calories. One cannot accept his implied argument that modern man is healthier on the carnivorous diet than his primitive forbears, but the general idea is sound that the fundamental fault of the present-day diets is that increasing wealth permits increasing dietary protein and fat without corresponding decrease in the intake of foodstuffs such as cakes, ice cream, biscuits and sweets. There is no doubt that many people can lose excess weight with a diet low in carbohydrate but unrestricted in protein and fat. The case for not restricting protein is unanswerable; that for allowing unrestricted fat is on less certain ground. According to Prof. Yudkin, restriction of carbohydrate will usually be associated with relatively little, if any, increase in fat, but many people will take extra cream with their fruit and butter with their peas and beans. He wisely avoids discussing the possible effects of dairy fats and unsaturated vegetable fats in increasing or decreasing, respectively, the incidence of coronary disease.

In presenting his slimming regime, the author has taken a leaf from the notebook of the diabetic. Lawrence's line-ration scheme enabled the great majority of diabetics of widely differing mental acumen to control carbohydrate intake while retaining freedom of selection of foodstuffs. Lawrence's unit was the black portion corresponding to 10 gm. carbohydrate, and all the intakes of diet were tabulated according to the number of such portions they contained; Yudkin has selected 5 gm. carbohydrate as his unit, wisely since he hopes to restrict his slimming subject to 4 or less of such units, whereas diabetic patients require much more. This scheme provides an acceptable method of caloric reduction deserving wide use.

One can quarrel with little of the scientific content of this book, although the physiological reality of the 'appetate' is open to some doubt. Many authorities believe that water retention may play an even more important part than the author suggests in delaying weight reduction in subjects on diets of undoubted efficacy.

CHARLES H. GRAY

DYNAMICS OF FISH POPULATIONS

On the Dynamics of Exploited Fish Populations

By R. J. H. Beverton and S. J. Holt. (Ministry of Agriculture, Fisheries and Food—Fishery Investigations, Series 2, Vol. 19.) Pp. 533. (London: H.M. Stationery Office, 1957.) 126s. net.

THE cover jacket of this important work states that, "Many of Beverton and Holt's methods will be applicable to other living populations—animals or plants—and their theoretical framework should form part of the syllabus of teaching in agriculture, in ecology, in geography, in sociology, and in nature preservation". This is a wide claim but true enough in so far as the application of mathematics to the study of fish is ahead of its application to populations of land organisms. The book is in four parts, of which the first two are primarily theoretical representations of the four primary factors, recruitment, natural mortality, fishing mortality and growth. The application of the theoretical methods is developed in Part 3, concerned with the estimation of parameters, and in Part 4 where population models containing these parameters are used to investigate the reactions of fish populations to exploitation. The

argument is here primarily concerned with North Sea plaice and haddock, but examples are taken from other fish, including perch in confined lakes, which offer particular opportunities for getting to grips with population problems.

Some readers, more interested in the practical applications than the theoretical analyses, will doubtless turn straight to Part 4, but this would do the book less than justice, because it is mainly in the mathematical treatment of the subject that new ground is broken. But, while the authors are to be admired for their enterprise after seven years of effort in compiling a work of such magnitude, bringing into prominence the role of mathematical models in ecological theory and application, their methods are not beyond criticism. The work would, indeed, have benefited by a closer revision, for some of the lucidity is lost at critical points. In the treatment of random migration, for example, the authors get into rather deep water because they do not distinguish clearly between the case where displacements (d) are constant in magnitude and that where the displacements are variable. In this way they confuse the mean value of d^2 with the square of the mean value of d , whereas in the analogy they draw with the kinetic theory, the former is twice the latter.

Proofs of essential theorems are usually given fully, but some readers may be discouraged by arrays of impressive symbols, contortions and rearrangements, where simple and lucid arguments are available. For example, pages 37 and 38 are devoted to demonstrating in a particular case that the total annual yield from a steady-state population is the same as the yield from a single recruitment class followed through its life, an obvious and general result which can be rigorously proved in a few lines without mathematics. Again, the theorem on pages 39–40 is a rather unnecessary exercise in elementary summation and integration, for it follows immediately from the more easily demonstrated theorem that an exponentially declining population grouped into year classes is geometric. There are several instances where the formulation of the problems could have been more fully stated with the exact conditions, and with their formal enunciation more prominently displayed and numbered. Some ambiguity might thereby have been avoided.

There is a useful and extensive bibliography which, however, appears somewhat deficient on certain central themes. No mention is made in the text of the classical work of Lotka on stable age-structures, and the growth equations discussed at length are attributed to Bertalanffy (1934) instead of Pütter (1920). A few references could well have been omitted, for example that to Pétart (1938), because the serious reader unacquainted with higher mathematics might misunderstand its humour.

These criticisms, however, do not detract materially from the high value of this book as a major contribution to fishery science and a source of reference and interest to workers in mathematical biology. He who thinks in terms of living organisms rather than of symbols will inevitably take some buffeting, but it is pleasing to find support given to "the tradition dating from T. H. Huxley's time, and reaffirmed by Graham, that the best management of fishing is to leave it alone until events show that intervention is necessary". There is a useful index.

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