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1887. *Ibid.*, 'Oyster Industry.' III. report, pp. 27.

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1888. *Ibid.*, XVI. report, pp. 30.

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BASHFORD DEAN.

COLUMBIA UNIVERSITY,
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ILLINOIS RIVER PLANKTON.

THE Illinois State Laboratory of Natural History has published, as Article II. of the sixth volume of its Bulletin, a report on the results of a virtually continuous study of the minute plant and animal life, or plankton, of the Illinois River and its tributary waters, carried on for five successive years by the staff of the Illinois Biological Station. This makes a volume of 534 pages, illustrated by 2 maps, 11 half-tone plates, and 37 full-page diagrams.

Opening with an elaborate description of the Illinois River and its drainage basin, this report treats of the effect of variations of temperature and peculiarities of chemical condition on the life of the stream, and presents at length and in detail a comparative study of 630 plankton collections made from the river at Havana, from one of its tributaries which empties into it at that point, and from five bottom-land lakes of various character and variously related to the main stream. These collections were so made, at regular intervals, with identical apparatus, and by a uniform method, that they can be compared with each other quantitatively, and may be used as the basis of general conclusions concerning the system of minute life in these waters, from season to season and from year to year.

It appears from these studies that the plankton is distributed in the main stream of the Illinois River about as evenly as it is in the stationary waters of a lake, and that generalizations based on an examination of a small part of it are consequently as reliable as those concerning that of a lake. The ratio of the plankton of the river, year in and year out, was 2.7 parts per million of the water in the stream, and its total average amount moving down stream past any given point reached the astounding aggregate of 75,000 tons per annum, or 8.5 tons an hour. This is about 15 times the total weight of the fish taken from the river in a year.

The production of the plankton falls to its minimum, as a rule, in January and February, and reaches its maximum in April, May, and June. Floods, of course, dilute it, and falling waters concentrate it, but, on the other hand, a season of general high water increases its total quantity, and a season of general low water decreases it. Light and heat favor its development, and it is consequently more abundant, other things being equal, in a season during which clear and warm weather preponderates than in a cold and cloudy one. The freezing of the river does not seriously affect it, unless the ice-sheet continues until the water becomes foul with the gases of decay. The addition of sewage to the river water greatly increases the production of this minute life by increasing the supply of available food, although an excessive amount of sewage may render the water too foul for it at the point of discharge.

The production of plankton is less in short streams with relatively swift current than in long streams with slow current, and short tributaries consequently tend to dilute the plankton of the main stream. On the other hand, the stagnant and relatively permanent waters of shallow lakes bear a more abundant plankton than the temporary waters of flowing streams, and the outflow from such lakes hence enriches the plankton of the river. Parts of a stream with many small tributaries will contain less plankton than those with which numerous lakes are connected.

The bottom-land lakes differ widely in the amount of plankton which they contain, this

being least in those with an abundance of coarse submerged water plants, and greatest in those virtually free from such vegetation. The reasons for this difference seem not well established in this paper, but they are possibly connected with differences of light and heat already referred to. The most productive body of water examined was a large permanent pond, with neither inlet nor outlet at a low stage of water, and with bottom and shores of bare mud.

The conditions which favor a large annual production of this minute aquatic life also seem to favor a large catch of fish, but no direct connection of cause and effect is here made out. The plankton is, however, an indispensable element in the food of fishes, the young of nearly every species in our waters being absolutely dependent upon it at some period of their lives, and adult fishes of several species making large use of it during the season of its greatest abundance.

No study of the minute life of a river system has heretofore been made of equal extent, thoroughness, and scientific character with that reported in this paper, and a knowledge of the facts contained in it is indispensable to an understanding of some of the problems of a scientific fish-culture in fresh-water situations.

The work here reported is a part of that of the biological survey of Illinois. It was planned, established, and equipped by Dr. S. A. Forbes, director of the State Laboratory, and was done under the immediate superintendence of Professor Frank Smith, of the University of Illinois, during the first fifteen months, beginning with April, 1894, and of Dr. C. A. Kofoid, superintendent of the station, the writer of this report, during the remainder of the five-year period.

THE MISSOURI BOTANICAL GARDEN REPORT.

Advance galleys of the administration report of this well-known institution, for which we are indebted to its director, show the customary progress. In 1904 the number of species and varieties of plants cultivated was increased from 11,357 to 14,207, an addition of 25 per cent. The herbarium was enlarged from 465,205 to 489,310 specimens, an increase of a little over 5 per cent., and the total of books and pamphlets in the library was raised from 42,262 to 45,892, or something over 8 per cent.

The world's fair recently held in St. Louis raised the visitors to the garden to over three times the customary number, a total of 316,747, or about 2 per cent. of the entire paid admissions to the exposition. That these visitors were of an unusually intelligent and interested class is noted from observation and inferred from their purchase of a little handbook of the garden, the sales of which amounted to 1.51 per cent. of the number of visitors in contrast with an earlier average of .246 of 1 per cent.

The report also contains information as to the school of botany, the gardening course, the research work at the garden and the testamentary flower sermon, banquets, and flower show, all of which latter were influenced by the holding of the St. Louis exposition, at which the garden met with recognition in the form of two grand prizes and several minor awards.

The financial report of the trustees shows that street improvements, sewers, property expenses and the like have wiped out their savings of the past fifteen years, on which needed buildings and enlargements have been planned by the director, and it is evident that unless unexpected aid is rendered the garden by some public-spirited citizen these improvements must necessarily be deferred for at least ten years, although the maintenance of the establishment on its present scale is not in doubt, and there is assurance in its unencumbered endowment of some $3,000,000 that gradually it will enlarge to an importance and usefulness equaling the most sanguine expectations of its friends.

THE NATIONAL GEOGRAPHIC SOCIETY.

Professor Willis L. Moore, chief of the U. S. Weather Bureau, was elected president of the National Geographic Society, at the last meeting of the board of managers, at Washington. Professor Moore has been ac-