



The Impact of Species Changes in African Lakes.

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on aquatic plants were quite relevant to the study presented on the effects of phenol on water hyacinth. Most of the very few references in the entire book were one to three decades old, a situation that points to a widely recognized void in the availability of modern information to Chinese scientists.

A great number of typographical errors occur unevenly throughout the book. Although most are simply distracting, erroneous spelling of species names, absence of reference to taxonomic authorities, or lack of citation of source reference works indicate a need for greater scholarship that should have been demanded by the editors. Although many of the data presented show responses to experimental manipulations, simple statistical analyses of confidence intervals were often absent. Where used, as in the thorough and instructive analyses of the accumulation and elimination of hexachlorobenzene in different stages of fish development (Huang et al.), credibility of the conclusions improved greatly.

This compilation is a small step toward enhancing exchange of examples of problems and research on the surface waters of China. Discourses of this type can accelerate reduction of the information gaps that are so evident in works of this ilk.

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THE IMPACT OF SPECIES CHANGES IN AFRICAN LAKES. *Chapman and Hall Fish and Fisheries Series, Volume 18.*

Edited by Tony J Pitcher and Paul J B Hart. London and New York: Chapman and Hall. \$95.00. xxxii + 601 p; ill.; author, species, and subject indexes. ISBN: 0-412-55050-4. 1995.

This excellent series is devoted to the biology of fishes, from pure to applied aspects. This book is based on a conference that took place in 1992 at Imperial College in London, and was sponsored by the Overseas Development Administration of the British Government. Since much of Eastern Africa, where the African Great Lakes are located, used to be in the British Empire, this seems fitting. In 24 chapters (four authored or coauthored by Tony Pitcher himself), 37 contributors document and discuss the biggest mass extinction of vertebrate species in modern times—the extinction of hundreds of endemic species of haplochromine cichlids from Lake Victoria in East Africa, largely owing to the introduction of the exotic Nile perch. What lessons for the preservation of biodiversity and prevention or promotion of future species introductions can be learned from this devastating ecological disaster?

The tragic event was caused by the willful (“deliberate”) introduction of the Nile perch (*Lates niloti-*

cus) by fisheries officers from the Uganda Game Fisheries Department (see Chapter 10 and references therein) into Lake Victoria in the 1950s and 1960s. The Nile perch is a very large (specimens of almost 2 meters in length have been caught) piscivorous species. The analysis of biological, ecological and economic changes in Lake Victoria that were brought about by this exotic species are the focus of this book, particularly in the first 12 chapters (Part I). Additionally, in the last 12 chapters of the book the effects of other introductions, namely that of the planktivorous freshwater sardine *Limnothrissa miodon* to other lakes, are discussed. For further comparison, the ecological situation in other African lakes (e.g., Lakes Kariba, Kivu, Naivasha, Itezhi-tezhi, Turkana, Malaŵi, Malombe, Tanganyika) with, or without, introduced species and with, or without, heavy fishing pressure are described in this second section of the book.

The size of Ireland, Lake Victoria is the largest lake in Africa and one of the largest lakes in the world. For about 100 years, mostly British ichthyologists have studied the extraordinary fish fauna of this lake, which is (was) dominated by an adaptive radiation of more than 300 endemic species of haplochromine cichlid fishes. This magnificent diversity of cichlids has declined since the introduction of the Nile perch, but other changes (such as increased fishing pressure on the cichlids) in the Lake Victoria ecosystem occurred at the same time. Moreover, comparisons with other lakes to which the Nile perch had also been introduced or lives naturally, but where it seemed to have less devastating effects, suggest that the Nile perch alone may not be to blame for the current situation in Lake Victoria. These comparisons make it clear that the exotic Nile perch cannot be the single cause for whatever has deteriorated the Lake Victoria ecosystem (see Bundy and Pitcher, Chapter 7). It is clear, however, that it is the overwhelming cause of all evil in Lake Victoria. Because of its introduction, the architecture of the food web changed dramatically—the prawn *Cardina nilotica* has increased in abundance, and the population of the water hyacinth (*Echhornia crassipes*), nonnative to lake Victoria, is exploding. Deoxygenation of the deeper water layers of the lake and other more drastic changes in its physical environment contributed to the observed dramatic effects on the Lake Victoria ecosystem.

This book is at a crossroads, since it discusses the advantages and consequences of preserving biodiversity (the extraordinarily diverse fauna of Lake Victoria) and the economical advantages of having created successful fisheries owing to introduced species (e.g., *Limnothrissa* and tilapia cichlids) in man-made and natural lakes (such as Lakes Kariba, Itezhi-tezhi, Naivasha, and Kivu). The difficulty (or

impossibility by some accounts, discussed in several chapters) of being able to predict the biological effects of natural invasions or deliberate introductions is highlighted by the contrasting results of the biological disaster (albeit some probably short-term economic advantages) in Lake Victoria with the overall seemingly positive outcome of the sardine introductions to the man-made Lake Kariba.

From the perspective of a biologist interested in conservation, the answer seems obvious: If you cannot predict the outcome, don't introduce exotic species. However, limnology of African lakes is by its nature an interdisciplinary effort that involves more than purely biological issues and needs to concern itself with the sociological, humanitarian and ecological impacts of the necessary human exploitation of the resources in these lakes. The actions and recommendations of fisheries officers to introduce or not to introduce are of profound consequence, not only for the preservation of biodiversity but also for the sustainability of large human populations that live around the great East African lakes. It has been estimated that the livelihood of about 30 million people depend on the fisheries for mostly two species of freshwater sardines that are endemic (except for human introductions) to Lake Tanganyika. Therefore, these determinations demand cooperation among different groups of scientists that do not typically interact or speak each other's language and can only be achieved by multidisciplinary conferences (such as the one from which this book resulted) and by the active cooperation between "applied-thinking" and "pure-thinking" scientists.

This book contains many outstanding, exemplary chapters of very high quality by African researchers and other, mostly European, workers who spend many years in Africa. Pitcher and Hart once again edited a volume of excellent quality. The contribution of the researchers from the University of Leiden in the Netherlands stands out. In Chapter 6 Frans Witte, Tijs Goldschmidt and Jan Waninck summarize twenty years of ecological baseline and also quantitative fisheries work. This chapter sadly, but accurately documents the temporal dynamics of the decline and eventual lamentable demise of about 200 endemic species of Lake Victoria cichlids from different ecological guilds and the concomitant increase in the Nile perch population. The differential effects on and spatial and temporal dynamics of the cichlid flock extinction highlights the different effects of the disappearance of different trophic groups of cichlid fishes. The decimation of detritivores is likely to have caused more microbial decomposition and algal blooms, resulting in decreased oxygen concentrations—the final outcome is a lake with a much less complicated and shorter food web, which makes the Lake Victoria ecosystem

less stable and more eutrophic. The newly developed fisheries for the Nile perch in Lake Victoria will likely not sustain in the long term, even if fishing effort is reduced and size limits on the catch implemented.

This book documents important lessons about the prevention of future introductions of exotic species, which can be learned from the ecological disasters that resulted from past mistakes. This book is of much value not only for anyone interested in African fishes and limnology; it is a "must read" for all interested in conservation of biodiversity, introductions of exotic species, and the sustainability of natural resources in a continent that crucially depends on the exploitation of the fishes that live in its lakes.

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ENVIRONMENTAL SCIENCES

THE ENCHANTED AMAZON RAIN FOREST: STORIES FROM A VANISHING WORLD.

By Nigel J H Smith. Gainesville (Florida): University Press of Florida. \$29.95. xiv + 194 p; ill.; index. ISBN: 0-8130-1377-1. 1996.

The Amazon Basin is the largest wilderness area left in the world. Its biodiversity is stunning; so is the rate at which it is disappearing. As I was beginning to collect my thoughts to write this review, my eye was caught by a headline from a page-one article in the *New York Times* (Sun., July 21, 1996): In Brasil, Indians Call on Spirits to Save Land—Haunted Treasure, A Special Report. The article describes a confrontation between an indigenous Indian tribe in Amazonia and the forces attempting to develop the Indians' lands in the modern mode—dams, mines, lumbering—just the sorts of things that hover in one's mind while reading Nigel Smith's *The Enchanted Amazon Rain Forest*. For those reasons alone this book is important; it might well serve as an informal repository for the cosmologies, beliefs and folklore of the indigenous tribes and peasants of the Amazon Basin—informal because it is written for the layperson; a repository because it is well documented as to dates and places of the various interviews Smith held with the Indians and peasants of the area. One thing I feel the book needs, however, is a good map showing the relation of the study areas to the Basin as a whole, and to Brasil and its neighboring countries. The map provided in the book is entirely too small and difficult to read. Very helpful would have been a one-page map of Brasil, showing its borders with its neighbors and delineat-