

**THE LIFE OF INLAND WATERS:
AN ELEMENTARY TEXT BOOK
OF FRESH-WATER BIOLOGY FOR
AMERICAN STUDENTS, PP. 1-191**

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
JAMES G. NEEDHAM & J. T. LLOYD

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THE LIFE OF INLAND WATERS

An elementary text book of fresh-water biology
for American students

By


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and

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PREFACE

IN THE following pages we have endeavored to present a brief and untechnical account of fresh-water life, its forms, its conditions, its fitnesses, its associations and its economic possibilities. This is a vast subject. No one can have detailed first hand knowledge in any considerable part of it. Hence, even for the elementary treatment here given, we have borrowed freely the results of researches of others. We have selected out of the vast array of material that modern limnological studies have made available that which we deem most significant.

Our interests in water life are manifold. They are in part economic interests, for the water furnishes us food. They are in part aesthetic interests, for aquatic creatures are wonderful to see, and graceful and often very beautiful. They are in part educational interests, for in the water live the more primitive forms of life, the ones that best reveal the course of organic evolution. They are in part sanitary interests; interests in pure water to drink, and in control of water-borne diseases, and of the aquatic organisms that disseminate diseases. They are in part social interests, for clean shores are the chosen places for water sports and for public and private recreation. They are in part civic interests, for the cultivation of water products for human food tends to increase our sustenance, and to diversify our industries. Surely these things justify an earnest effort to make some knowledge of water life available to any one who may desire it.

The present text is mainly made up of the lectures of the senior author. The illustrations, where not otherwise credited, are mainly the work of the junior author. Yet we have worked jointly on every page of the book. We are indebted for helpful suggestions regarding the text to Professor E. M. Chamot, Dr. A. H. Wright, Messrs. W. A. Clemens and Ludlow Griscom. Miss Olive Tuttle has given much help with the copied figures.

Since 1906, when a course in general limnology was first established at Cornell University, we have been associated in developing an outline of study for general students and a program of practical exercises. The text-book is presented herewith: the practical exercises are reserved for further trial by our own classes; they are still undergoing extensive annual revision.

The limitations of space have been keenly felt in every chapter; especially in the chapter on aquatic organisms. These are so numerous and so varied that we have had to limit our discussion of them to groups of considerable size. These we have illustrated in the main with photographs of those representatives most commonly met with in the course of our own work. Important groups are, in some cases, hardly more than mentioned; the student will have to go to the reference books cited for further information concerning them. The best single work to be consulted in this connection is the *American Fresh-water Biology* edited by Ward and Whipple and published by John Wiley and Sons.

Limnology in America today is in its infancy. The value of its past achievements is just beginning to be appreciated. The benefits to come from a more intensive study of water life are just beginning to be disclosed. That there is widespread interest is already manifest in the large number of biological stations at which limnological work is being done. From these and other kindred laboratories much good will come; much new knowledge of water life, and better application of that knowledge of human welfare.

JAMES G. NEEDHAM.
J. T. LLOYD.

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CHAPTER I
INTRODUCTION



INDIANS GATHERING WILD RICE, N. MINNESOTA

THE home of primeval man was by the waterside. The springs quenched his thirst. The bays afforded his most dependable supply of animal food. Stream-haunting, furbearing animals furnished his clothing. The rivers were his highways. Water sports were a large part of his recreation; and the glorious beauty of mirroring surfaces and green flower-decked shores were the manna of his simple soul.

The circumstances of modern life have largely removed mankind from the waterside, and common needs have found other sources of supply; but the