COMPARISON OF TERRESTRIAL AND MARINE ECOLOGICAL SYSTEMS

A WORKSHOP on this subject was held in 1989 with partial National Science Foundation support. The report (copies available from J. Steele) discusses the various problems, logistic and conceptual, in making such comparisons, but its main conclusion is that we should have workshops or summer schools that focus on specific topics where interactions between the different sectors would be most fruitful. A recent meeting of the Steering Committee (J. Cohen, P. Dayton, T. Kratz, S. Levin, R. Ricklefs and J. Steele) proposed that three topics be selected from the report—patch dynamics, long-term data sets and analysis of community structure. Each of these would be the focus of a workshop/school lasting four weeks, with about twenty-five to thirty participants. The intent would be to compare data sets and methods of analysis across the terrestrial, freshwater and marine sectors. The output would be research methods, ideas and applications. The present tentative plan is to hold the first of these workshops on patch dynamics in summer 1991 with S. Levin, T. Powell and J. Steele as the organizers. We wish to learn the level of interest, especially at the graduate student and post-doctoral level. Please contact any of the organizers with your ideas and opinions: S. Levin, Center for Environmental Research, 345 Corson Hall, Cornell University, Ithaca, NY 14853-2701, (607) 255-4617; T. Powell, Division of Environmental Science, University of California, Davis, CA 95616, (916) 752-3026; J. Steele, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, (508) 548-1400. ❑

BIOLOGICAL OCEANOGRAPHY: AN EARLY HISTORY, 1870 TO 1960

By Eric L. Mills

1989, 378 pp., $42.50, Cloth, Cornell University Press, Ithaca, NY.

Reviewed by David J. Carlson

In the mid-nineteenth century, biologists studying the oceans were mostly interested in discovering deep-sea organisms. Today biological oceanographers pay most attention to processes in the surface ocean. In his latest volume of oceanographic history, published by Cornell University Press in its History of Science Series, Eric Mills describes the period from 1870 to 1960 during which focus shifted from deep-sea natural history to upper ocean plankton dynamics and when, as a result, biological oceanography evolved and separated from marine biology. Although the history is titled *Biological Oceanography*, the book's primary topic is the progressive understanding of plankton dynamics in relation to chemical and physical oceanographic factors, a topic relevant, perhaps instructive, to many present-day oceanographers. Dr. Mills also touches on historical patterns of promotion and remuneration of oceanographers, of ship availability, and of private, federal and institutional support for oceanography, issues that provoke and perplex us still.

The inception and evolution of biological oceanography—distinct from marine biology by its attention to process rather than organism and destined eventually to separate from general ecology because of its attention to fisheries, its early need to invent and apply mathematical models, and its operation largely at institutes dedicated to oceanography—occurred mostly in northern Europe. There, increased populations, diminished agricultural resources, and improved fishing technology had most affected fisheries, and trained observers and experimenters were available from non-marine disciplines in the European university system. Because most instructors and students in that system were men (and severely well dressed if photographs of sea-going attire are accurate evidence), the initial biological oceanographers were male (Sheina Marshall of the Scottish Marine Biological Association laboratory and Penelope Jenkin and Marie Lebour of the Plymouth Laboratory are notable exceptions). Mills introduces us first to Victor Hensen, a German biochemist, anatomist and physiologist who turned his attention to marine subjects when nascent Germany formed a commission for the study of its seas. Hensen recognized that small planktonic organisms were important components of marine systems but more importantly felt that their abundance could be determined systematically and accurately. He eventually developed and calibrated plankton nets to be lifted vertically through the water column. Hensen was followed by Karl Brandt who, with colleagues of the so-called Kiel School (after Kiel University), first determined that nitrogen and other nutrients could limit phytoplankton growth and recognized geographical patterns evident in plankton abundance data collected by Hensen. (One of Brandt's colleagues, Hans Lohmann, also showed that Hensen's nets failed to collect nanoplankton and developed centrifugation and filtration techniques to improve collections.) The work of the Kiel School was extended in Norway by H.H. Gran. Gran described spring blooms in Norwegian coastal waters (the Kiel group had not recognized or not emphasized blooms in their data), documented vertical inhomogeneity (which had been obscured by Hensen's vertical tows), understood (with the help of A. Nathansohn, a German physicist) the importance of vertical mixing in supplying nutrients and controlling phytoplankton growth and described and then measured (using light and dark bottles) the compensation depth—that depth where energy gained by photosynthesis balances the energy spent in respiration. These and other efforts led eventually to the work of G. Atkins and H.W. Harvey at the Plymouth (England) Laboratory who improved meth-

[CONTINUED ON LOWER PAGE 62]

David J. Carlson, College of Oceanography, Oregon State University, Oceanography Administration Building 104, Corvallis, OR 97331-5503.

A FRAGILE POWER: SCIENTISTS AND THE STATE

By Chandra Mukerji
1989, 253 pp., $24.95, Princeton University Press

Reviewed by Andrew G. Dickson

What does the state expect for its research dollars? What intellectual and political compromises does a scientist make by seeking government grants or contracts? Do such questions haunt you as you write your final reports, your new proposals? Perhaps they should. In her recent book, Chandra Mukerji, professor of Sociology at the University of California, San Diego, studies oceanographers as paradigms of soft-money scientists at large (those who seek government funds to further their research, not solely those whose salary depends on such funds) and concludes that most scientists delude themselves as to the extent of their individual scientific autonomy—that scientists have sold their "voice" for a mess of pottage.

Andrew G. Dickson, Marine Physical Laboratory, Scripps Institution of Oceanography, La Jolla, CA 92093-0902.

Her discussion focuses detailed attention on two seemingly different programs: research funded by the U. S. Department of Energy ostensibly to examine the suitability of the oceans as a site for the disposal of nuclear waste and expeditions funded by the National Science Foundation to study submarine hydrothermal vents. She uses these as case studies to examine the relationship between scientist and state and dismisses as oversimplified the utilitarian concept that

BIOLOGICAL OCEANOGRAPHY: AN EARLY HISTORY, 1870 TO 1960

[CONTINUED FROM PAGE 61]

ods for measuring nutrients, submarine light and phytoplankton pigments, recognized the importance of thermally-induced stratification, and identified the role of grazers in controlling phytoplankton blooms. Eventually, Gordon Riley at Yale and the Woods Hole Oceanographic Institution used Plymouth Laboratory information on nutrients, light and grazing to develop (with H. Stommel and D. Bumpus) mathematical models of physical and chemical controls on phytoplankton and zooplankton growth over Georges Bank. Mills contends that at that point (approximately 1960) most major paradigms, sampling schemes and analytical techniques in use in biological oceanography today were in place. One wonders whether development of fluorometric assays for chlorophyll pigments by Yentsch and others should have been included among the fundamental developments, but otherwise Mills seems to have given a thorough and accurate recounting. What is striking, and perhaps cause for reassessment, is that so much of what we do today derives with clear lineage from a few investigators with whom most of us share a common and, it must be said, a somewhat narrow geographical and cultural heritage.

Mills charts for us the exchanges of information during these ninety years of research, the character of the investigators and their laboratories, the development of ideas and analytical and sampling technologies, the national financial support and international sampling programs, and the blooming and senescence of the Kiel and Plymouth groups. The author's prose is clear and precise and figures and data are supplied in a useful manner. A map would have been helpful to understand northern European coastlines and non-oceanographers might wish for a glossary. Nevertheless, learning this history, being introduced to predecessors whose names may be familiar only from bindings of taxonomic guides or as parenthetic appellations to scientific names, discovering the sources of our understanding, is an enjoyable voyage.

It is also a voyage that provokes. We find ample precedent for grand programs implemented to measure ocean processes that eventually deteriorate to uncertainty about sampling efficiency, for radical changes in understanding as a result of analytical improvements, for progress as a function of ship availability, and for the evocation of oceanic microenvironments to render nonconforming conditions or processes more plausible. This history provides no explicit lessons or remedies, but reminds us that we in 1990 are not so unprecedented as we suppose nor so heretical as our reviewers contend. It also reminds us that since the start of oceanographic research we have been dependent on the expertise and energy of oceanographic technicians and that oceanography in general has been very successful when it has been able to attract talent from other disciplines. One wonders, as we cut technician salaries to reduce grant budgets and anticipate numerous retirements among senior oceanographers over the next five to ten years, whether our present system of attracting undergraduates from traditional science disciplines into employment or graduate training in oceanography will provide sufficient diversity of talent and whether enough skilled science undergraduates will be available from any discipline.

In 1989, when this history of European and American research on plankton blooms in the North Atlantic was published, European and American oceanographers were involved in a major research effort on plankton blooms in the North Atlantic. That the topic has developed global import does not perforce indicate that our understanding has expanded proportionally. Dr. Mills provides us a valuable reference against which to check our intellectual, logistical and analytical progress. He also does us a considerable service, in a pleasant manner, by supplying us with oceanographic history that most of us failed to get as part of our education, by reintroducing us to our intellectual forebears, and by reminding us of the excellence and limitations of our heritage. ❑