portantly in Danish limnology, possibly because the lakes of Denmark are small and usually shallow.

The FBL might be a useful model for national programs in limnological research. The first element of the model seems to be reliable financial support, at least as judged from the constancy of full-time personnel at the FBL. Also, the FBL has shown evolutionary rather than catastrophic programmatic change, and the result is much beneficial continuity over time. There seems to be a well-established connection between the trainees of the laboratory and governmental technical posts that deal with limnological subjects. If so, this is a marked contrast with the United States, where limnological tasks in government often are performed by individuals whose main expertise lies elsewhere. A final point concerns the organizational philosophy of the FBL, which appears to work through the scientific motivations of independent investigators rather than through a master plan with fixed component directed from above.

Denmark is a nation of only 5 million persons. If the United States were to follow the Danish model with linear scaling to population, it would have some 60 limnological centers staffed by 600 research limnologists, all of whom might spend more time solving limnological problems and less time writing proposals than the present ones do. This seems improbable in the short term, but it is food for thought.

Freshwater Biology concisely satisfies one's curiosity about Danish limnology, and is also an excellent general reference work. There is one unanswered question: Why does *limnology* appear only inside the book and not on the cover?

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HAUER, R., AND G. LAMBERTI [EDS.]. 1996. **Methods in stream ecology.** Academic Press, San Diego. ISBN 0-12-332905. 674 p.

The stated intent of this book is a compilation of techniques and exercises useful in a wide array of teaching and research in stream ecosystems. Chapter topics range from stream geomorphology to fish competition. Each chapter includes a brief introduction to the topic, followed by a discussion of general approaches, the important questions, and then one or more detailed exercises. The common structure of chapters (Introduction, General Design, Specific Exercises, Review Questions, and Material Lists) adds greatly to the overall coherence and utility. The cross-referencing among chapters is generally good and the overall structure (physical, organismal, community, ecosystem) is quite logical. Most chapters include some discussion of statistical analyses of data and sampling design, which are too frequently ignored. Fortunately, a few chapters include sample datasets (e.g. "Primary Production" by T. Bott, "Macroinvertebrate Production" by A. C. Benke) that are very helpful for instruction purposes since the actual data collection process for many of the exercises is prohibitive. There are relatively few typographical errors, although two occur in equations (8.1 and 16.5).

Stream ecology encompasses many disciplines and this book has quite a broad coverage. No book can be all-inclusive but there are a few topics that are underrepresented in these exercises. Dissolved organic carbon appears only sporadically (yet prominently in "Heterotrophic Microorganisms" by A. Ward and M. Johnson). A simple survey of stream waters, springs, riparian wetlands, and debris dams would be informative as to the sources and sinks of DOC in streams. Simple absorbance measures may often provide sufficient resolution to obviate the need for automated carbon analyzers. Second, fungi do not even appear in the index, although there are a number of easy techniques (spore collection in "bubblers," plating) that could be used to demonstrate their occurrence and distribution among habitats in streams and rivers. Nitrogen cycling and(or) limitation receives no attention, although nitrate in surface waters is recognized as a serious problem and an indicator of anthropogenic effects as well as being a limiting nutrient in many cases. Information on sampling for solutes in general is underrepresented (e.g. alkalinity is not mentioned). A range of simple exercises examining storm samples, samples above/below farmland, and subdivisions could be used to demonstrate solute inputs and potential effects on biota. Alternatively, data are readily available for nitrate concentrations in a wide range of streams (e.g. USGS Water Resources reports and National Summaries) and could be used in laboratory or classroom exercises.

The editors intend the book to be useful for both undergraduates and seasoned scientists, and the editors have largely met these goals but they are to some degree mutually exclusive. The rigor and sophistication that make this a useful research reference make it less desirable as a set of undergraduate laboratory exercises. Most of the exercises are much too technical and time-consuming to fit into one or two laboratory periods of an undergraduate course. A graduate-level or more intensive summer course can probably use approximately half the exercises. The other half of the suggested exercises would be most useful in designing the initial steps of a thesis or multi-year research project. Most of the exercises are simplified (sometimes not) versions of the authors own research interests and as such tend not to cover the full range of exercises feasible to explore any one subject, and the authors tend to underestimate the difficulty of gearing up for a technique they use every day. The level of detail provided is quite valuable when using this book as a research reference, which is clearly beneficial for graduate students in the early phases of thesis planning or starting a new research project.

In reading this book, the "large river phobia" that permeates stream ecology as a discipline is quite evident although some chapters have a more balanced view (e.g. "Transport and Storage of FPOM" by Wallace and Grubaugh). There is a need for lotic ecologists trained in approaches and techniques appropriate for all classes of running water ecosystems, and perhaps more importantly, our conceptual frameworks occasionally seem to be constrained by sampling logistics rather than fundamental differences between large and small rivers. The societal impacts and dependence on rivers are clear (e.g. Boon et al. 1992), yet we run the risk of not training the scientists required to deal with future science, management, and policy issues in these larger systems. Obviously, from a practical point of view, one cannot arrange boat transportation for a whole class of undergraduates but one can imagine a range of simple exercises (temperature, suspended sediment above/below dams, power plant effluent streams, artificial substrate incubations adjacent to channelized vs. natural shorelines) to expose students to the habitats, flora, and fauna and to desensitize their anxiety about large river systems. Just as useful and appropriate would be use of existing datasets as instructional examples. For instance, most larger rivers have relatively long-term flow and water chemistry records readily accessible from the USGS that could be used in a wide array of instructional activities. There may be historical maps that could be used to show large-scale habitat modifications, or a class could compare historical with recent faunal surveys to detect invasive species and(or) extinctions.

In summary, we believe this is a very useful book, better suited for the researcher than for the undergraduate and should be part of any well-rounded stream ecologist's library. Our comments are intended to describe the scope of this book and use it as a barometer of the state and direction of the discipline. Stream ecology is a healthy, broad discipline and this book can help an individual researcher increase the scope of his or her research interests by facilitating application of new techniques.

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MILNER, A. M., AND M. W. OSWOOD [EDS.]. 1997. **Freshwaters** [sic] **of Alaska: Ecological syntheses.** Springer. ISBN 0-387-94379-X. 369 p.

Exploitation of the environment results in profound alterations of natural ecosystems. Evaluation of these changes, as well as their potential suppression or reversal, presumes some understanding of conditions at an earlier stage. In spite of the intensive modifications of the temperate and tropical regions of the world by rampant, exponentially increasing human exploitation, vast areas of the arctic and subarctic regions are relatively unmodified by direct human interventions. Alaska is a small but important portion of these regions. Our understanding of existing limnological characteristics of the inland waters of Alaska is largely in its infancy.

The small book on the fresh waters of Alaska makes no attempt to be encyclopaedic in summarizing limnological data available from this large, relatively remote state. Rather, examples of different freshwater ecosystems are synthesized, in as much as is possible at these early stages of evaluation and understanding. Some ecosystems are studied most intensively—coupled descriptive and experimental analyses of these few systems provide disproportionately greater insights into the resiliency and potential recovery capacities of these systems.

Because of the uneven and usually limited depth of understanding of the structure and functioning of waters of Alaska, coverage in this book is similarly uneven. The severe climate along an extensive latitudinal gradient results in a vast habitat and climatic diversity of the state. The small human population and restricted access to surface waters has resulted in limited degradation. Recognition of the need for understanding of these resources, however, and excellent support logistics associated with the military have attracted a bevy of good limnologists to the region. By far the most thoroughly studied lake ecosystem in Alaska is Toolik Lake, where the seemingly simple food-web structures are in reality large and complex. Importantly, the largely phosphorus-limited planktonic food-web is dominated by microbial components, and clearly most organic matter and energy emanates from benthic and allochthonous sources. Frequent seemingly dogmatic statements given as fact regarding controlling mechanisms for carbon and energy fluxes in the Toolik ecosystem are perhaps founded in the many studies cited, but often many alternative explanations exist. The limnological summary of the shallow, highly humic stained, and eutrophic cryogenic Smith Lake provides a marked contrast to the Toolik system and touches on the enormous lake diversity of this region.

The detailed studies of the Kuparuk River indicate the marked temporal variability that occurs in tundra riverine ecosystems. Although little is known of the microbial utilization of organic matter, the fluctuating regulatory capacities of phosphorus, nitrogen, and invertebrate grazing on attached communities demonstrate the temporal volatility that exists in these tundra systems. The concluding chapter by M. W. Oswood presents a particularly instructive analysis of both the diversity and commonalities among streams and rivers of Alaska, in which the comparative climatic and edaphic traits of the region are integrated with biological components.

Much of the book is devoted to the effects of organisms on surface waters. Discussion of waterfowl and wetlands is most general, and where the general characteristics of waterfowl distributions and migrations emerge, practically no ecology of the vast wetlands is presented. Much attention is directed to effects of land management, mining, and forestry on salmon habitat, behaviors, and migrations. Clearly the loading of nitrogen from marine sources by the migration, spawning, and death of salmon can be significant in some lakes, although quantification is very difficult. The management practice of fertilization of oligotrophic lakes to increase growth rates of salmon has been variably successful because of the individualistic balances among nutrients and fry stocking. Eutrophication of lakes for salmon, most of which are never harvested, is quite antithetical to contemporary management strategies and cannot be justified.

Climate is obviously a dominant driver of the bioenergetics, biodiversity, rates of biogeochemical cycling, and productivity in the aquatic ecosystems of this arctic region. Climatic variability results in frequent disturbances of habitats, community structure, and productivity. The idea that these freshwater ecosystems are simple is obviously misplaced. The primary messages of this eclectic collection of limnological essays are how little we understand of these tundra and arctic fresh waters and the difficulty of extrapolating our general concepts of ecosystem operation to these systems so severely constrained and modified by climate.

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RICHARD Y. MORITA. 1997. **Bacteria in oligotrophic environments: Starvation-survival lifestyle.** Chapman & Hall. 529 p.

Bacteria have extraordinary capability for survival in the absence of energy and nutrient sources. Viable (i.e. capable of growing and producing progeny following resuscitation) bacterial cells have been recovered from rocks, coal, frozen soils, ice cores, solar salt deposits, subsurface deposits, and waters with apparent ages of thousands of years. Owing to the ease with which such samples can become contaminated during handling, it is often difficult to verify claims