BOOKS: OCEANOGRAPHY

Organizing Pelagic Ecosystems

Sharon L. Smith

Alan Longhurst's masterful and stimulating book, *Ecological Geography of the Sea*, immediately brings to mind another synthetic work, one that has influenced oceanographic teaching and research for more than fifty years. In *The Oceans* (*1*), Harald Sverdrup, Martin Johnson, and Richard Fleming asserted that "[t]he character of the fauna and flora is thus governed by the nature of the currents—namely, their origin, direction of flow, magnitude, coldness or warmth, degree of salinity or density, and their character as regards other attributes such as relative richness in nutrients...." Until recently, such an inclusive view of the fluid that covers 70 percent of our planet has been eclipsed by specialization and narrowed focus. Thus it is refreshing to find the insight and new ideas Longhurst has obtained from a limited set of basic principles and a broad focus. Longhurst beautifully shows us that the pelagic ecology of many ocean regions can be understood using a few fundamental concepts. With the coherent and simplified understanding presented in this book, everyone from the specialist to the layman will look at the ocean with new interest and appreciation.

Ecological Geography of the Sea
by Alan Longhurst
Academic, San Diego, 1998. 412 pp. $79.95. ISBN 0-12-455558-6.

For many years it has seemed that no one had time to organize the interdisciplinary understanding contained in our burgeoning knowledge of the world's oceans and seas. With numerous and exciting discoveries in various disciplines (chemistry, biology, physics, geology, geophysics, geochemistry), these have generated new subdisciplines. Oceanography has been accelerated down paths that are diverging instead of coalescing. New paradigms have developed quickly, and technology has added to the pace and to the paradigms. Synthesizing the now abundant region-specific data, Longhurst has come up with a scheme for uniting at least the physical and biological parts of the multidisciplinary enterprise known as oceanography.

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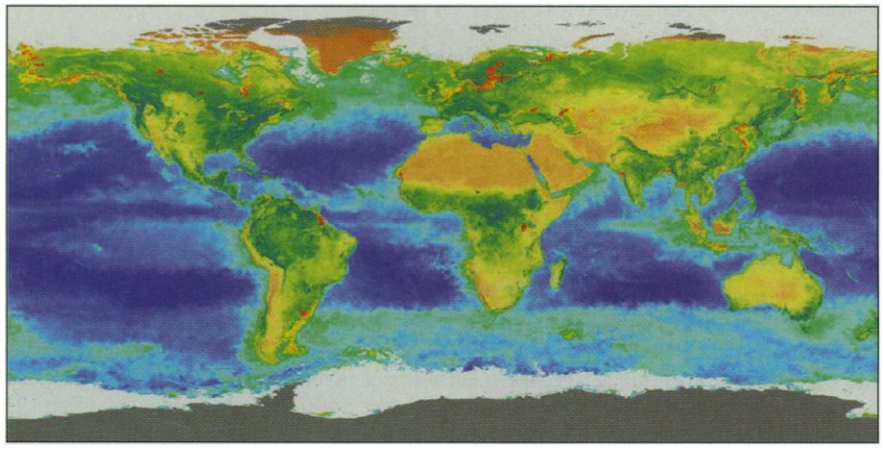
After introducing the aims and approach of the book, Longhurst develops the framework for his synthesis in short chapters on boundaries between ecological communities, physical factors that control biological processes in the oceans, primary and secondary areas of distributions (biomes and provinces), and temporal changes in the positions of boundaries. These five chapters are enriched by Longhurst's fruitful integration of ideas from terrestrial ecology. For example, Longhurst considers oceanic fronts (both vertical boundaries between water masses and the horizontal "front" at the shallow pycnocline, the sharp density gradient usually found at depths between 30 and 200 meters) as ecotones, transitions between two ecological communities. He remarks "that ecotones exhibit special ecological characteristics which differ from either of the separated communities, and they may be the habitat of specialized 'edge effect' species." Terrestrial ecologists are not surprised to find greater diversity and abundance of life in ecotones, and Longhurst notes: "A short examination of ecotones at sea will demonstrate a similar effect there—an effect that must be acknowledged in any overview of the ecological geography of the surface waters of the ocean." Longhurst discusses physical attributes of various types of fronts and density discontinuities in the ocean, and what these mean for biological communities and productivity. His account is succinct yet inclusive; one sees the physical forcing of biological response in a new light. Each of the other framework chapters is similarly interesting, thought-provoking, and a wonderful text for teaching. Longhurst has captured the "common wisdom," redirected it slightly, and added a global overview of properties and processes derived from several large databases.

The remaining 70 percent of the book consists of a "geography for marine ecologists," four chapters treating primary biomes within the Atlantic, Indian, Pacific, and Southern oceans. These chapters provide a region-by-region encyclopedia of upper layer processes (both physical and biological) and of seasonal patterns in properties. As such, they offer integrated descriptions of various ocean sectors that will serve a wide audience: laymen interested in climate or sports fishing; graduate students trying to formulate research topics; research scientists looking for integrated, regional overviews; and teachers wishing to introduce the breadth of ocean ecology.



Pelagic biomass. Composite ocean color image for austral spring (boreal fall) 1997, showing relative chlorophyll concentrations (mg/m^3) at the sea surface. (Green is about 1.0, dark blue about 0.01.)

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The simplification required for a broadly synthetic effort such as Longhurst provides is the book's principal weakness; there will be specialists who can find fault. But readers unhappy with the author's treatment of their favorite bit of the ocean should be challenged to improve his presentation and to distill their own knowledge into something as understandable, comprehensive, stimulating, and succinct. For the regions I am most familiar with, I asked myself how I might refine Longhurst's synthesis. The result was mixed: The Arabian Sea is covered comprehensively, and the reader is offered many hypotheses in need of testing. The account of the Bering Sea is missing some major studies, and overlooks ideas concerning its food webs and ice-edges. Nonetheless, Longhurst has pointed us in a direction that can be profitably followed and exploited.

I find it interesting that this book and one by Mann and Lazier (*2*), which together formulate "modern" biological oceanography, were both written by scientists who spent a significant portion of their careers at the Bedford Institute of Oceanography in Nova Scotia. What attribute of that environment stimulated these authors? Certainly not the snow, fog, and mud, I presume.

Ecological Geography of the Sea is based upon the inseparability of physical environments and the biological communities and processes that occur within them. Its elaboration of this major theme provides another reminder of the earlier synthesis by Sverdrup, Johnson, and Fleming (who noted that marine ecology "must be based in part on data which provide a reliable picture of ocean currents both locally and in general"). Longhurst has provided the intellectual successor to *The Oceans*; his synthesis will be used in biological oceanography for a very long time. It is an inspiring, "I wish I could have done it," book.

References

1. H. U. Sverdrup, M. W. Johnson, R. H. Fleming, *The Oceans* (Prentice-Hall, Englewood Cliffs, NJ, 1942).
2. K. H. Mann and J. R. N. Lazier, *Dynamics of Marine Ecosystems* (Blackwell Science, Cambridge, MA, 1996).

BOOKS: BIOETHICS

Choosing to Favor Animals

Adrian R. Morrison

One of society's more contentious debates concerns its use of animals. In recent years, a number of people have entered the fray as adjudicators between those who would stop research involving animals and the scientists who believe animal research is necessary for medical progress. *The Human Use of Animals* was written by five such individuals to promote discussion of the ethical issues related to animal welfare.

The Human Use of Animals
Case Studies in Ethical Choices
by F. Barbara Orlans, Tom L. Beauchamp, Rebecca Dresser, David B. Morton, John P. Gluck

Oxford University Press, New York, 1998. 342 pp. $55. ISBN 0-19-511907-X. Paper, $26. ISBN 0-19-511908-8.

The authors come from different disciplines: physiology, philosophy, law, veterinary medicine, and psychology. They cover a variety of subjects, including Santeria sacrifice and modern agricultural practices, in 17 chapters, but emphasize questions arising from biomedical research. Readers new to the issues may assume it is balanced. The knowledgeable reader, though, will detect a distinct tilt toward what I surmise to be the core belief of at least some of the authors: Use of animals to benefit humans is morally wrong. A strong statement, but examine the evidence that this premise underlies much of the discussion in the book.

The first chapter, a primer on ethics and "moral issues about animals," forms the heart of the book. It begins by segueing from a 16th-century debate between two Spaniards on whether American Indians were human to the authors' statement, "Many believe that today's debates about human-animal interactions are fundamentally similar." It ends with quotes from neurosurgeon Robert White (a long-time target of animal rightists), who (quoting the authors) "believes that including non-human animals in our ethical system is a 'philosophically meaningless' ambition." Although White is presented as an extremist, his papers reveal a humane physician who holds that humans are special in comparison to animals, which is certainly not an extreme view. In the intervening pages, the authors consider questions about the validity of drawing sharp distinctions between humans and other animals.

The authors seem to give little consideration to all the ways that humans can rightfully claim significant differences from the rest of the animate world. Yet reasons abound for taking pride in being human and feeling worthy of special consideration. We are the only species to care for other species, or for our brain-damaged children for that matter. It is humans who have eliminated or alleviated the miseries of many animal diseases (as well as our own afflictions), and we are the hope for future advances.

I cannot leave this key chapter without also noting that the authors exhibit a remarkable inconsistency in demanding rigorous, scholarly defense of claims from scientists, while not displaying the same standards themselves. Note 70 announces their search of "every available database" found nothing documenting claims that "too much clinical experimentation with humans occurs prior to scientific animal studies." Yet the chapter (and book) is awash with off-the-cuff, unsubstantiated statements. For example: "In the scientific literature, there is a tendency to assume that animals have different forms of pain perception and cannot anticipate or remember pain—and therefore suffer less than humans." Have the authors not heard of conditioned aversion?

Most of the case studies are presented with an obvious slant against animal use. In one chapter, the University of Pennsylvania's Head Injury Research Laboratory, raided by the Animal Liberation Front (ALF) in 1984, is treated with the same unbalanced, scientifically uninformed bashing it has received in the animal-rights literature for 15 years. One learns little not found in literature from People for the Ethical Treatment of Animals (who handled ALF's publicity) and almost nothing to put the research in a medical context. I could find no consideration of what is, to me, the key question: Can one ethically choose to injure a limited number of baboons in efforts to solve the awful problems of severe head injuries (which, in the United States, occur every 15 seconds and lead to a death every 5 minutes)?

The authors' choices and presentations of individual cases frequently seem bent on portraying the use of animals in the worst light possible. The diverse issues of wildlife research are illustrated only with discussion of one bizarre case: A graduate student killed an out-of-range bird for collection and study by (non-sportingly) enticing it out of a national park with recordings of its voice. Are the authors leading the reader toward negative views of museum collecting by stating at the chapter's end that the vagrant vireo's skin lies untouched in a museum case and that no published report of the collector's research could be found? The vast and important field of aggression research is treated in similar fashion, with a focus on one experiment involving infanticide in mice. Is this to make it easier to exploit the readers' emotions? The discussion of ethical issues in pet ownership is restricted to tail docking of dogs, and is introduced with an obviously inhumane act by an untutored layperson.

Some subjects are more fairly treated. Harry Harlow's monkey experiments and their significance for understanding primate social development are described as accurately as I have seen. The ethical questions the authors raise seem quite appropriate to me. A chapter (which should have been the book's standard) on Santeria sacrifice addresses the difficult question of balancing religious freedom with legal and community standards in a measured, informed manner. Although good questions are asked throughout the book, too often they are presented in a leading fashion. One question remains: Should a book designed to foster ethical reflection push so obviously in one direction?

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