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THE CONTRIBUTIONS OF ZOOLOGY TO HUMAN WELFARE[1]

To indicate the contributions of zoology to human welfare as related to or dependent upon the aquatic resources is the task which has been assigned to me, but because of time limitations the subject must necessarily be covered in a superficial way. The consideration of this phase of the general topic, whose application may for present purposes be restricted to the United States, is based on the assumption that the condition of aquatic resources affects our national prosperity, and that full and accurate knowledge of those resources is a prerequisite to their proper utilization.

The theme is fertile and inviting, and there should exist no difficulty in establishing a case for zoological research as a noteworthy contributor to our welfare. My task is lightened by the readiness with which nearly every one will recall important rôles that zoology has played in the modern history of the fishing industry.

It is doing no violence to truth or justice to claim that the beginnings of sane and beneficent fishery administration in the United States date from the time when a man, already eminent in science, with many years' experience in zoological work, was chosen by the President of the United States as the proper person "to prosecute investigations on the subject of the diminution of the valuable fishes with a view of ascertaining whether any and what diminution in

[1] Read before Section F (Zoology) of the American Association for the Advancement of Science at a symposium upon "The Contributions of Zoology to Human Welfare," Pittsburgh, Pa., December 31, 1917.

the number of the food-fishes of the coasts and the lakes of the United States has taken place; and, if so, to what causes the same is due; and also whether any and what protective, prohibitory or precautionary measures should be adopted in the premises."

Since that year (1871) when Baird began those masterly and far-sighted inquiries, zoology has been the constant forerunner or associate of fishery progress; and the conservation of the resources of our lakes, rivers and coastal waters became an established policy and an accomplished fact many years before the term conservation came into general use as applied to any other resources.

At the outset of that pioneer movement, it was recognized that the only rational basis for the administration of the fisheries was a complete knowledge of aquatic creatures to be acquired by intimate investigation. The early researches, which have served as models for subsequent work, were expected to yield practical results but were conducted without any sacrifice of the cherished principles of science. In fact, Baird had the courage, which some persons might have regarded as temerity, to insist in his communications to Congress and the general public that in the elucidation of the economic problems which Congress had imposed it would be of doubtful value to study only the major forms which supported fisheries and that "useful conclusions must needs rest upon a broad foundation of investigations purely scientific in character."

Baird's reputation and official position and the attitude with which he approached his tasks enabled him to draw to his aid a large body of men trained in the methods of zoological research; and the great success of his early investigations, as of the later work that has been their continuation or outgrowth, was largely, in many instances entirely, dependent on the services of zoologists, most of whom were university men. I need only mention the names of Birge, Brooks, Bumpus, Dean, Evermann, Forbes, Gilbert, Goode, Grave, F. H. Herrick, Jordan, Kellogg, Lefevre, Linton, Mead, Parker, Rathbun, Reighard, Ryder and Ward to recall to you zoological work that has made an impress on the public welfare and entitles them, and others whose names will occur to you, to the thanks of a republic which has become more and more grateful as the knowledge of their work has spread.

It was the work of Baird and his associates in zoology that chiefly induced Huxley to assert his belief that no nation at that time had comprehended the question of dealing with the fisheries in so thorough, excellent and scientific spirit as the United States.

Brief reference may now be made to a few special cases out of the many that might be cited in which zoology has rendered noteworthy service. Passing over the high degree of perfection that has been attained in various branches of governmental and private fish culture, largely as a result of embryological and physiological studies, attention may be invited to the American oyster, which because of its prominence as our principal water product has deservedly received consideration at the hands of some of the leading zoologists. I need only recall the work of Brooks and Ryder who, with others, brought their highly developed scientific minds to bear on the practical problems of the oyster industry and, through their studies of the biology of the oyster and from experimental work in oyster rearing, rendered conspicuous and enduring aid.

With the oyster, as with other water creatures, the teachings of zoology have been at complete variance with the confirmed practises and deep-seated prejudices of certain states. The welfare of their

oyster industry was for a long period neglected; and the delivery of these states from the thraldom of obsolete, inefficient and wasteful methods has depended on their eventual willingness to accept zoological facts as the basis for administration.

Another of our great aquatic resources that has suffered from the failure or refusal of the states to be guided by the teachings of zoology is the lobster. If the states had given heed to the elementary needs of the lobster as proclaimed by Herrick, instead of shaping their course so as to conform with the interests of those who for years have been profiteering at public expense, they could have made the lobster a staple, moderate-priced food for all time, whereas it has become such a rare and expensive article that the food administration might very properly place an embargo on its use as a wholly unjustifiable extravagance. One alleviating circumstance is that, through the adoption of a system of artificial rearing devised by the zoologist Mead, the lobster supply in the waters of Rhode Island has been maintained better than in any other state.

One of the most noteworthy cases of the application of zoology to the public good is the prompt use that the government made of Lefevre and Curtis's investigations of the habits of the glochidia of the pearly mussels. The practical problem here presented was the maintenance of an industry that supports many thousands of people and directly affects every man, woman and child in the United States. It should be remembered to the everlasting credit of our national law-making body that it was willing on purely zoological claims, which were the only ones that could be put forth at the time, to establish an expensive station and adequate personnel for applying the results of zoological researches and experiments. The influence of that laboratory on the policy of the interested states has been great; the immediate results of practical value have been conspicuous; and the way has been made plain by which this great national resource, which far surpasses in value and volume that of all other countries combined, may be preserved through proper utilization.

Reference should be made to the extraordinary advance in knowledge of the age and growth of fishes that has come from recent studies of their scales and bones, and to the opportunity that is thereby afforded for the first time to substitute facts for guesswork in formulating protective fishery laws bearing on the size and age of food and game fishes.

A year or two ago there arose a situation in one of the largest seaboard cities where ill-advised administrative action threatened to exclude from the market one of the most abundant and wholesome marine fishes, with consequent disturbance of long-established trade and serious loss to the fishermen even of remote regions. A real disaster impended because a market inspector saw certain parasites and misconstrued their significance. The evil was averted by the ability of the government to recommend to the city authorities a zoologist with a most convincing mass of zoological evidence, with the result that the embargo was promptly lifted and in all probability will never again be placed in that community for such a reason.

The great contributions that zoology has made to all branches of fishery work have not exhausted the field. Dependence must continue to be placed on zoological research for the elucidation of the greater problems that are looming. A hopeful sign of the times is that the public now appears to be more willing than ever before to defer to and depend on the recommendations of zoology in the handling of fishery questions.

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