

CHANGES OF CLIMATE

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Proceedings of the Rome Symposium organized by Unesco and the World Meteorological Organization. (Arid Zono Research—XX.) Pp. xii+488. (Paris: Unesco; London: H.M. Stationery Office, 1963.) 28 francs; 40s.; 8 dollars.

THE study of climatic change is an attempt to reduce into some semblance of order changes in the Earth's climate on diverse scales in both space and time. It must consider the operation and effect of a large number of geophysical mechanisms, and involves the collation of results from many different scientific disciplines. It is an open secret that, perhaps because the subject is so complex, specious arguments have tended to go unchallenged and occasional dubious conclusions have found their way into text-books of climatology. A forum was obviously needed where ideas could be presented and criticized: the October 1961 symposium in Rome provided this. The volume under review contains the text of forty-five papers presented at the symposium together with a brief summary of the ensuing discussions.

Throughout the volume a laudable concern is shown for the physical significance of results, particularly those inferred from analyses of time series. There is a distinct tendency to adopt a more precise approach to the subject than hitherto. Also it should be noted that the problem considered was to assess whether any significant changes in climate can be resolved from available data and to understand the mechanisms involved; it was not to attempt any prediction of future trends. The papers are divided into four main sections.

The first section deals with changes during the period of meteorological records. Most of these papers try to show the way in which the evidence falls into a pattern in which the physical significance depends on the combined results of several different variables. However, even when distinct trends can be firmly established there was difficulty in interpreting these in terms of what had happened to the atmospheric circulation. Section 2 is devoted to changes during late geological and early historical records. The net result here is to show how various disciplines can combine to pose questions which meteorologists, without a quantitative theory of global climate, find great difficulty in answering. Occasionally in the first two sections there is a tendency to consider mean atmospheric and mean oceanic circulations as though they are complete physical entities in themselves rather than part of a statistical description of highly fluctuating flow-patterns. This is particularly noticeable when cause and effect are discussed: the importance of deviations from the average flow (eddies) were sometimes forgotten. There are obviously many interrelated mechanisms going on that are extremely difficult to assess adequately in a qualitative way, and one is left with the feeling that a more precise treatment along the lines indicated by the papers in the next section is urgently required.

Theories of changes of climate are the subjects of Section 3. Here there is a call for an attempt to produce a rough model which can represent realistic seasonal variations; later the model might be used to discriminate between likely and unlikely hypotheses. A pointer to the probable line of future attack is given by two papers using a quantitative approach and extremely simple models to describe the effect of a hypothetical increase in solar constant, and to test the validity of possible mechanisms of climatic change. Simple numerical techniques might well be profitably applied to some of the other theories advanced. Section 4 concerns the significance of changes of climate—on vegetable cover, patterns of land use, geomorphological features, etc. The importance of *variability* of rainfall to agriculture in semi-arid regions is emphasized, and the final paper stresses the practical implications of

statistically insignificant changes in climate when a threshold, peculiar to the area and the crop, is crossed.

The whole publication is excellently produced in a paper-covered volume, but a summary of each paper in English as well as in French (vice versa for some papers) would have improved the presentation. For nearly 500 pages of valuable material the price is extremely low.

G. B. TUCKER

RUSSIAN APPROACH TO FISH ECOLOGY

The Ecology of Fishes

By G. V. Nikolsky. Translated from the Russian by L. Birkett. Pp. xv+352. (London: Academic Press, Inc. (London), Ltd.; New York: Academic Press, Inc., 1963.) 75s.

THIS most stimulating book is especially welcome for three reasons. First, no other book covers the same ground, and it should be a very useful reference work for both academic biologists and those concerned with fishery problems. Secondly, this book and English translation make the great contribution of Soviet ichthyologists and ecologists available to the many who cannot read Russian. Thirdly, and in the long run perhaps most important, this book is to be welcomed for its refreshingly unifying approach to biology.

Throughout the book one is aware of Prof. Nikolsky's appreciation of the unity of the organism and environment, and that it is the adaptive interactions to particular elements in the environment which ensure the development and existence both of the organism and of the species. It is made quite clear that ecological studies must be based on knowledge of the structure and functions of the organs, and that such studies, at all stages of the life-cycle, make the only basis for rational fishery development.

The book is divided into three parts. In the first, Nikolsky considers "Interrelationships between Fishes and their Abiotic and Biotic Environment". It is here that the reader is most conscious of Nikolsky's continual awareness of the interchange between the organism and all the many facets of the environment proceeding simultaneously: some factors having greater effect at one stage of the life-cycle and others at another, some having greater significance at one stage of the evolution of the species and others at another, a continual flux and web, with continual interaction of the different factors. This interaction so often appears to be forgotten by those designing ecological experiments.

The abiotic relationships considered are the density and pressure of water and adaptive changes of the swim bladders of different fish groups, water salinity and osmoregulatory mechanisms, gases in solution and adaptations for aerial respiration, the effects of temperature, light, sound, electrical and electromagnetic forces, and the fishes' reactions to bottom deposits and water movements. There is also mention of work on X-rays and radioactivity on fish, very relevant to the modern problem of dumping atomic waste. From experience in high latitudes, attention is directed to the many ways in which ice affects fish.

The discussion on biotic relationships begins with those which are intraspecific. This includes a useful summary of work on shoaling in fishes, of great importance for the design of fishing gear. When discussing interspecific relationships, Nikolsky comments on the differences in faunistic complexes at different latitudes, the more intensive predator-prey relationships in lower latitudes, with corresponding increase in the development of protective adaptations (such as great fecundity, care of young, armour), and that lower-latitude fish tend to be more stenophagic. The interrelationships of fishes and other organisms are then treated group by group, from