

agriculture. Over recent years a happy linkage has arisen between the development of tourism and the establishment and growth of an effective conservation service, backed up by the international Charles Darwin Research Station. Most of the islands' area now falls within a national park and there are hopes that this will be enlarged to include the nearshore marine zone, which, like the land, is very rich in endemic species.

I judge that this book has achieved its objectives. There are nineteen chapters, most dealing with different taxonomic groups. A wide variety of approaches is used by authors, reflecting the imbalanced state of knowledge about different groups. This diversity in no way detracts from the value of the book which I found of interest throughout.

Biologists naturally search for explanations in terms of evolutionary advantage to account for the behavioural or morphological characteristics of organisms. Thus, it has been suggested that continuous breeding in many Galapagos seabirds is prevented because the gonads need time to recuperate after breeding (. . . or perhaps to provide time for the replacement of the main wing and tail feathers). Again, the tree habit of many *Opuntia* (cactus) species may be because of browsing by tortoises (. . . or perhaps is due to long-term interactions with other woody plants). Finally, in an example highlighted by Bowman, inter-island differences in food resources are held to be sufficient to explain morphological variation in mockingbirds (. . . but population ecologists invoke competition to explain the similar morphological variation among the finches, which live on the same islands as the mockingbirds). The apparently arbitrary nature of many hypotheses advanced to explain 'adaptations' will not aid the evolutionists' cause in the public eye. Bowman is rash to associate opposition to the ideas of organic evolution with anti-intellectualism and dogmatism (p. 280). As he himself admits, scientists can be just as dogmatic as creationists.

There have been some notable advances in knowledge about the evolution of life on the Galapagos since Darwin's time. Thus, the age of the islands is reasonably well established by radiometric measurements, it is now certain that the islands have always been detached from the continents and have been colonized by organisms with good cross-sea dispersal, the relationships between some related taxa have been clarified by electrophoresis (with, for example, a new understanding of the relationships of the tortoises on the various islands) and now there is fossil evidence of natural extinction

and immigration. the Galapagos have been and, thanks to effective conservation, are likely to remain a major outdoor laboratory for students of ecology and evolution.

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Severn Barrage, published for the Institution of Civil Engineers by Thomas Telford Ltd, London, 240p. £22.00, ISBN 0-7277-0156-8.

This volume represents the proceedings of a symposium organized by the Institution of Civil Engineers in October 1981 following the appearance of the report by the Severn Barrage Committee chaired by Sir Herman Bondi. Because most of the participants in the symposium were engineers, not all aspects of the Bondi Committee report were addressed. In particular, the biological consequences of environmental changes resulting from construction or operation of the barrage were not considered. Nonetheless, the 22 papers that constitute this book provide a brief but comprehensive account of physical, environmental, engineering, and economic aspects of the proposed Severn Barrage development — often by the same author who prepared the much more voluminous and detailed reports for the Severn Barrage Committee. It is thus of particular value to those interested in other aspects of tidal power, rather than to engineers themselves, who presumably would find the original reports more informative.

The papers are organized into several sections, dealing respectively with: background information on the Severn proposals and data collection programmes for tides, currents, waves, geology, and sediments (5 papers); mathematical models (3 papers); plant design and transmission aspects (4 papers); caisson design and construction (3 papers); embankments and lock facility designs (2 papers); sediment movements and water quality (3 papers); and economic perspectives of tidal power (2 papers). At the end of each section is a discussion.

Judging by this volume, harnessing of tidal power from the Severn Estuary is technically feasible, and detailed examinations of plant and barrage design, and transmission aspects, are well under way. Significant decisions still have to be made before the final acceptability of the project can be determined. These include the choice of turbine (bulk,

shaft, or rim generator), its diameter (7 or 9 m), and the size of concrete caisson required for housing them (1, 2 or 3 units/caisson). For the most part the relative merits of various construction techniques and designs are presented fairly, but one should not look to this volume for an entirely objective account of those merits. It is apparent from the discussion of several papers that many of the participants in the symposium represented vested interests — turbine manufacturers, construction engineers, or proponents of specific electrical generation systems — who were anxious to promote their own cause. The formal papers, however, generally conformed with the Committee Report in favouring the inner barrage between Brean Down and Lavernock Point, which would accommodate 160, 9.0 m diameter turbines. Substitution of rim generators appear to depend upon success of the prototype 7 m Straflo™ turbine currently being tested at Annapolis Royal (Nova Scotia).

Projections of the power generated (and hence its economic potential) and the environmental consequences of building the barrage rest heavily upon numerical models of tidal movements. Initial conflicts between the 2-dimensional model of tidal amplitudes developed by Heaps at the Institute of Oceanographic Sciences (Bidston) and a smaller scale 2-d model constructed by Miles at the Hydraulics Research Station appear to have been resolved, and both models produce results near the $\pm 6\%$ variation in amplitudes and $\pm 15\%$ cm variation in mean sea level commonly found.

They are not so easily validated, however. An obvious and serious uncertainty remains in interfacing these model predictions of tidal movements with sedimentation and erosion processes, particularly in the upper estuary and Bridgewater Bay where cohesive sediments predominate. Since suspended sediment load is an important biological parameter, much further work obviously needs to be done in making satisfactory predictions of environmental effects.

One weakness in the volume is its apparent lack of editorial judgement. The papers were obviously written independently, and no attempt has apparently been made to avoid redundancy. There are, for example, no less than 21 figures showing the general layout of a turbine inside a caisson, some of them with no labelling whatsoever. Many of these are clearly redundant, and much space would have been saved by omitting them and substituting appropriate cross-references. A half-page sketch of a lock layout (p. 175) serves no real purpose what-

soever. Most papers are relatively free of typographical errors, although there are several obvious ones in Odd's paper on sediment transport, and some serious inconsistencies in the output energy for different generation tests in Table 1 of the paper by Ackers. The most irritating and unnecessary editorial lapse, however, is the fact that questions and answers in the discussions are separated — all the questions are reported first, and then the reader must hunt for the answers provided by each speaker which are combined together at the end of the discussion.

Despite these cavils, this volume is a very valuable summary of engineering aspects of the Severn Barrage proposal. It will undoubtedly become dated very quickly if the proposed Acceptability and Preliminary Design Study is undertaken, because of the extensive effort that study will initiate. For the time being, however, anyone interested in tidal power, particularly in its environmental aspects, will find this a useful and informative reference.

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The United States Without the Law of the Sea Treaty, edited by Lawrence Juda, 1983. Times Press, 82 High Street, Wakefield, Rhode Island. US\$ 30.00.

Decisions by the US Government to withdraw from discussions of, and not to participate in, the Law of the Sea (LOS) Treaty, provides the impetus for this heart-searching (I hesitate to write soul-searching) volume. The verbatim text is based on a conference held at the University of Rhode Island in June 1983.

The book ranges across the interface between international law/politics and ocean management. The former tend to receive more attention, indeed, to judge by discussion comments, many of the managers present seemed bemused by the legal subtleties and nuances. It would appear that in this case many Governments want a strong legal framework before exploitation of resources begins, yet the haggling and the compromises seem unrealistic to many observers. It is largely lack of flexibility in the LOS proposals that worries the US Government.

America's withdrawal from the LOS policy process leaves a number of unanswered questions,