PRIMARY PRODUCTION OF PHYTOPLANKTON
IN THE
THREE TYPES OF AMAZONIAN WATERS

by

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I. Introduction

The limnology of the waters in the Amazon region, a landscape which is characterized to a very great extent by the interrelationship between the land and the water, has for a number of years been in a state of intensive investigation (see SIOLI 1965a, SCHMIDT 1972e). This activity corresponds to the growing scientific interest in these tropical ecosystems and also to the growing practical economic significance which these systems have for the entire region. Until now, however, there has been very little concrete data having to do with the important question of the productivity of these waters (see SCHMIDT 1972d).

The earliest exact information of this nature was furnished solely by BRAUN (1952), who wrote on the biomasses of plankton and benthic organisms in lakes that lie in the Teriary of the lower Amazonian region, by MARLIER (1961), who wrote on the biomasses and production of plankton, benthic fauna and shore vegetation of waters in the vicinity of Manaus, and by FITTKAU (1964), who wrote on the biomasses of lower fauna from smaller deep forest streams. One single series of investigations on primary production of phytoplankton in the Rio Negro was published by HAMMER (1962).

As the findings of the above mentioned authors and as the ample practical experience and the numerous observations of those who have become well acquainted with this region indicate, the fundamental differences which distinguish the three Amazonian water types (white-, black-, and clear-water; see SIOLI 1950, 1951, 1965b) in their physical and chemical characteristics also have an effect on their biological productivity. In order to acquire a deeper insight into these problems, detailed investigations were begun in 1967 at the suggestions of SIOLI by JUNK, who concentrated on the ecology and production of the floating meadows, which are strongly developed on numerous rivers and lakes of this region, and by the author, who concentrated on the primary production of the phyto-
plankton in the three water types of the region. As SIOLI already pointed out in 1969, these two biological areas together represent the most important sites of suspended materials, becomes considerably more favorable for the phytoplankton. The more suitable sites are lakes of the flood plain region of the Amazon, its varzea. In protected inlets and other regions of the river with little current and partial sedimentation of the suspended materials, i.e., away from the open water, the conditions for phytoplankton naturally also become more favorable. However, due to the expected strong influence of the very widespread floating meadows and other environmental conditions the inlets appeared less favorable for the planned investigations. The use of a lake as an example of a white-water naturally resulted in the fundamental problem that the supply of nutrients to this area is not so continuous, as is the case with running water. In those varzea lakes, which are directly connected to the river throughout the year, however, the entire water mass will for all practical purposes normally be replaced each year, so that at least in this way the nutrient supply is renewed. Finally, the varzea lakes should in general not be neglected entirely anyway in a comprehensive investigation of phytoplankton primary productivity in Amazonia because of their great number and significance.

SIOLI (1951 and 1957) has already reported on the origin of the varzea and its lakes and on other features of this region, so that more on this need not be dealt with further here. For this study, naturally, only those lakes were considered which contained as much as possible only “decanted” white-water, that is, water from the Rio Solimões after more or less complete sedimentation of suspended material specific to that river, and having no other tributaries. These theoretical prerequisites encountered various difficulties, however. All of these lakes contain rain water, which not only falls directly on the lake’s surface, but also drains directly from a more or less large catchment area into the lake. In addition numerous smaller lakes of the varzea are connected to the river only at high water level. Because of the possibly incomplete annual water exchange in these lakes, the conditions were too specialized to be included within the scope of this study. On the other hand, other lakes are fed by tributaries from the terra firme, land not part of the flood plain. These stream-fed lakes are more or less strongly pronounced black waters, a situation which can likewise present very special water conditions that are very difficult to generalize. Finally, the choice of a lake had to also include the practical consideration that we had to be able to get to it on a somewhat regular basis with the means at our disposal.

In the end, Lago do Castanho, which lies in the region of Janauacá in the vicinity of Manaus, was chosen as the best compromise to all these various considerations. As will be confirmed by the results of the investigations, which almost expanded into an entire course of study in the total limnology of this lake, Lago do Castanho may be designated as a quite typical representative of the varzea lakes of central Amazonia. Further details on the limnology of this water will also be reported in separate papers in this series. As should be emphasized right away, however, even Lago do Castanho may not be simply regarded as the typical varzea lake. This is generally not possible because still too little is known about these lakes in regard to their morphological characteristics, the various aspects of their aquatic conditions and the particularities of their limnology.
References


SCHMIDT, G.W. (1972b) : Chemical properties of some waters in the tropical rain-forest region of Central Amazonia along the new road Manaus—Caracarai. — Amazoniana 3 : 199—207


