apparatus, and the skilled methods required for these feats. And too often the specifications of the inventions were amended by ignorant officials, and their application entrusted to unskilled persons. Such costly errors can be avoided in the future, and the requisite support given to the deliberate pursuit of science, only if the nation generally learns to understand and sympathize with scientific men and scientific work.

Mr. Rowell is confident that the popular press is indispensable for any general contact with a wide public. He offers advice, based on American conditions, as to how such a result may be accomplished. He distinguishes between the daily newspapers and the Sunday newspapers. The latter vehicle is less sharply marked off in this country than in America, Germany and Vienna, where the vast bulk of the Sunday issues overwhelms those who make first acquaintance with them. Mr. Rowell says that it is necessary to "print an excessive amount of reading matter, to float the advertising." The news will not go round, and so, as a desperate resort, the editors have recourse to literature, science, and the arts. Scientific men are given this friendly advice: the Sunday papers will take anything, even science. But entrance to the columns of the daily newspapers is another matter. That goes by merit. The test of merit is that the "copy" is news. There is no hope, says this expert, of getting things printed as news because they are "useful or useless, beneficial or injurious." "The eternal verities are not news, though a temporary or adventitious fact regarding them may be." The reference, we repeat, is to conditions in the United States, but they may be worth noting by the English public, who are more responsible for the contents of the newspapers they read than they perhaps realize.—The London *Times*.

SCIENTIFIC BOOKS

Starfishes of the Philippine Seas and Adjacent Waters. By Walter K. Fisher. United States National Museum Bulletin 100. Washington, Government Printing Office. 1919. Pp. xxi + 712, 156 pls.

For several years, students of echinoderms have been awaiting with some impatience the appearance of Fisher's complete report on the sea-stars collected by the *Albatross* in the East Indian region, between December, 1907, and December, 1910. Several preliminary papers have appeared, in which most of the novelties were described, but it was well understood that the full report would be a monograph of the greatest importance to the morphologist and zoogeographer as well as to the systematist.

This expectation is wholly justified by the present volume, with its wealth of illustration and its ample discussions of structural and taxonomic problems. The brief preface, besides the customary acknowledgments for help received, recounts the chief facts as to number of species collected, the number of novelties and the new genera and subgenera represented. An introduction of some twenty pages gives a brief historical sketch of our knowledge of Philippine sea-stars and then plunges into a detailed analysis of the distribution of the species and the relationships of the fauna. There is a very large amount of zoogeographical material presented here, but the obvious criticism may be made that the treatment is too exclusively analytical. Probably, in view of the fact that the large and highly important material collected by the *Siboga* in the Dutch East Indies is as yet but partially studied, Dr. Fisher felt that any conclusions drawn from the *Albatross* material alone would be premature and almost certainly liable to revision. The introduction closes with two pages of analysis of the composition of the *Albatross* collection and one wonders why this is placed at this point rather than in connection with the similar data presented in the preface. Following the introduction is an important list of the sea-stars of Celebes and the Moluccas, with the authority given for each record, and then is given the list of *Albatross* stations at which sea-stars were taken.

Examination of this station list reveals some interesting facts. The largest number of species taken at any one station was *nine*

and that occurred but once. This was at station 5648 in Buton Strait, Celebes, in water 559 fathoms deep, and it is very remarkable that all of the nine species were new to science, three represented new genera, and of only one was there more than a single specimen! Surely this is one of the most notable dredgings of sea-stars ever made. At two of the *Albatross* stations, *seven* species of sea-stars were taken, but these were both in shallow water (9 or 10 fathoms) in the Tawi Tawi group; in one case, all were representatives of previously known species; in the other there were two new species, one representing a remarkable new genus. At each of two stations in the Philippines, 5482 at 67 fathoms and 5536 at 279 fathoms, half a dozen species were taken.

The remainder of the volume is occupied with the detailed account of 182 species and 10 subspecies, all but two of which were taken by the *Albatross*. Only one or two are here described for the first time, but 134 were new when taken and were originally described from this collection. Many of these are notable for structural peculiarities and 18 represented new genera, while others made the segregation of 6 additional genera or subgenera desirable. The method of treatment is admirable; a brief diagnosis of each species is followed by a description, more or less detailed according to the condition of the material and the importance of the species. If young specimens are available, a special paragraph is given to them, the features in which they differ from the adult being pointed out. The museum number of the holotype and the exact position of the type-locality are then given, followed by a statement of the known distribution and a list of the specimens examined. Last, and oftentimes most important of all, is a paragraph of "Remarks," in which is discussed the relationships of the form, its diversities and peculiarities, and any nomenclatural or distributional facts that need elucidation.

Many of the families and genera are treated in the same thoroughgoing way and in these discussions, Dr. Fisher's exceptional knowledge of sea-stars and of the literature concerning them is well shown. But more than this is revealed—clear thinking, openmindedness and a perfectly balanced judgment, that are very attractive and most convincing. The writer has no hobbies to ride and no hypotheses to defend; he is obviously seeking all the available facts and only the deductions which may reasonably be drawn from them. He is always seeking to throw light on the subject in hand and to unsnarl the tangles due to lack of knowledge or to misinformation. The frequent and carefully detailed keys to species and genera well illustrate this and will prove of constant service to other workers.

The recognition of subspecies, in the ornithological sense of forms passing by gradation into the typical form but occupying a different geographical area, is something of a novelty in the taxonomy of echinoderms but is of course the natural result of increasing knowledge. The question which may fairly be raised is whether we have sufficient data and material as yet to warrant their recognition. Probably we have in some cases, but in others it were well to be cautious. Thus Fisher recognizes the typical form and three subspecies (using trinomials as in ornithology) of *Asterina coronata,* of which very few specimens are as yet known; it is quite possible that we are here dealing with a somewhat variable species, and a large amount of material will show that there is no correlation between the diversities and the distribution.

In typography, arrangement and illustration the volume is very satisfactory. It is too bad that "starfishes" is used in the title when Dr. Fisher is known to be an advocate of "sea-stars" as a substitute for the more familiar word. No doubt the editor considered "starfishes" a more "popular" title but it is so lamentably inaccurate, it is a pity Fisher could not have had his way in the matter. It is a little odd that neither term seems to be used in the text; at any rate, I have found neither; but once the phrase is used, "specimens of Asteroidea"! There is a good table of contents at the beginning of the volume, and at its end, a very full and useful index. The plates are half-tones, printed on both sides of the paper, interleaved

with pages of explanatory text; the arrangement is unusual and at first sight not attractive, but as soon as one has become accustomed to it, it is found to have much to commend it. The photographs from which most of the plates were made are exceptionally clear and hence the necessity of using halftones is not so unfortunate as might be. The impossibility of using a lens on such plates is counterbalanced by the numerous drawings of the essential details, so that every important species is amply illustrated. The volume is a credit to the Government Printing Office, as well as to the National Museum, and it amply confirms Fisher's position as chief among students of the Asteroidea.

Hubert Lyman Clark

NOTES ON METEOROLOGY AND CLIMATOLOGY

AGRICULTURAL METEOROLOGY

Since weather is a prime factor in crop production, the study of agricultural meteorology is not lagging in this great farming country. It is only comparatively recently, however, that the U. S. Department of Agriculture has made available a large amount of reliable information about crops in such a form as to be used readily for comparison with weather and climate. For six years there has been a division of agricultural geography, Mr. O. E. Baker in charge, the principal object of which has been to issue by sections a carefully wrought "Atlas of American Agriculture." An advance rainfall map of the United States,[1] and advance folios on Frost and the Growing Season,[2] and on Cotton[3] have appeared, as well as extensive graphic contributions in the Year Book of the U. S. Department of Agriculture, 1915,[4] 1916,[5] 1917[6] and 1918,[7] and a fine small atlas on "The Geography of the World's Agriculture."[8] The Weather Bureau's contribution to the Atlas of American Agriculture has been the material for the climatic section, of which there is much still to be published; and now its division of agricultural meteorology, Professor J. Warren Smith, in charge, is pushing forward several lines of investigation on the influence of weather and climate on dates of planting and harvesting crops and on crop yields,[9] and on the occurrence of damaging frosts and the possibility of forecasting them from weather conditions the day before.[10] Furthermore, with the excellent crop maps now available, Professor R. DeC. Ward, of Harvard, has written an interesting interpretation of the "Larger relations of climate and crops in the United States." Some of the recent Weather Bureau contributions to agricultural meteorology will be reviewed briefly here.

Relation between Vegetative and Frostless Periods (by J. B. Kincer, *Mo. Weather Rev.*, Feb., 1919, Vol. 47, pp. 106–110, 5 figs., 8 charts). Since 6° C. (about 43° F.) is gen-

[1] Reproduced in *Mo. Weather Rev.*, July, 1917, and discussed on pp. 338–345 by R. DeC. Ward. (Reviewed in Science, N. S., Vol. 48, July 19, 1918, pp. 67–71.)

[2] Reviewed in *Mo. Weather Rev.*, November, 1918, pp. 516–517, and in *Geog. Rev.*, May, 1919, pp. 339–344. (Reprinted, *Sci. Am. Suppl.*, August 23, 1919, pp 117–118.)

[3] The climatology of the cotton plant is being reprinted in the *Mo. Weather Rev.*, July, 1919, and is reviewed in *Geog. Rev.*, May, 1919, pp. 348–349.

[4] "A Graphic Summary of American Agriculture," by Middleton Smith, O. E. Baker and R. G. Hainsworth, pp. 329–403, 4 graphs, 78 maps.

[5] "A Graphic Summary of World Agriculture," by V. C. Finch, O. E. Baker and R. G. Hainsworth, pp. 531–553, 74 figs.

[6] "A Graphic Summary of Seasonal Work on Farm Crops," by O. E. Baker, C. F. Brooks and R. G. Hainsworth, pp. 537–589, 90 figs. Abstracted and discussed in *Mo. Weather Rev.*, May, 1919, pp. 323–327.

[7] "Arable Land in the United States," by O. E. Baker and H. M. Strong, Separate 771, 10 pp., 10 graphs, 9 maps.

[8] By V. C. Finch and O. E. Baker (Office of Farm Management, U. S. Dept. of Agric.) Washington, 1917. Reviewed in *Jour. of Geog.*, January, 1919, pp. 39–40.

[9] A thorough discussion of the effect of weather on the yields of corn, potatoes and winter wheat, by J. Warren Smith, is published in Proc. Second Pan-Am. Sci. Cong., 1915–16, Vol. 2, pp. 75–92: see review, in *Geog. Rev.*, Vol. 4, 1917, p. 317.

[10] "Predicting Minimum Temperatures," by J. Warren Smith, *Monthly Weather Review*, August, 1917, pp 402–407.