

investigated in varying detail, and a considerable amount of correlated experimental work undertaken. The paper is the best account which we have at present of a piece of shore ecology in all its aspects, as may be gathered from the titles of the principal sections into which the paper is divided: — physical-chemical factors; general biology of the dominant species; distribution of the various year-groups; rate of growth of *Macoma* and *Cardium*; distribution of the various species on the shore, etc. There is, in addition, a very full bibliography of papers dealing with the subject, to which constant reference is made. There are also twenty-six clear and interesting plates at the end of the paper which give a very good idea of the type of ground on which the work was done, and of the detailed appearance of the habitats of the principal species.

With regard to the physical-chemical factors some ten were analysed, and of these, period of submergence, texture and water-content of the substratum, temperature and food-supply were found to be the determining factors.

The investigations at Skalling were carried out along two lines on the shore, each about five hundred metres in length, extending from H. W. M. to L. W. M. The fauna was that usually associated with the *Cardium-Macoma* zone divisible into two sub-zones, an upper one marked by *Hydrobia-Pygospio-Corophium*, and a lower one marked by *Arenicola-Cardium-Macoma*. In parts the population was very dense, although the number of species is naturally rather limited. As many as 3,000 to 4,000 individuals, having a weight of 3.4 kg., were taken on a square metre.

A series of curves is given showing the numbers of each species per m.<sup>2</sup> and their weight, at different seasons. These give a clear idea of the seasonal variations in density and distribution.

*Arenicola* was found most abundantly where the sand was mixed with a little mud; *Scoloplos* where there was pure sand. *Corophium* cannot live on the same ground as *Cardium*, since the latter breaks up its tubes. *Macoma* was found to be most abundant in the lower reaches of the beach, since it is there that its food is most abundant.

At the higher stations the numbers of individuals were much greater than at the lower stations (as 16:1), but the total weight was in the reverse order (as 1:30). The consumption of oxygen was also greater at the lower stations (as 1:7).

Altogether this is a most interesting and useful paper and the author is to be congratulated on it. We look forward to further contributions on the same subject, more especially on certain important problems which have just been touched on in the present paper, and on which further work is promised.

A. C. S.

**E. Fischer-Piette.** "Études sur la biogéographie intercotidale des deux rives de la Manche." Journ. Linn. Soc. London, Zool., Vol. XL, pp. 181—272. London, 1936.

For a number of years Dr. Fischer-Piette has studied the distribution of the common species of animals and algae in the littoral zone on the two sides of the Channel, and he has now brought together the results of his investigations in the form of charts of the variation of abundance of the different species from place to place. While emphasizing the necessity of more prolonged study of each individual locality before a positive statement can be made of the absence from it of any given species, he

shows that there are a number of species whose distribution shows a general relation to certain geographical or physical features.

In the first place there are a number of species such as *Laurencia pinnatifida*, *Purpura lapillus*, *Littorina rudis* and *Patella vulgata*, which are practically universally distributed. Then there is a second group including the various lichens, and *Patella depressa*, *P. intermedia*, and *Balanus perforatus* which are influenced chiefly by whether there is a suitable surface for attachment. A number of species show an apparently erratic distribution, but one which is presumably linked with some at present unknown environmental factor, and two of these, *Patella intermedia* and *Actinia equina*, show a marked inverse correlation with one another, the one being rare where the other is common. Two species of barnacles also show an inverse relation of another type, *Balanus balanoides* progressively replacing *Chthamalus stellatus* eastwards up the Channel.

Finally there is a group of species, nearly all algal, whose abundance is greatest on points of land jutting out into deep water, and a second group, all animal, whose numbers increase markedly in the more sheltered bays. Among the former are *Bifurcaria*, *Alaria* and *Himanthalea*, and among the latter *Pomatoceros*, *Mytilus edulis* and *Balanus perforatus*.

A sufficient number of localities has been worked for the above facts of distribution to be taken as significant, and the next step is to correlate them with definite environmental factors. Unfortunately this is difficult, and Dr. Fischer-Piette, who has made a big step forward in thus indicating where such factors are to be sought, is able to make only a very tentative suggestion of a substance beneficial to certain species in the inshore waters of bays, and of a factor beneficial to others in the pure waters round exposed headlands. Admittedly such factors appear to exist, but it is hard to reconcile the apparent sensitivity of an alga such as *Himanthalea lorea*, which is supposed to be favoured by the comparative purity of the water in the Lizard—Start Point area, but excluded by the less pure waters of the Start Point—Portland Bill area, with its abundance in the relatively very muddy waters of Plymouth Sound. Such difficulties are freely admitted by Dr. Fischer-Piette himself, and it is to be hoped that his further work will be able to provide an answer to them.

H. B. M.

**H. B. Moore.** "The Biology of *Balanus balanoides*." Journ. Mar. Biol. Assoc. N. S., Vol. XIX—XX, Plymouth, 1934—1936.

I. "Growth Rate and its relation to Size, Season and Tidal Level." (Vol. XIX, No. 2, 1934.)

The locality chosen for the investigation is situated in the Dub Reef in Port Erin Bay, and about a hundred specimens of *Balanus* at three different levels of the rocky shore were kept under observation for a whole year. As soon as the new spat were large enough for measurements a series of these was also included. A method of measurement was employed which allowed a calculation of the volume of the barnacle.

It was found that the growth-rate is greatest in the smallest individuals and in those at the highest level. As regards the seasonal variation there was in general a high growth-rate for a short period in the spring and summer, followed by a period of slower growth throughout the winter. The time of maximum growth-rate varies, however, on the different patches and with different sizes of barnacles.

It seems that a group of the young barnacles settled later than the typical members of the community and this group was not able to get