ans are ancestral to the Aotinae and Callicebinae and that omomyids gave rise to the other platyrrhine lineages.

One interesting point is that South Asia is emphasized by a number of authors, either as the area of origin of the first anthropoids or as the source of prosimians ancestral to both platyrrhines and catarrhines. New finds of *Amphipithecus* and *Pondaungia* from the late Eocene of Burma and paleontological similarities between Africa and Asia seem to be responsible for this.

The issue of anthropoid origins seen from a platyrrhine perspective remains unsettled. No persuasive arguments are offered about whether the last common ancestor of the platyrrhines and catarrhines had achieved an anthropoid level of structural organization or whether the platyrrhines and catarrhines developed in parallel from a prosimian ancestor. The authors who unhesitatingly affirm the monophyly of the anthropoid grade also accept the high probability of trans-Atlantic crossing, which makes the plate tectonic evidence significant in phylogenetic reconstruction, although inconclusive by itself. The available fossil material does not document the prosimian-anthropoid transition (though it would have been appropriate to include a chapter on fossil platyrrhines and perhaps one on Oligocene catarrhines), and so the morphology of extant anthropoids becomes of paramount importance. The problem is to achieve a level of analysis that allows one to distinguish between convergent structures developed in parallel, homologies caused by symplesiomorphy, and homologies caused by synapomorphy. Delson and Rosenberger, summarizing evidence of this volume, list certain anthropoid characters that they believe are uniquely derived, but, with the exception of the developmental and reproductive traits investigated by Luckett, the characters listed do not persuasively seem to be synapomorphies uniting platyrrhines and catarrhines rather than convergent, nonhomologous similarities developed in parallel, and the authors do not explicate their method of categorizing traits. In the case of Bugge's work on the carotid circulation, it is even unclear whether characters examined are individual variations, because his anthropoid data set comprises only four catarrhines (one taxon) and four platyrrhines (two taxa).

In summary, this volume will be a major reference work for researchers interested in platyrrhine morphology and such important topics in primate evolution as the origin of higher primates and the origin of platyrrhines. As the editors stress, it is a preliminary attempt at understanding the relationships among higher primates. As such it stands as a significant contribution to primate evolutionary biology.

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Fisheries: Collapses Assessed

Resource Management and Environmental Uncertainty. Lessons from Coastal Upwelling Fisheries. MICHAEL H. GLANTZ and J. DANA THOMPSON, Eds. Wiley-Interscience, New York, 1981. xx, 492 pp., illus. $42.50. Advances in Environmental Science and Technology, vol. 11.

In the 1960's the Peruvian anchoveta fishery expanded to become the world's largest single fishery. Then in 1972 the anchoveta stock collapsed, and today anchoveta constitute only one of several modest fisheries off the west coast of South America. Similar collapses occurred in the California sardine fishery in the 1950's, in the North Sea herring fishery in 1969, and in the South West African/Namibian pilchard fishery in 1970. This volume tells the fascinating and troubling stories of these collapses and explores the causes and consequences of such events. Why do they occur? Was the anchoveta collapse due to the environmental perturbation known as El Niño that took place in 1972–73? Or was it due to heavy fishing? This volume offers evidence and arguments on each side. Even the consequences are not clear. The Peruvian anchoveta collapse is often cited as causing a number of drastic problems for Peru and the rest of the world, but a number of other events occurred in the early 1970's to confound the picture. One of the more interesting questions is posed by Warren Wooster in his foreword to the volume: "How then should one manage a fishery to accommodate not only environmental uncertainties but also their biological and social consequences?" This question, too, is left unresolved, though some attempts are made to address it.

Obviously, the real value of this volume is not in the answers it provides. Rather, its value is in the hard questions it poses, its demonstration of the complex physical, biological, economic, social, political, and administrative relationships associated with the problem of stock collapse.

The volume is organized in four parts. Part 1 consists of six background papers on the stock collapse phenomenon. Following Glantz's introductory chapter, Thompson presents an excellent overview of the primary physical relationships among climate, upwelling, biological productivity, and fisheries. The third chapter is a reprint of the late Gerald Paulik's 1971 paper "Anchovies, birds, and fishermen in the Peru current." Though the Paulik paper presents valuable information on a wide variety of issues, the account of the biological aspects of the anchoveta and El Niño effects is dated. For a more recent discussion of biologists' understanding of these issues see the *Proceedings of the Workshop on the Phenomenon Known as "El Niño"* (UNESCO, 1980). Not only is the next chapter, by Robert Murphy, dated (it was written in 1954), it is full of subjective analysis and casual observation. I did not find it useful. In one of two chapters in the volume that do not concern the El Niño phenomenon off the west coast of South America, John Radovich provides an interesting account of the collapse of the California sardine fishery and reviews the debate on the cause of the collapse. In the other such chapter, David Cram presents a brief account of the rise and fall of the South West African/Namibian pilchard fishery. These two chapters are dissatisfying in that they offer us few answers but are at the same time useful for demonstrating that the physical, biological, economic, social, and administrative problems associated with stock collapse are not peculiar to Peru or an El Niño event.

In part 2, which is devoted to scientific aspects of El Niño, James O'Brien *et al.* provide an excellent introduction accessible to neophytes to the physical oceanographic aspects of El Niño events. The majority of the chapter presents upwelling models that are not made accessible to nonoceanographers, however. Readers interested in the oceanographic and biological aspects of El Niño are advised to supplement their reading of this part of the volume with the UNESCO volume cited above.

In many respects the papers in part 3 addressing the societal implication of El Niño are the most valuable in the volume. In one, economist John Vondruska analyzes the trends in fish meal production, consumption, and prices. The anchoveta, pilchard, sardine, and herring, of course, have been principal raw products for fish meal. By examining the behavior of the fish meal market since World War II, Vondruska provides us with a good appreciation of some of the economic effects of the collapse of the

Peruvian anchoveta fishery. In 1970 world production of fish meal peaked at over 5 million metric tons (mmt), with Peru producing over 40 percent of the world total. In 1972, Peru's production fell by half and in 1973 by half again. Despite this large drop in Peruvian production, world fish meal production averaged 4.43 mmt during the period 1973–77, compared with an average 4.38 mmt during 1965–69. During the 1970's, Japan and the U.S.S.R. nearly offset the decline in Peruvian production and became the world's leading producers of fish meal. Vondruska correctly observes that El Niño was but one of several factors contributing to the doubling of fish meal prices in 1973 following the 1972 El Niño event. He cites the drop of fish meal prices in mid-1977, following the El Niño event of 1976, as another case where developments in world markets for all high-protein meals determine price behavior. While Vondruska provides interesting data and insights, his chapter falls short on at least two counts. First, for his analyses of price behavior, he relies on U.S. prices of menhaden meal instead of Peruvian fish meal. Since he states he had Peruvian meal prices for 1964–78, presentation of these data in the discussion of the El Niño events of 1965, 1969, 1972, and 1976 would make his results more credible. Also, one is tempted to draw some conclusions that Vondruska ought to have drawn. For example, it appears that the demand for Peruvian fish meal is highly elastic (that is, changes in Peruvian production do not affect price very much) and is significantly subject to the vicissitude of international events. This leads to another important implication, namely that the uncertainties of the market may rank in empirical significance with the uncertainties of resource availability, and both have implications for inventory-holding policy as well as harvesting policy. One wishes for more explicit recognition of such implications.

The chapter by Linn A. Hammergren, a political scientist, is an excellent description and analysis of fishing policy under three governments in Peru. The quality of the writing is clearly above that of the other chapters in the book, making it accessible to all readers. This chapter represents an insightful application of public administration theory to explain political and bureaucratic decision-making regarding fisheries. Hammergren convincingly argues that "Peruvian fishing policies from 1958 to 1978 . . . have been less responsive to El Niño or to any other industry-specific condition than they have been to the more general political and economic situation." And "the crux of the problem has been the persisting fragmentation of policymaking in the sector, which has meant that decisions have frequently worked to contradictory ends, and that such apparently critical issues as resource management have been virtually ignored." In my experience, the conclusions apply equally to most coastal states around the world. Appropriate resource management will not become a reality anywhere until the many problems inherent in existing bureaucratic and political decision-making processes are solved.

By the late 1960's, the Peruvian anchoveta fishery had become seriously over-capitalized, an inherent tendency of all open-access (or common-property) fisheries. Part 3 also includes a reprint of an old but excellent analysis of the over-capitalization problem in the anchoveta fishery, the Instituto del Mar del Perú's Panel of Experts' Report. The analysis is practical, to the point, and accessible to the non-expert, giving careful and clearly reasoned estimates of the substantial gains realizable by reducing processing and harvesting capacity. The report represents a standard of analysis and exposition that we all should strive for when communicating with fisheries administrators.

Two other papers in part 3 are of marginal worth. In one, César Caviedes presents an imperfect economic analysis of events in Chilean fisheries before and after the 1972–73 El Niño. In another, Matthias Tomczak views the Peruvian fisheries situation in the context of the struggle for independence from imperialism. The reader who fails to read these two papers will not miss much.

In part 4, Colin Ramage concludes that successful forecasts of El Niño phenomena are not likely in the near future. Despite this conclusion, Glantz polled 60 experts on what ought to and could have been done if the 1972–73 El Niño were perfectly forecast. The responses to this hypothetical problem reveal the crucial issues behind the stock collapse problem. Several important research topics leap off the pages of Glantz's summary of the responses.

In sum, I strongly recommend this volume to those interested in fisheries management. Though it has a number of shortcomings, the dedicated reader will add significantly to his or her appreciation of an important class of resource management problems.

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The Inner Solar System

Earthlike Planets. Surfaces of Mercury, Venus, Earth, Moon, Mars. BRUCE MURRAY, MICHAEL C. MALIN, and RONALD GREELEY. Freeman, San Francisco, 1981. xvi, 388 pp., illus., + plates. Cloth, $24.95; paper, $14.95.

Earthlike Planets is meant to serve as a supplementary textbook in college astronomy and geology courses, as a primary textbook in introductory courses in planetary geology, and as a vehicle that allows the educated layperson access to some of the more important results from the planetary exploration program. The book begins with an overview of the earthlike or terrestrial planets that includes examples of how our ideas of planetary origin and evolution have changed over the past decade as a result of exploring the moons and planets. In the next couple of chapters the kinds of physical and chemical processes that shape the surfaces of the terrestrial planets are discussed. The following three chapters highlight the more important scientific results obtained from exploration of the earth's moon, Mercury, and Mars. The last chapter deals with comparative planetology—lessons to be learned about the origin and evolution of the solar system, including the earth, from examination and comparison of the geological records of the earthlike planets.

The book is generally well organized, well written, and remarkably free of typographical errors, the reproduction of figures is excellent, and, most important, the level and nature of the science discussed are generally superb. The book provides a rare insight into a new and growing field. Technical jargon is kept to a minimum. There is an appendix that lists background information and ways of acquiring the lunar and planetary images that are figures in the text. The utility of such an appendix will be clear to anyone who has ever tried to probe the NASA data-management bureaucracy in an attempt to obtain image data. In the last chapter, the interweaving of scientific results with arguments about what future planetary missions to undertake proves to be a powerful method of illustrating the need for future planetary exploration. Because they have been involved in planning such missions, the authors have been able to provide special insight into the possibilities and probabilities for future exploration.

I see two problems with the book. First, several hypotheses are presented as if they are well established in planetary geology, although the field is so new