

Book review

CARMOUZE (J.-P.), DURAND (J.-R.) and LÉVÊQUE (C.) (Editors), 1983. — *Lake Chad: Ecology and productivity of a shallow tropical lake ecosystem*. Dr. W. Junk Publishers. The Hague, 1983 (Monographiae Biologicae, vol. 53), 575 pages, \$US 137.00.

To appreciate the scale of Lake Chad imagine a single pencil line 0.5 mm thick as representing the mean depth of the lake (ca. 2 m). If a longitudinal section was drawn to the same scale as the depth that line would be 58 m long! Values such as a lake basin of 0.25×10^6 km², lake area of 21×10^3 km² are difficult enough to comprehend, but when biomass values of molluscs (for instance) are given as 474×10^3 tonnes one begins to realise the size and productivity of this lake. The even greater fascination in reading about Lake Chad comes from trying to grasp the spatial variability. Submerged sand dunes whose crests just appear above lake level provide a myriad of waterways and habitats over the so called "archipelago" regions which occupy 23 % of the lake surface. Some 8 200 km² (39 % of lake surface) is occupied by beds of emergent macrophytes (*Phragmites australis*, *Cyperus papyrus*) and 38 % is classified as open water. Add to this spatial diversity, a temporal complexity of dry and wet seasons (two thirds of the lake's water is replaced each year), and long term droughts (in which half the lake dries out completely) and one wonders how a few limnologists can hope to present a synthesis of the functioning of such a system. This book is an attempt to do so, and the result is a valuable addition to the tropical literature.

Following a useful introduction (pictures of the research vessels will be of interest to all tropical limnologists) the book is divided into five parts which I summarise as:

- (1) the lacustrine environment (meteorological and hydrological data, physics, chemistry, palaeolimnology);
- (2) the biological communities (macrophytes, phytoplankton, zooplankton, benthos, fish);
- (3) production (phytoplankton, zooplankton, benthos, fish);
- (4) trophic relations (food webs including birds);
- (5) the ecosystem as a whole.

The index to organisms and the general index are adequate. The photographs are excellent, although I felt that there were too few of these given the diversity of the system. The figures are clear and well drawn but the legends to the figures and tables are often not explicit enough. Typographical errors were few, but why is the Shari river spelt Chari in the figures? The translation to English was generally good although the unmistakable French "flavour" was well expressed in one particular subheading: "6.2.4.1 History of the revolution of the lake..."

After these minor criticisms, back to the science. Why does an old endorheic lake in a desert area have a low conductivity? The answer lies in a complex regulatory system including groundwater seepages, soil adsorption, geochemical precipitation and biological removal. It was while reading this fascinating chapter that I realised the book is written by scientists for scientists. Throughout the book equations, growth coefficients and multivariate analyses are presented on the assumption that the reader has a good background knowledge of the subject. It was good to see that water movements in the lake are fairly well understood but unfortunately on the chemistry side, data for nitrogen and phosphorus are conspicuously lacking.

The great diversity of phytoplankton (> 1 000 species and taxa) and fish (120 species) compared with other African lakes of similar depth is striking. In several chapters, particularly those on benthos and zooplankton, attempts to relate biological changes to the environment were not really successful. One is continually reminded of the temporal and spatial complexity of this lake system which makes such relationships very hard to establish. This, in spite of the fact that Lake Chad is unique in Africa (and in the tropics in general)

for its relatively long term (3-10 years) biological and environmental measurements. Of particular value in this respect is the 9 year data set of chlorophyll *a* and primary production. In the chapter on secondary production there are some valuable data (some of the very few for the tropics) on growth rates, development and production of zooplankton and molluscs. Although some of this information has appeared as separate papers in the past, its integration into this single book is very welcome.

The complexity of the Ghad system and its various links with the catchment are perhaps best appreciated by reading the fisheries chapters. The great importance of the inflowing river floodplains to a lake fishery are well illustrated. The socio-economic constraints on fisheries management (how can one realistically prevent the trapping of immature fish moving across the vast flood plains) is also emphasised.

Throughout the book a comparison is made between conditions during "normal" Lake Chad (area 21 000 km²) and the drought conditions resulting in the "lesser" Chad (ca. 8 400 km²) and in the final section of the book these comparisons are brought together in a well synthesised discussion.

Although there are clearly some major gaps in the understanding of the Lake Chad system (particularly bacterial studies, nutrients, the role of periphyton) this volume presents what is probably the most comprehensive overall data set for any tropical lake. The price \$ 137.00 is high, but no aquatic research group should be without a copy.

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