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FRESH-WATER FISH-CULTURE IN FRANCE.

Encyclopédie agricole. Pisciculture. By Georges Guénaux. Introduction by Dr. P. Regnard. Preface by M. Charles Deloncle. Pp. xii+489. (Paris: Baillière et Fils.) Price 5 francs.

THIS is a comprehensive, compact, and eminently practical handbook on all matters relating to fresh-water pisciculture. Much of the information and criticism which it contains applies almost equally to England as to France, since most of the fishes dealt with are found in our islands, and the almost complete neglect of fresh-water pisciculture—except in the case of the Salmonidæ—is as characteristic of this country as of that. What is true of the depopulation of the French watercourses is partly true of our own. In France the depopulation and its neglect were due partly to obvious causes inseparable from industrial progress, such as the opening of canals, the development of navigation, and the establishment of manufacturing works and chemical factories on the river banks, and partly to lack of enthusiasm following on historical events. The means adopted to arrest the depopulation, much less to restock the waters, have been, and continue to be, utterly disproportionate to the extent of the waters and to the magnitude of the task.

The results of this neglect are:—(1) That France consumes extremely little fresh-water fish, either absolutely, or relatively to the consumption of marine species; and (2) that the great bulk of what little she does consume is derived from adjacent countries, principally Germany, where the rearing of carp especially has been developed into a paving industry by long years of experience and the application of scientific methods. While it is possible, as hinted by the author, that a protective tariff might do a little to obviate this unsatisfactory state of affairs, the only complete solution of the problem is for France to grow her own fish. These French watercourses (our own rivers and broads also to some extent) are capable of producing an abundance of highly nutritious food. In both countries there are numerous fresh-water species the *chaire* of which, M. Guénaux assures us, is *excellente*, and would form a pleasing variant to the marine species which at present more or less flood the fish markets and almost exclusively appear on our tables. Clearly something should be done to develop this branch of food production, and to some extent M. Guénaux's practical text-book points the way.

But although fresh-water fish-culture is in the main neglected in France, there are a few salmon- and trout-hatching establishments, which seem to cost very little and pay remarkably well; also several laboratories connected with schools of agriculture, which contribute to the repopulation of the waters. Finally, attached to the Universities of Grenoble, Clermont-Ferrand, Toulouse, and Dijon are scientific laboratories for the study of fresh-water biology which pursue a double aim, scientific and practical. The

University of Toulouse in particular has a large institution, started in 1903, devoted entirely to fresh-water pisciculture and hydrobiology, with museums, aquarium, and laboratories. In this matter England has something to learn from France, since, to the best of the reviewer's knowledge, the only station devoted to fresh-water hydrobiology in this country is a small private one on a Norfolk broad.

In writing a book on the whole subject it has been necessary for its author to combine the knowledge and qualities of a naturalist with those of an engineer and "practical man." This unusual demand on one's capacity and versatility has been met by M. Guénaux with conspicuous success. A critical inspection of the text of this book shows that its author is almost equally familiar with the morphological characteristics, taxonomic relations, and bionomical reactions (including feeding and spawning habits and requirements) of each species of fresh-water fish as he is with the merits and demerits of different kinds of salmon ladders, or the latest devices connected with egg-hatching apparatus, while he is evidently thoroughly *au fait* with the French laws relating to fresh-water fisheries, the weaknesses of which legislation he criticises in a characteristically practical manner.

The book opens with a brief account of the general anatomy of fishes, proceeding to take up each group in its natural order, explaining their taxonomic relations, and then giving a concise description (with good figures) of the distinguishing features and natural history of all the principal species, the most important features, namely, the feeding and spawning peculiarities of each, receiving particular attention. Then follows the subject of pisciculture proper, which forms the bulk of the volume. There are two kinds of pisciculture—natural and artificial. The object of natural pisciculture is to multiply the more valuable species by favouring their conditions of existence. Under this heading come such matters as the effects of navigation, canal-making, and industrial works, and the methods of combating these effects, and of restoring natural conditions, the planting of canals and dykes with plants on which the useful species may deposit their eggs, or seek shelter, the erection of ladders, and the construction of ponds, &c. By "artificial pisciculture," on the other hand, is meant the artificial fertilisation and hatching of the ova and the subsequent rearing of the fry. With the principal technical details of both kinds of pisciculture M. Guénaux deals exhaustively in a methodical and discriminating manner. As has been said, this is a thoroughly practical handbook, abounding in figures from statistics, measurements, and the critical comments of one who has had much first-hand experience of every branch of the business. There are plenty of good wood-cuts to illustrate construction of apparatus, &c. A succinct but fairly comprehensive account of aquatic invertebrate fauna and the flora next follows, and there is, finally, an excellent section on the parasitic diseases of fresh-water fishes and of injurious insects, reptiles, birds, and mammals. These chapters are also amply illustrated.

But even M. Guénaux's knowledge and versatility

have their limitations, and when he passes from fresh to salt water (metaphorically speaking) he appears somewhat "out of his element." Otherwise he would not have quoted antiquated and rejected notions regarding the growth of salmon after its migration to the sea in the face of the well-ascertained results of a vast amount of more recent research. Again, the author's account of the life-history of the eel is not abreast of current knowledge, since he makes no mention of the most important and not so very recent discovery of the breeding-grounds of this species all along the eastern shelf of the Atlantic basin. Reading M. Guénaux's account, one would suppose that the latest word on the subject of the eel had been said by Signors Grassi and Calandruccio, which is not so.

Then, again, the fear (casually expressed, it is true) lest certain species of pelagic sea fishes, such as the pilchards (sardines) off the west coast of France, be in danger of extermination through over-fishing is probably unwarranted, and argues a lack of knowledge of the conditions of life in the sea. Finally, returning to the salmon, it will surely surprise anyone who has some knowledge of the Highlands of Scotland and of the rigorous restrictions to which salmon-fishing is subjected in this region at the present day, to be told that:—

"*Aujourd'hui, c'est dans ce pays [viz., Scotland] que les domestiques sont obligés de stipules à l'avance que le saumon no paraîtra trop fréquemment dans leur ordinaire!*"

These happy days are almost ancient history. But such matters are, after all, quite on the fringe of M. Guénaux's subject. Enough has been said to indicate that the book is a small mine of information, and should be consulted by all whose business or pleasure brings them face to face with any of the difficult problems connected with fresh-water pisciculture.

WILLIAM WALLACE.

A CYCLOPÆDIA OF AGRICULTURAL CHEMISTRY.

Kleines Handwörterbuch der Agrikulturchemie. By Dr. Max Passon. Two vols. Erster Teil, Aadl-kynurensäure. Pp. iv+454. Zweiter Teil, Lab-zymogen. Pp. 415. (Leipzig: Verlag von Wilhelm Engelmann, 1910.) Price 22 marks.

THESE two volumes bear striking testimony to the enormous strides made during the last twenty years in agricultural chemistry. Only within very recent times has the need for a cyclopædia been felt; previously the chemist could always pull through if he possessed one of the larger analytical treatises and had access to a set of the *Jahresberichte* for agricultural chemistry. Rapid progress set in when the subject was emancipated from the analytical stage; when the chemist, instead of being confronted with an interminable succession of analyses of manures, feeding-stuffs, and soils, was free to study the numerous problems presented by the plant in its relation to the soil, on the one hand, and the animal on the other.

To the popular mind the agricultural chemist is still an analyst, and beyond doubt the analyst is more necessary than ever he was; but the distinction be-

tween the two is fast becoming as sharp as in pure chemistry. This process of segregation is going even further, and already men are specialising in the various branches of agricultural chemistry itself. Hence the need of reference books like the present volumes.

One of the features of the book is the treatment of laboratory operations. The ordinary methods are dealt with in some detail, there are numerous illustrations, and, where necessary, tables of figures. Even such minor but important processes as the recovery of platinum, silver, &c., from their residues find a place. In addition, a number of tests are given, and methods for finding whether nitrogen is present as an amide group, an amino-acid, or an ammonium salt. Although these are probably the fullest articles in the volumes they are rather restricted in their scope, attention is devoted almost exclusively to German methods, little space being given to those in use elsewhere. In several instances the book suffers in consequence. Thus we find the methods for the mechanical analysis of soils are very incomplete; the separations are carried only far enough to include material more than 0.2 mm. in diameter, all below this limit being grouped together as fine sand, &c. This is very unfortunate, because it is now known that the finer fractions—those falling between 0.2 and 0.04 mm., between 0.04 and 0.01 mm., between 0.01 and 0.002 mm., and below 0.002 mm.—really play a controlling part in soil fertility; indeed, no soil analysis can be fully interpreted without knowing them.

The book is, however, more than a laboratory manual, and space is found for some of the great generalisations and theories that have played a part in the development of the subject. The treatment is all too brief, especially when one remembers the importance rightly attached in Germany to theoretical considerations. Liebig's famous "law of the minimum" is stated, but its modern developments are not mentioned. "The growth of the plant is governed by the quantity in the soil of that food constituent which is present in the smallest amount." This generalisation has proved of great value in agriculture, but it is now merged in the wider conception of limiting factors, which we should like to have seen discussed in the book. It is now recognised that certain requirements must be fulfilled before plants will grow well—there must be ample water, air, warmth, food, light, and no injurious substance must be present. Any increase in one of these factors may lead to an increased crop production, but the increase is soon limited by the insufficiency of some one or more of the other necessary factors. If all are increased, the limit is finally set by the plant itself. In general, however, modern hypotheses are not given; we have been unable to find any mention of the well-known toxin-excretion theory of Whitney, which supposes that infertility arises through the excretion of toxic substances by plant roots. Whether it ultimately turns out correct or not, this theory has led to so much investigation that it deserved a place.

A critic could easily point out much more that has been omitted. But he would find it difficult to see how it could be otherwise within the limits of two