORNIA ROSEBUSH