

DAMS AND THE PROBLEM OF MIGRATORY FISHES

BY

DR. S. L. HORA

(Zoological Survey of India)

STUDENTS of fish and fisheries in India are no doubt aware that since the sixties of the last century efforts have been made in this country to provide fish passes in the construction of dams so as not to interfere with the migration of the fishes ascending to their breeding grounds and afterwards on their return journey to the feeding grounds or *vice versa*. The available evidence goes to show that fish passes were and are still being constructed by the engineers who may be described as almost wholly ignorant of the habits of the fish that are meant to be saved from possible extermination. For instance, to save the extensive and valuable Hilsa Fisheries, the Government of Madras, at the suggestion of Dr. Francis Day, constructed fish passes, across anicuts, as early as 1869, but these proved ineffective, and after another exhaustive enquiry by Sir F. A. Nicholson in 1909, fish passes as a protective measure for Hilsa were finally abandoned, and for the preservation of the species the proposal for the construction of a Hilsa hatchery at the Lower Anicut on the Coleroon River was adopted instead. In a recent contribution on "Fish Ladders in the Punjab"¹ Dr. Hamid Khan has concluded that

"Most of the fish ladders in the Punjab are ineffective and their main defects are:—(i) the majority of them are too steep and too narrow; (ii) the upstream inlets are generally too severe to allow the smaller species of the migratory fish to ascend; (iii) the downstream openings in most cases are too small, and therefore too inconspicuous to be perceived by the ascending fish, that is to say, the fish ladders are not self-advertising; (iv) there is hardly any pool at the entrance of the ladders where fish could collect before ascending; (v) the water supply in the ladders is not available during the periods when the fish migrate; and finally (vi) the majority of them are not fish ladders but mere fish traps for catching fish.

"The effect of inefficient fish ladders in the Punjab is beginning to be felt in the higher reaches of the rivers and there seems to be no doubt that as a result of it the stock of fish in the Punjab rivers has decreased very considerably during the last fifteen or twenty years."

The effect of placing permanent or semi-permanent weirs across streams on the population of migratory fishes, such as *Mahseer*, was also referred to by Hora and Mukerji²

in the course of their studies on the fish of the Eastern Doons.

It is a matter of considerable interest, therefore, to know that the Western Division of the American Society of Ichthyologists and Herpetologists, and the Western Society of Naturalists jointly held a symposium at the Stanford University on June 29, 1939, under the Chairmanship of Dr. F. B. Summer on "Dams and the Problem of Migratory Fishes". The detailed report of the symposium, which has now been published in a special issue of the *Stanford Ichthyological Bulletin*,³ contains valuable information on all aspects of the problem. It is worthy of special note that all the members taking part in the symposium were, from experience, training and first-hand knowledge of fishes, best able to deal with the problems that were discussed. Dr. Willis H. Rich, who discussed 'Fishery Problems Raised by the Development of Water Resources' is now Professor of Biology at Stanford University and Director of the Department of Research of the Fish Commission of Oregon. Dr. Rich was in charge of the Division of Scientific Inquiry of the U.S. Bureau of Fisheries, 1922-26, and was Chief of the Bureau's Salmon Investigations, 1926-30. During his service with the Bureau, he directed very extensive marking and tagging experiments upon salmon. Mr. Harlan B. Holmes, who read a paper on "The Passage of Fish at Vonneville Dam", was Aquatic Biologist of the U.S. Bureau of Fisheries for several years, but was later assigned to the U.S. Army Engineers. In this capacity, he was the man who planned and saw to completion the gigantic fishways of the Bonneville Dam. Mr. Holmes also participated in some of the basic experiments upon salmon migration, in co-operation with Dr. Gilbert and Dr. Rich. Dr. Wilbert McLeod Chapman, who narrated "Fish Problems connected with the Grand Coulee Dam", was Scientific Assistant with the International Fisheries Commission at Seattle, and is now in charge of the fisheries investigations being made relative to the Grand Coulee Dam by the Department of Fisheries of the State of Washington. He has carried on extensive studies of the anatomy, physiology and

taxonomy of fishes, as well as matters more directly related to the fisheries. Dr. Harry A. Hanson, who presented "Preliminary Report on an Investigation to Determine Possible Methods of Salvaging the Sacramento River Salmon and Steelhead Trout at Shasta Dam" has been Scientific Assistant with the International Fisheries Commission at Seattle, later Assistant Chief of the Division of Scientific Inquiry of the U.S. Bureau of Fisheries. He is now chief of an investigation party of the U.S. Bureau of Reclamation, investigating the Sacramento River salmon. In this position he is in direct charge of fisheries investigations at the Shasta Dam. Dr. A. C. Taft, who gave "A Summary of the Present Status of Dams versus Migratory Fishes on the Pacific Coast with Especial Reference to Problems in California" is the Chief, Bureau of Fish Conservation, California Division of Fish and Game, was for a number of years Aquatic Biologist of the U.S. Bureau of Fisheries engaged in salmon and trout studies in Alaska and California. In the course of these studies he conducted various marking experiments on both Pacific salmon and steelhead trout.

In the discussion that followed the presentation of various papers in this symposium several points of interest were brought out, and finally the following Resolution was adopted:—

"The Western Division of the American Society of Ichthyologists and Herpetologists and the Western Society of Naturalists, being assembled at Stanford University, California, at this annual meeting and having considered in considerable detail the effects of dam construction in west coast waters and their incident and usually harmful effect on migratory fishes such as salmon and steelhead trout, hereby offer the following resolution to be presented to the various Federal and State Agencies, National Resources Committee, Western States Planning Boards, Water Resources Committees, and other bodies concerned with water planning programs:

"Whereas construction of the Bonneville and Grand Coulee Dams on the Columbia River in Oregon and Washington, the Shasta Dam on the Upper Sacramento River in California, and other such Federal and State projects has, and will

continue to, greatly jeopardize the continued productivity of salmon and steelhead trout to the people of West Coast States, and

"Whereas actual construction work on each of these dams has, almost without exception, been begun without sufficient advance consideration of the effects of the proposed structures on salmon and trout, therefore

"Be it resolved: that fisheries resources be given consideration equivalent to that given all other water uses by Federal and State Planning or Construction Agencies and that before starting construction of any dam or other type of structure proposed in any basin containing salmon or steelhead trout, surveys of the fisheries resources be made by qualified experts, to parallel engineering surveys, over a minimum period of five years, or sufficient to cover the life-cycles of all economically important fishes concerned."

The above resolution directs pointed attention to a matter of very grave importance to the fisheries of the United States of America. In India also more extensive measures are now being adopted to harness the water resources of the country for purposes of irrigation, generation of electric power and in connection with various industries. Though no one doubts the great utility of these projects, due consideration must also be paid to the conservation of the fisheries, and this is of particular importance in connection with the provision of proper water channels for the migration of fishes, and the prevention of the pollution of the streams. Here reference may be made to a very appropriate quotation from Veblen (*The Instinct of Workmanship*) given on the last page of the Symposium Number in which it is stated that

"Virtually all thoughtful persons will agree that it is a despicably inhuman thing for the current generation wilfully to make the way of life harder for the next generation, whether through neglect of due provision for their subsistence and proper training or through wasting their heritage of resources and opportunity by improvident greed and indolence."

¹ *Bombay Nat. Hist. Soc.*, 1940, **41**, 551.

² *Rec. Ind. Mus.*, 1936, **38**, 135.

³ 1940, **1**, 173.

OBITUARY

SIR J. J. THOMSON (1856-1940)

IN the demise of Sir Joseph John Thomson, on the morning of 30th August, the world has lost a great and distinguished leader of science, whose pioneering work blazed itself across the scientific firmament of the last quarter of the 19th and the first decade of the present century. Born on December 18, 1856, his earlier education was at Owen's College, Manchester, and Trinity College, Cambridge. He was elected to the Fellowship of the Royal Society in 1884, and during the same year called to the chair of Cavendish Professorship. For thirty-five years he filled this chair with great distinction, and organised the Research laboratories which soon became the Mecca of physicists all the world over. He was elected to the presidency of the Royal Society during 1916 to 1920, and was the recipient of almost all the distinctions which the scientific world could bestow on one of its greatest devotees.

Sir J. J. Thomson's remarkable achievement lay in the realm of the electronic constitution of matter. His classical and ingeniously devised experiments on the discharge of electricity through gases were crowned with the brilliant discovery of the corpuscular nature of the cathode rays, the particles constituting these rays having a mass two

thousandth of that of the hydrogen atom. It was this discovery, supported by other significant and almost simultaneous investigations of Zeeman and Lorentz in Holland and Lenard in Germany, that helped to firmly establish the electronic theory of matter.

Besides his numerous papers in *The Proceedings of the Royal Society* and the *Philosophical Magazine*, Sir J. J., as he came to be called affectionately in later years, was the author of a number of well-known books, the most famous of which are on the conduction of electricity through gases, and a series of general text-books on Physics, written in collaboration with Prof. Poynting.

Sir J. J. was the leader of a very active school of Physics. More than twenty-five of his students have been elected to the Fellowship of the Royal Society, and six of them for the award of the Nobel Prize. He retired from the Cavendish chair soon after the last World War, and was succeeded by Lord Rutherford. It was an appropriate tribute that was paid to the abounding energy of Sir J. J., when the late Lord Rutherford referred to him at a dinner party given to celebrate his eightieth birthday, as "A star of the first magnitude, a central sun that does not shrink with age, but draws on some unknown source of energy".

INTELLIGENCE SERVICE FOR INDUSTRIAL RESEARCH

AT a conference of chemists, called by the Indian Munitions Board at Lahore on the 8th January 1918, it was agreed that (1) a monthly list of researches in progress should be circulated to all chemists who are assisting the Board with Research work, (2) at the foot of the list, a list of problems awaiting investigation should be published and (3) chemists undertaking research work for the Board should be requested to inform the Board of any problems that may occur to them.

To-day, the Government of India has inaugurated the Board of Scientific and Industrial Research which has already taken the initiative in launching a number of research schemes of immediate practical interest.

A periodical (monthly) publication of the list of researches together with any import-

ant achievements made in each of the lines, would be helpful in many different ways: The research worker will be enabled to keep himself informed of the various lines of industrial work pursued in the country and wasteful duplication could be avoided. The publication will further be helpful for the research worker to get into touch with his colleagues who may be working in a closely allied line. The several provincial and State governments, the industrial magnates and the interested public will have an opportunity of keeping themselves informed of the progress of industrial research in the country.

We earnestly hope that the Board of Scientific and Industrial Research will consider the advisability of publishing the list of researches and reporting upon their progress from time to time.