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LIVINGSTON, R. J. 2001. **Eutrophication processes in coastal systems.** CRC Press. 318 p. US\$100. ISBN 0-8493-9062-1.

This book summarizes what the author and a succession of students and collaborators have learned in 30 yr of work on seven shallow river estuaries in eastern Alabama and the western panhandle of Florida—a region spanning about 10% of the coastline of the Gulf of Mexico. The focus is on the role of microalgae and, in particular, phytoplankton in eutrophication. The author repeatedly underscores that little is understood about these central players, and even less is known of how food webs respond to changes in microalgal community composition. Unlike most eutrophication research, nutrients are not given center stage.

About half the text is a detailed description of Perdido Bay. It is based on an 11-yr study of the effects of a pulp mill. It is apparent that nutrient discharge from the mill caused most of the problems, but analysis of these effects was complicated by alternating periods of flood and drought. The spatial and temporal variations of nutrients, hydrography, phytoplankton, zooplankton, fish, sediment characteristics, benthic fauna, microalgae, and vegetation are described exhaustively. In this wealth of detail, it is not easy to see the larger picture, and the diagrams are often not very helpful in showing how different components varied in relation to each other. Undoubtedly there were drastic eutrophication effects, particularly when high phosphate loading from the mill coincided with drought, but the highly variable flushing rates made evaluation of these effects qualitative rather than quantitative. There are numerous tables of *p*- and *r*²-values from regression analyses, but little effort to sort causal mechanism from spurious correlation. Effects on secondary production are clear during droughts, but it is not evident to me that an influence from toxic constituents in the mill discharge can be entirely ruled out. The impression is rather that the decline of environmental quality in Perdido Bay resulted from a combination of anthropogenic stresses, including the increased salinity and stratification resulting from a new canal to the sea, with excessive nutrient load from the pulp mill delivering the *coup de grace*. It would have been interesting to learn also of effects on commercial and recreational fisheries and on other recreational uses of Perdido Bay.

Great efforts were made to identify organisms correctly, as documented in long tables of scientific names and quantitative measures of abundance. I question the value, however, of devoting several pages to a table (table 4.5) of species with biomasses given either as — or 0.000000. In contrast, nutrient analyses used standard methods of low sensitivity, and some diagrams contain numerical values for ammonia concentration that are clearly below the stated detection limit, without explaining how they were obtained (e.g., fig. 6.8). Nutrient limitation was studied for only 1 yr, and is accorded just over three pages; a nutrient budget is nowhere to be seen.

After the in-depth description of the Perdido Bay system, comparisons are made with six other estuaries, which range from oligotrophic to highly nutrient enriched. The conclusion is that secondary production depends largely on benthic microalgal production, being greatest in moderately nutrient-rich areas and collapsing when nutrient enrichment is excessive (because of phytoplankton blooms that deleteriously affect sediment quality). The mechanism remains unclear, but the author questions the commonly accepted influence of hypoxia. Unfortunately, comparisons are not

based on quantitative dose–response or concentration–response relationships, and recommendations are made for emission limits for the pulp mill on Perdido Bay based simply on not exceeding levels during the early part of the study, when conditions in the receiving water were still acceptable. This ignores possible changes in other nutrient sources to the bay and the likelihood that successful restoration may require more than just a return to the load level shortly before the system switched to a degraded state (cf. Scheffer et al. 2001).

The most readable part of the book is a heartfelt lament over the difficulty of obtaining support for long-term ecosystem research, the resulting sorry state of research on coastal ecosystems, and the widespread and continuing coastal environmental destruction caused by local politicians in collusion with commercial interests in the U.S. Here, Livingston harshly criticizes some distinguished colleagues and inevitably invites the question of whether he has a better analysis to offer.

Being currently involved in reporting 26 yr of data from an ongoing ecosystem study of coastal eutrophication, I appreciate the difficulty both of summarizing many years of multifaceted data in a comprehensible way and of drawing quantitative conclusions from them, resulting in predictions and recommendations. Livingston struggles boldly, and partly successfully, with the first part of this job but hardly even attempts the second. The writing often gives the impression of a draft in need of editing for brevity and clarity, and proofreading has been deficient. There are many typographic errors, and figures sometimes do not show what their legends claim; for example, fig. 4.4(a) on nutrient loading to Perdido Bay gives nitrogen loading twice, instead of promised information on carbon compounds and silica, and fig. 4.4(b) lacks the data on total nitrogen loading mentioned in the legend.

I would not have agreed to review this book had it been correctly titled “Eutrophication processes in some Gulf of Mexico estuaries.” Although I would have missed much detailed information about these particular ecosystems, no new insights useful in my own work would have escaped me. Those working in Gulf of Mexico estuaries may want to own a copy for the unique quantitative data set and taxonomic detail it offers, but the high price should deter others. For an overview of eutrophication problems in all Gulf of Mexico estuaries, there is much more useful information in selected chapters in Bianchi et al. (1999), a valuable reference not cited by Livingston.

In summary, despite its grandiose title, this is not a general book about coastal eutrophication processes. It is a location-specific study of the effects of eutrophication on species composition and trophic organization in shallow estuaries in the northeastern Gulf of Mexico, from which no quantitative generalizations likely to apply to other areas emerge.

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References

- BIANCHI, T. S., J. R. PENNOCK, AND R. R. TWILLEY [EDS.]. 1999. Biogeochemistry of Gulf of Mexico estuaries. Wiley.
 SCHEFFER, M., S. CARPENTER, J. A. FOLEY, C. FOLKE, AND B. WALKER. 2001. Catastrophic shifts in ecosystems. *Nature* **413**: 591–596.