less-developed countries for a new legal order in Antarctica. Radical changes would, according to him, endanger the remarkable achievements of the existing order. He proposes, however, to broaden the basis for participation in the Antarctic Treaty System. This would reflect the interests of states that lack the economic means to be actively involved in this region.

This book is undoubtedly an important contribution to the legal literature on Antarctica. It provides the reader with a detailed analysis of the social and political context in which a unique legal framework has developed. It is therefore much more than a mere description of the legal texts adopted to regulate the status and the uses of Antarctica. Despite some incongruities (all related to an updating problem) and the use of sometimes obscure language, this work will be welcomed by those having a special interest in the public orderof the frozen continent. (Serge Pannatier, Faculté de Droit et des Sciences Economiques, Université de Neuchâtel, Avenue du 1er – Mars 26, CH-2000 Neuchâtel, Switzerland.)

ANTARCTIC FISH BIOLOGY: EVOLUTION IN A UNIQUE ENVIRONMENT. Joseph T. Eastman. 1993. San Diego: Academic Press. xiii + 322 p, illustrated, hard cover. ISBN 0-12-228140-3. US$74.95.

Until recently, information on Antarctic fish was scattered in original publications or briefly summarized, for example, in chapters of the SCAR biology symposia. Only as late as 1990, the first comprehensive book on Antarctic fish taxonomy and systematics, *Fishes of the Southern Ocean*, was published by Gon and Heemstra. In 1991 DiPrisco's *Biology of Antarctic fish* appeared, followed in 1992 by Kock's *Antarctic fish and fisheries*. Number four in this short list is the new book by Joseph T. Eastman, *Antarctic fish biology: evolution in a unique environment.*

The subtitle characterizes Eastman's approach to Antarctic fish biology: evolution and environment. The environmental factors of the Antarctic habitat both in the geological past and today set the stage for the evolution of a widely endemic Antarctic fish fauna and its adaptations over geological time from life in a warm paleo-ocean to the present Antarctic sub-zero environment.

In three parts — 'Environment – present and past,' 'The modern fauna,' and 'Adaptations' — a wealth of information is presented based on the author's own profound scientific work in the field and derived from more than 600 references to Antarctic fishes and their habitat. The coverage of scientific literature on the subject is excellent and truly world-wide.

The first part of the book contains a stringent presentation of relevant physical factors and processes characterizing Antarctica today. A detailed geological history of the habitat then shows the possible influences of temperature development and geomorphological changes on the fish fauna. This section is especially well written and is didactically excellent, and even a less-dedicated reader will pass through it without difficulty. Tables of time scales and informative diagrams add to the chapter's content.

Antarctica's fossil fish fauna are only known from sparse fossil records. Eastman presents the state of the art of our knowledge on the origin of Antarctic fish. This chapter is based partly on the author's original work and contains information one could not find elsewhere in the literature in a comparably digestible form.

Zoogeography and taxonomic composition of the modern Antarctic fish fauna are given as a short and handy summary. A useful presentation of habitats and their fish assemblages provides ecological background to the otherwise often tiring lists of species and their occurrence. The main emphasis is on the species of the suborder Nototheniidae and its general biology. Most aspects are covered, although a notable gap is evident in the species' life histories. The absence of data on growth, feeding, reproduction, and population dynamics is a shortcoming of the book as a whole, but it was the author's declared intention not to duplicate information that is available in other existing compilations, such as Kock's book.

A rather lengthy chapter on systematic relationships among the notothenioids dives deep into the methodology of cladistic analysis, which is interesting mainly to the dedicated reader. Here the author obviously writes very close to one of his own areas of expertise and does not find the same distance to subject as shown in other sections of the book.

The origin and evolution of the modern fish fauna then are presented as an excellent overview on possible pathways of Antarctic fish evolution. The author discusses the role of seasonality vs temperature in evolution, which is of importance to understand adaptational biology of Antarctic fishes today. The chapter is very detailed, but nevertheless shows how little we know about evolution in Antarctica. Much remains speculative, such as the questions about why there are no sharks and so few rajids in the Antarctic seas.

Another very useful part of the book is the chapter on biochemistry and metabolism. In this area, published knowledge is especially scattered over the scientific literature, and controversy — for example on metabolic cold adaptation — often makes an understanding of the subject difficult for the non-specialized reader. Eastman explains the current concepts in an understandable and convincing way.

In my opinion, the section on buoyancy is too detailed. As a special subject of many years of his own work, the author presents the morphological adaptations for flotation in the water column in the fashion of a piece of original literature, which makes it hard to read in the context of a book. On the other hand, buoyancy of the swimbladderless notothenioids is, of course, a key for the understanding of evolutionary radiation and pelagization, so this should be forgiven.

Summaries on antifreeze glycoproteins are to a certain extent available in the literature. Eastman's chapter on that subject goes beyond existing compilations, as it gives an

ecological background for the understanding of the different antifreeze strategies. Also, he shows the use of antifreeze in the clarification of the evolution of the notothenioids. Briefly mentioned and hypothetically explained is the surprising similarity of antifreeze in taxonomically unrelated species such as Antarctic notothenioids and Arctic gadoids.

Swimming performance, cardiovascular and respiratory systems, and the nervous system are analyzed and interpreted in the light of systematic origin and environmental determination. Notothenioids are at the low end of the range of activity and swimming speeds of fishes, and, therefore, it is hard to obtain comparable species from temperate regions for comparison. 'Antarctic sea water, its thermal constancy, increased oxygen solubility, and high kinematic viscosity set the Southern Ocean and its fauna apart from all other marine habitats' (page 220).

Eastman's concluding remarks, that Antarctic fishes, notably notothenioids, on the first glance do not show the striking morphological difference that one would expect compared to other teleosts, may surprise in the light of the above statement. What makes Antarctic fishes special, however, are the many adaptational details that only appear on closer investigation. Some of the adaptations may be related to the phyletic position of the suborder rather than to the Antarctic environment. This differentiated approach may be disappointing for those who look for the 'extreme' in Antarctic fish, but it may help better to understand biology of extreme environments in general.

Eastman's book is the most exciting Antarctic fish book on the market. Over most parts it is well-written and didactically excellent. The book is enriched by impressive original photos of preparations and live specimens and by well-prepared tables and figures. Unpublished personal field observations at McMurdo Station, where Eastman had the chance to study live fishes in aquaria, add to the originality of the presented information. By its evolutionary and ecological approach, *Antarctic fish biology* is of interest not only to Antarctic fish workers, but to biologists and interested laymen in general. The book will facilitate teaching and learning in polar courses, and it gives a sound basis for future work on the fascinating details of fish life in a unique environment. (Gerd Hubold, Institut für Seefischerei, Bundesforschunganstalt für Fischerei, Palmaille 9, D-22767 Hamburg, Germany.)

CHANGING TRENDS IN ANTARCTIC RESEARCH. Aant Elzinga (Editor). 1993. Dordrecht, Boston, and London: Kluwer Academic Publishers. xi + 161 p, maps, hard cover. ISBN 0-7923-2267-3.

Only a few of the diplomats and politicians involved in Antarctic policy have any scientific understanding, and only a few of the Antarctic scientists have any political ability or interest. Mutual misunderstanding should be the order of the day, and the Treaty should be a disaster. It isn't — so the logic must be wrong. This conundrum clearly fascinates lawyers and political scientists, perhaps partly because the scientific community has played such a significant and unusual role in the development of this international forum. The meeting on which this book is based attempted to unravel the historical complexities and provide a forum in which a range of protagonists could discuss what the future might hold.

The meeting was a brave attempt to bring scientists, political scientists, managers, and NGOs together for constructive discussion. For a book on such a topic, the balance of both speakers and participants was unusual. Half of the eight invited speakers were Scandinavian and there were only 19 participants in all. The views expressed cannot therefore be considered as representative of the Antarctic community as a whole. What was obviously missing was a strong diplomatic/political input.

The text shows that there was interesting discussion, but the format adopted by Elzinga for publication is strange. The book comprises 15 chapters: an introduction, eight narrative accounts of presentations and the ensuing discussions, one report of a panel discussion, four written versions of papers presented as narrative in earlier chapters, and a summary of a recent International Council of Scientific Unions (ICSU) examination of the role of the Scientific Committee on Antarctic Research (SCAR). In addition there are three appendices giving a list of participants, the programme of the meeting, and a list of Antarctic research stations. Throughout the book there are little vignettes taken from the illustrations used in Nordenskjold's original account of the Swedish South Polar expedition.

For those interested in management systems, the chapters by Barry Heywood on the British Antarctic Survey (BAS) programme and by Bruce Davis on the Australian programme will make an interesting comparison. The BAS centralised system, overseen by a variety of outside committees, apparently provided the most acceptable general model to the participants. Davis, on the other hand, provided a very critical assessment of the Antarctic Division, noting the difficulties an outside researcher faced in gathering facts and the high level of political interference in Antarctic affairs. Nigel Bonner provided a robust defence of the need for SCAR advice on environmental protection, whilst Jim Barnes, presumably representing the 'vociferous populist groups whose experience is mainly in the field of manipulating media,' argued that the concerns of NGOs are very similar to those of the science community.

Monitoring and its role was an important theme addressed by several participants — is it a dirty word? Others raised questions on applied versus strategic research, ethical acceptability, and the impact of advanced technology on field activities.

A recurrent theme, addressed in different ways by several speakers was that the implementation of the Protocol on Environmental Protection to the Antarctic Treaty would inevitably reduce the importance and influence of SCAR on the Treaty Parties. Indeed, in the final chapter by Rita Colwell, it is suggested that 'SCAR's mission and goals might be sharpened so that science co-ordination, stimulation and quality enhancing functions are clearly