

Overall the book is nicely produced and very well illustrated with appropriate figures and tables. The bibliography is extensive and current although there is no mention of web-based resources which is surprising with there being so much on-line. Despite the minor reservations outlined above this is an excellent introduction to the use of GIS in archaeology and the authors are to be congratulated on condensing a massive body of information and presenting it in such an accessible manner.

GARY LOCK
Institute of Archaeology
University of Oxford, UK.

Geographic Information Systems in Oceanography and Fisheries. By VASILIS D. VALAVANIS (London: Taylor & Francis, 2002). [Pp xviii + 209]. ISBN 0-415-28463-5. Price £45.00 Hardback.

The science and practice of oceanography are normally broken down into several major subdisciplines, depending on the nature of an investigation: (1) geological oceanography or marine geology (rocks, sediments, shape of the ocean floor); (2) marine geophysics (rock structure and properties); (3) physical oceanography (ocean currents and air-sea interactions); (4) chemical oceanography (composition of seawater and processes altering this composition); (5) biological oceanography or marine biology (organisms within the ocean and ecological interactions); and (6) ocean engineering (design and construction of instruments, vehicles, and associated technologies to assess and monitor the oceans). *Geographic Information Systems in Oceanography and Fisheries* is largely concerned with applications of GIS to biological and physical oceanographic problems. It was conceived within the timeframe of an international workshop on GIS and fisheries that was a satellite meeting to the Millennium Cephalopod Conference of the Cephalopod International Advisory Committee (for the uninitiated, cephalopods include octopi, squid, cuttlefish, and the like). The book is especially timely with the recent explosion of worldwide interest in and applications of GIS to fisheries management, including stock assessments, marine species population dynamics, species life history, habitat characterization, and marine protected area design.

The book includes four main sections, all extremely well referenced with regard to the burgeoning literature of geographical information science and marine/coastal applications of GIS. The author did his homework well.

An excellent foreword, by noted fisheries GIS researcher Geoff Meaden, provides an excellent introduction that summarizes the main purpose of the book in addressing how GIS can contribute to fisheries management and the understanding of related physical oceanographic processes (with the accompanying challenges of 3-D and 4-D ocean environment that push the envelope of geographical information science), but places special emphasis as well on how important this is now, given the poor environmental management practices that pervade the world's oceans. Fisheries stocks are declining due to over fishing, various forms of pollution threatens habitats, and we still lack sufficient knowledge of the ocean environment to protect and manage it.

Chapter 1 provides a basic overview of GIS principles including the main components of most marine GIS projects, the crucial link between GIS and remote sensing for understanding the air-sea interface and water column, and the emergence of the Internet as a mean for data distribution and project collaboration. Included is an excellent summary and table identifying major international and national GIS consortia, which oceanographers lacking a background in geography should find helpful. Pursuant to this, there is also an excellent section on spatial thinking, which draws on recent literature in spatial cognition. Why and how should oceanographers, regardless of subdiscipline, develop the ability to think spatially, and what are the primary marine spatial questions as one attempts to understand the nature and dynamics of marine processes? These are discussed at length and identified in a table, a very useful resource for students and researchers alike. As 3- and 4-D processes are so crucial for the ocean, the chapter concludes with a savvy discussion of GIS and scientific visualization systems, summarizing studies that have incorporated them, and providing a review of various software packages.

Chapter 2 is most impressive in terms of how comprehensively it reviews studies that have incorporated GIS in all the major subdisciplines of oceanography. Included are descriptions of published studies of GIS as applied to marine geology, coastal and ocean management, coastal zone dynamics, coastal hazards (including coastal flood assessment and marine oil spills), sea level rise, natural and artificial reefs, wetlands and watershed, submerged aquatic vegetation, upwelling events, temperature and chlorophyll fronts, circulation gyres, sea surface classifications of temperature, salinity, air pressure, wind speed, and other environmental parameters; and seafloor mapping, including benthic habitat characterization. Worldwide oceanographic initiatives are reviewed, as well as web sites that provide data, online tools, and online mapping. Data collection and sampling methods of physical oceanographers are described next, with information on all of the major satellites, their sensors, and web URLs where one may download data from the sensors. Table 2.2 includes several pages listing the web addresses of major oceanographic data providers.

Chapter 3 is structured in a similar matter but is specifically focused on fisheries, thereby providing an extensive showcase of fisheries GIS applications for monitoring seasonal essential habitats, species life history, migration corridors, spawning grounds, etc., their data sources, organizations via web sites. Ideas for further developments in these areas are presented in chapter 4.

Two appendices are comprised of ESRI Arc Macro Language (AML) scripts that provide many useful avenues for downloading, converting, processing, and manipulating sonar, satellite and water column data. While the inclusion of these scripts is an excellent idea and most laudable, their presence in print form only is unfortunate. In order for them to be implemented the reader must retype them from scratch into their computer, which can be a tremendous source of error and frustration. Perhaps for a second printing of the book the publisher might consider providing these on an anonymous ftp site. For now the reader is better off contacting the author directly to obtain digital copies of the AMLs.

This book is highly recommended as a reference book for physical and biological oceanographers, fisheries biologists, marine and coastal geographers, coastal resource managers and consultants, marine technologists, and government researchers. Rather than introducing new results and interpretations, it does an excellent job of summarizing and synthesizing what has recently been published. And although the author states in the book's final chapter that the time is ripe for someone to produce a marine GIS textbook, it appears that *Geographic Information Systems in Oceanography and Fisheries* has made an excellent start. So until a formal marine GIS text is produced, this book will certainly be suitable as a supplementary text for undergraduate or graduate students in a marine fisheries, marine resource management, or GIS applications course, with laboratory exercises provided by the instructor. Indeed, as stated in the last sentence of the final chapter, '...to make the most out of GIS, mix it with water!'

DAWN J. WRIGHT
Department of Geosciences
Oregon State University
Corvallis, Oregon, USA