BOOK REVIEWS

Théorie Analytique des Associations Biologiques. I. *Principes*. 1934, 45 pp. II. *Analyse Démographique avec Application Particulière à l'Espèce Humaine*. 1939, 149 pp. By A. J. Lotka. (Actualités Scientifiques et Industrielles, nos. 187, 780.) Paris, Hermann.

The first of these monographs is a general introduction to the second. It (the first) is primarily a non-mathematical discussion of what the author regards as two types of biological evolution:

(1) The *intra-spécifique*, that which is concerned with the changes in the aggregate of distributions associated with a given biological species, brought about by mutation, genetic variation, natural selection, etc.

(2) The *inter-spécifique*, that which deals with the changes in the numbers of individuals in each of several coexisting biological species or groups, which are brought about by different birth and death rates caused by interaction of the species with each other and with other environmental factors.

The author's main interest lies in the second type of evolution, which he discusses at some length by elaborating on the implication of chains of species regarded as food chains, and other ecological points. The problem of the variation of the numbers of individuals in a system of n species is finally formulated in a system of equations $\partial x_i/\partial t = F_i(x_1, x_2, \cdots, x_n)$ $(i = 1, 2, \cdots, n)$ where x_j is the number of individuals in the jth species at time t. A formal solution is given for the case in which the F_i are approximately homogeneous linear functions of the $x_i - c_j$ in the neighborhood of $(c_1, c_2, \cdots, c_n)$ where $(c_1, c_2, \cdots, c_n)$ are the values of $x_1, x_2, x_3, \cdots, x_n$, respectively, for some "stationary state" for which the $\partial x_i/\partial t = 0$. However, this formal solution and its properties are hardly discussed at all. Special cases of solutions for the case $n = 1$ and 2 are given. For the case $n = 1$, the author shows that the Malthusian and the Verhulst-Pearl-Reed logistic growth functions are obtained by respectively assuming $F_1(x)$ to be linear and then quadratic in x.

In the second monograph the author concerns himself with the dynamics of human populations in which there is assumed to be no immigration or emigration. The first chapter in this monograph begins with the fundamental equation

$$N(t) = \int_0^w B(t - a)p(a)da \tag{1}$$