crafted to take account of this fact, is: 'over which the existence of State sovereignty is recognized by all Contracting Parties.' The author has interpreted the statement to mean only islands the sovereignty of which is not in dispute. This is wrong and is a serious misrepresentation by the author.

Great play is made of the importance of toothfish in the Southern Ocean ecosystem and yet that species does not appear in the food-web diagram. This is an example of the author's naivety, frequently expressed, in suggesting that all interactions within the system need to be taken into account. This is an unattainable objective and a convenient outlet for procrastination for those who do not want to see progress. The important point regarding the ecosystem approach is that those interactions which need to be investigated are those of greatest sensitivity to change due either to natural causes or to fishing.

I have concentrated on the situations within CCAMLR as being most closely within my sphere of knowledge. I do not have first-hand experience of the Bering Sea situation and consequently do not know whether, beyond the general story, the detail is correct.

The presentation of the book I found odd and at times irritating. I am accustomed to the use of footnotes to clarify text. I found their presence in this book extreme and in some instances stupid. I see no point in starting a sentence in the narrative 'As noted in Chapter 1,' and to have a footnote that says 'See Chapter 1.' Frequently footnotes are used to identify references and these are then repeated in the 'Selected bibliography' in exactly the same form and with the same errors and omissions. Are lawyers really akin to dim-witted administrators who need everything in duplicate before taking action? Through this and other actions there is enormous duplication and redundancy in the footnotes, which takes up much space unnecessarily. Discussion surrounding articles of the various Conventions would be much more clearly incorporated in full as 'Text boxes' rather than piecemeal as disparate footnotes. Furthermore, where different States have joined in a debate it is more useful to list them alphabetically, as has been done for chapter 3, rather than in the order in which they have spoken, as in chapter 4. The text is sprinkled with typographic errors some of which, such as 'fecundity is directly related to morality, and that very few fish die of old age,' are quite funny. The references are poorly presented, whether one is using footnotes or the selected bibliography. The publisher compounds such typographic errors by having to include an erratum slip to correct the author's name. SC-CAMLR clearly works with amazing speed as the fourteenth, fifteenth and sixteenth meetings took place on the same days! More seriously though, the author references CCAMLR Commission reports up to the eighteenth, but only Scientific Committee Reports to the sixteenth meeting. The reason is clear from the narrative, because the author relies on references to newspaper articles and popular journals whilst ignoring the fact that in many cases the same information had appeared *in extenso* earlier in Scientific Committee reports or refereed journals. The index is sparse, incomplete, and is of little help.

Initially I had expected the book to consider all fisheries in which more than one state has an interest, irrespective of whether any one state exerts national jurisdiction. This is not the case, as the author concentrates on fisheries that fall outside of national EEZs, a much more limited interpretation. Within that sphere, much useful information is presented, but sadly it is more in the format of a thesis that has been published rather than a book that has been prepared for a specified market. The price of £109 does not represent good value for money; judicious editing and more attention to presentation could have halved the bulk and presumably the cost. (Inigo Everson, British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET.)

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DANGEROUS CROSSINGS: THE FIRST MODERN POLAR EXPEDITION, 1925. John H. Bryant and Harold N. Cones. 2000. Annapolis: Naval Institute Press. xvi + 206 p, illustrated, hard cover. ISBN 1-55750-187-4. $US27.95.

In a recent review (Higginson 2001), I complained about the excessive number of times that the word 'first' is to be found in the titles of polar books. One possible response to this observation is that it is a little churlish to poke holes in a concept that is more often an actor's category than a publisher's marketing tool. Nevertheless, although achieving a 'first' has long been established as the defining characteristic of ultimate polar achievement, there is still a lingering suspicion that for certain authors, let alone certain explorers, the concept of priority overshadows all other considerations. When an inability to label a polar endeavour as a 'first' tricks us into leaving an interesting subject languishing in obscurity, then we will have to face up to the obsession of 'firsts' and give greater consideration to the 'also-rans.'

In the present volume, John H. Bryant and Harold N. Cones contribute the subtitle of *The first modern polar expedition* to the exponentially expanding genre, and list, of polar firsts. In this instance, 'first,' particularly when annexed to such a difficult concept as 'modern,' is a highly charged, contentious, and very problematic claim. Doubtless there are other claimants to such an accolade, but it is a credit to the authors of this book that they do the reader the courtesy of locating the term 'modern' and the significance of their claimed first in historical context. The 1925 MacMillan Arctic expedition, they explain, 'was the first to successfully apply shortwave radio...and aviation to...systematic geographic exploration' (page xi).

Their book examines the contributions of Donald B.

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MacMillan, Eugene F. McDonald, and Richard E. Byrd to the development of radio and aviation technology in polar exploration. They stress the importance of polar communication by providing a concise history of the problems of viable communication in polar exploration, and the often fatal consequences of its deficiencies before the advent of radio. From Franklin to Greely to Scott, they span the gamut of heroic failure due to failed communication.

However, radio communication was not instantly the universal panacea of polar communication. The eventual success of radio in polar regions was a matter of trial-and-error experimentation and of fortuitous meetings. MacMillan's earlier Crocker Land expedition of 1913 had already demonstrated the limitations of early radio technology. The low-frequency equipment carried by the expedition (in the range of 15–300 kHz) 'proved to be useless above the Arctic Circle' (page 11). Such equipment, operating on what is now called a long-wave frequency, was 'useless north of the auroral zone' (page 15).

A disillusioned MacMillan had decided to abandon further attempts with radio equipment until a chance encounter with Eugene F. McDonald Jr in 1923. McDonald, president and treasurer of the Zenith Radio Corporation, 'excited [MacMillan] about the possibilities of using the new and physically smaller "shortwave" radios' (page 14). Although only truly practicable during hours of darkness, and often requiring the support of radio 'hams' to relay messages, this new higher frequency technology (operating on what we now call medium wave) proved a positive asset during MacMillan's next expedition of 1923–24.

During the 1925 expedition further experimentation was to be conducted with sets 'transmitting on 20, 40, 80 and 180 meters' (page 40). There was even the expectation of being able to carry out voice communication with the 20-metre set. So successful were these experiments, with the expedition's ships able 'to communicate almost at will over planetary distances day or night' (page 153), that they played a 'significant role in the navy's decision to adopt shortwave radio for fleet communications' (page 154).

Despite the success of the new radio technology, flight operations under Byrd were only 'a partial success' (page 154), but, nevertheless, a remarkable achievement given the conditions. The open-cockpit Loening Amphibian biplanes, which were of a totally new and untested type, were transported in crates and assembled on the beach at Etah. The Liberty engine was inverted 'to raise the crankshaft as high above the water as possible' (page 47), but this caused 'problems with lubrication, especially of the rod and crankshaft bearings' (page 156). By the end of the expedition, all three spare engines had been used.

To add to these technical difficulties, the winter of 1924–25 was profoundly cold, resulting in much water that was to provide landing sites being unexpectedly frozen. Given the poor conditions, Byrd's personal diary suggests a desire to take chances and a continual state of agitation over maximising flying time. He wrote: 'I am continually after McDonald and MacMillan not to lose time. Of course we have been in ice. Should not have played game so damn safe' (Goerler 1998: 36).

On another occasion when 'Good weather ha[d] at last come,' Byrd's frustrations were readily apparent: 'NA-2 & 3 are out of commission. I am going tonight for the blessed old navy. We must make a showing for her. Everything went wrong today. NA-1 lost cowling overboard. NA-2 went down by nose. Almost lost her. NA-3 nearly sunk by icebergs and injured lower wing on raft' (Goerler 1998: 36–37). During the whole expedition the aviators had less than eight days of possible flying weather. Even so, they still managed to fly more than 6000 miles and viewed more than 'thirty thousand square miles of terrain, a large part of which was inaccessible to foot travel and, thus, never before seen by humans' (page 156).

Despite its technological achievements, the human story of the 1925 expedition is far from a straightforward account of camaraderie, common aims, and goals. With considerable revisionist flair, Bryant and Cones do much to reassign credit for the expedition's successes, in particular plucking McDonald, and his radio achievements, from relative obscurity. The personalities of the men whose story they tell are brought out well, and demonstrate that the expedition proved to be as much a testing of rivalries as it was a test of the new radio and aviation technologies.

McDonald, a 'swashbuckling entrepreneur...industrialist...in the romantic new radio industry' (page 37), and MacMillan emerge as the gentlemen of the expedition. In contrast Byrd, who had 'no previous expedition experience' (page 37), is very much the villain of the piece. The authors ponder the irony that MacMillan's 'reputation for modesty, understatement, and veracity' are the 'very qualities...responsible for his relative obscurity today' (page 10). They further argue that the 1925 expedition provided Byrd with a vehicle for his bid for fame as a polar explorer and provide strong evidence to suggest that Byrd (portrayed as a duplicitous, deceitful, and untrustworthy liar) was the very antithesis of the gentlemanly MacMillan (pages 32–39). Although, in the authors' words, 'Byrd's apparent misdeeds must...be viewed in the light of his positive behavior, demeanor and accomplishments' (page 166), they still present McDonald's testimony that he and MacMillan's 'principal trouble with Commander Byrd was that he wanted to report having accomplished feats that we never attempted' (page 166).

Overall, this is a well-researched book with appeal for both the general and specialist reader. It assumes little prior knowledge of polar exploration, and for the general reader gives a brief history of polar communication while also offering thumbnail biographies of the personalities examined in the text. Discussions of the technical limitations of radio and aircraft are of interest to the specialist historian of technology. The politics and rivalries of expedition organisation, the interservice antagonisms between the US Army and Navy, and the nationalistic project to 'seek more land for [the] US' will appeal to anyone interested in the practice and politics of polar

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exploration. (Ian N. Higginson, Centre for History and Cultural Studies of Science, Rutherford College, University of Kent at Canterbury, Canterbury, Kent CT2 7NX.)

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ICE IN THE OCEAN. Peter Wadhams. 2000. Amsterdam: Gordon and Breach Science Publishers. xii + 351 p, illustrated, hard cover. ISBN 90-5699-296-1. £44.00; US$67.00.

There has long been a need for a comprehensive introductory text on the physics of sea ice, and this book goes a good way to meeting that. While there are a number of edited volumes that cover the field (most notably *The geophysics of sea ice*, edited by N. Untersteiner, and *The physics of ice-covered seas,* edited by M. Leppäranta), these lack the unification of a single-authored work, and are only as good as the weakest contribution. The present volume is based very largely on the author's own research: Wadhams is one of the foremost sea-ice scientists, and this book evidences both the breadth and depth of his work.

The book is structured into eight chapters. The first, largely descriptive, introduces the geography and oceanography of the polar oceans, with somewhat more emphasis on the Arctic than the Antarctic, although Antarctic water masses are said to be the more complex. A minor irritant in this introductory section is that the maps are reproduced from other publications and, particularly for the Arctic, have a variety of orientations (prime meridian up, 180° up, 90°E up, 150°E up) and some place-names discussed in the text only occur on maps that appear much later in the book. The following chapter on the processes of sea-ice formation, growth, and decay provides a comprehensive descriptive overview of the various types of ice and the processes by which they form.

The next two chapters deal with the thermodynamics and dynamics of sea ice, respectively, and introduce a more rigorous mathematical treatment. The chapter on dynamics is particularly well handled. Starting from the case of free drift of a single floe without ocean drag, the complexity and reality of the solution of the equations of motion are gradually increased, clearly explaining the physical concepts involved in each step and showing the basis of the various empirical models of ice drift. I would have liked to have seen the thermodynamics chapter handled similarly, starting with the simple case of heat conduction through a capacitive-less ice slab balanced by the latent heat of freezing (the Stefan relationship), using this to show the relevance of the various empirical freezing-degree-day relationships for ice growth, and gradually increasing the complexity of solution (including snow cover, variable thermal properties in the ice, radiation penetration, and oceanic heat flux) to the Maykut-Untersteiner model. The physical concepts are, however, not as well explained in the thermodynamics chapter, nor is it shown how the turbulent exchanges at the snow–air interface can be parameterised in terms of meteorological variables, although the turbulent exchange at the ice–water interface, where the relationship is seldom used, is given. Chapter 4 also covers the simple theory of wind-driven coastal polynyas (the Pease model), but without reference to subsequent developments of that model by, for example, Darby.

Chapter 5, which is by far the largest, deals with the statistics of the ice-thickness distribution and pressure ridges. It includes a section on techniques of ice-thickness measurement, which is a continuing key challenge for sea-ice researchers. However, this omits any consideration of the simple, but widely used, ship-based observation system that is being currently used by a number of national programs in the Antarctic to develop a climatology of relatively thin Antarctic sea ice. Differences between the Arctic and Antarctic thickness distribution are discussed, and some examples are given of applications of the thickness distribution. That part of the sea-ice cover close to the open ocean where processes of wave–ice interaction are important, the marginal ice zone, is covered in chapter 6. The structure and processes of the MIZ are first described, leading to a mathematical treatment of models of wave attenuation and of floe flexure and break-up. This chapter also includes an interesting analysis of possible mechanisms for development of ice-edge bands.

Chapter 7 deals with the other form of ice in the ocean, icebergs. This chapter is largely descriptive, although it is indicated how theory of drift and of flexure and breakup of sea ice developed earlier can be extended to much thicker icebergs. I found this chapter to be the weakest part of the book, with a number of small errors and statements subject to misinterpretation, particularly in the discussion of ice sheets, the source of the icebergs. For example the total snow accumulation on the Antarctic ice sheet is about double the 10^3 km^3 quoted by the author, and more recent estimates of the volume of ice in the Antarctic are about 10% less than the figure given. The assertion that 'if there were no melting from ice shelf bottoms, the icebergs being calved from the front of ice shelves would just be a few metres thicker' is contrary to the known loss of as much as 50% of the interior mass flowing into some ice shelves, and melt rates as high as 30 m a^{-1} beneath the deepest parts of the floating shelves. While the author undoubtedly realises that it is the increase in drainage of grounded ice from the inland ice sheet, which may follow ice-shelf collapse (although this is still subject to considerable glaciological debate), that will increase sea level, the unqualified statement that 'a greater rate of loss from the ice sheet by iceberg calving and ice shelf melting ...could make a large contribution to sea level rise' is bound to be misinterpreted by some. This section finishes with a discussion of icebergs as a fresh-water source, a concept that in its

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