of this topic as holding out hope of controlling corrosion by separating the impurities and heat-transfer surfaces by physical means, it is clear that much confusion and lack of definition exist.

When treatment and separation fail, the results of interaction between deposit and boiler tube must be accepted, and the fourth and final session was devoted to this subject. The importance of complex sulphates was discussed, although there was some dispute as to whether acidic sulphates or pyro-sulphates were more active in destroying protective oxide films on alloys. The recognized action of chloride was further established, and its peculiar reactivity towards heat-resistant alloys was attributed by one author to the loss of volatile chromium chloride from the surface. Once more the discussion brought out the differences between plant experience and inferences drawn from fundamental work.

Some overall impressions remain after reviewing this volume. After thirty years work on the subject, the past ten of which have witnessed a marked acceleration of effort, the fundamental processes involved in fire-side boiler corrosion are still not sufficiently understood to permit of a realistic degree of control. Indeed, there appears to be a recurrent and clear division of opinion between those who seek a fundamental approach and those who urge that progress can only be made by testing in actual boilers. In fact, this is only one aspect of the wider problem concerning the way in which vital corrosion research is at present handled in Great Britain. In this particular case, as well as in the more general one of an annual national charge of £600 million due to the depredation of corrosion, it seems impossible to achieve a real degree of co-ordination of effort in research.

In conclusion, it must be said that this book is a credit to the editors and publishers; the amount of new material provided by the authors is very substantial and constitutes a noted addition to the literature. T. K. ROSS

LIFE OF THE TSETSE

The Distribution and Abundance of Tsetse

By J. P. Glasgow. Pp. xi+241. (Oxford, London, New York and Paris: Pergamon Press, 1963.) 60s.

DR. GLASGOW sets out the general purpose of *The Distribution and Abundance of Tsetse* in his introductory chapter. It is to examine the general theory of animal numbers put forward by Andrewartha and Birch in their book *The Distribution and Abundance of Animals* in the light of information available on a single genus of insect, *Glossina*. This purpose is reflected in the plan of the book, which is modelled as closely as possible on that of its prototype. Following a general account of the biology of tsetse are chapters on the innate capacity for increase and on the effect of different aspects of weather, of other organisms and of phenotypic variation on fecundity; the numbers and distribution of tsetse are then discussed and, on this basis, specific criticisms are made of Andrewartha and Birch's views.

The author provides an absorbing and lucid account of most aspects of tsetse biology, incorporating the results of work carried out since the publication of Buxton's monograph in 1955, and thus giving an authoritative summary of present-day knowledge. Chapters on the effects of weather are particularly valuable in emphasizing the complexity of seasonal interrelationships and warning against spurious simplification of the problems involved. The chapter entitled "Other Organisms of Different Kinds" includes an excellent account of predation, and suggests the need for further investigation of what is probably an important agent of mortality.

Objection may be raised to the precision estimates of the innate capacity for increase set out in Chapter 2. The

assumptions on which these estimates are based are questionable, and the physiological abnormalities which characterize tsetse under laboratory maintenance throw doubt on their validity. The values obtained are probably no more than broadly indicative of reproductive capacity in natural populations.

The chapter which describes the relation between tsetse and vegetation is rather less than satisfactory. This is scarcely surprising if a statement made on p. 170 is a true reflexion of the author's attitude: "Within the limits of altitude, wherever there is a covering of woody vegetation 15 ft. or more in height, one or more species of *Glossina* usually occur". Fortunately the situation is not quite so bad as that. In this chapter, the relation between the resting tsetse and vegetation could usefully have been discussed; results obtained in recent years suggest that the tsetse is less indifferent to vegetation than Dr. Glasgow.

The relation between the tsetse and its food supply also receives somewhat idiosyncratic treatment. The problem of host encounter is largely ignored, despite its obvious importance in relation to population dynamics. Instead, a detailed account is given of the 'host preference' of different species of *Glossina*, and prominence is accorded to the results of two experiments designed to provide a quantitative assessment of the burden of attack sustained by host animals in a tsetse habitat. Granted the validity of the population estimates on which such assessment is based, the experiments suggest that 'preferred' host animals may suffer very substantial loss of blood, perhaps sufficient to cause deleterious physiological effects. Furthermore, the intensity of attack may be such as to elicit vigorous defensive action on the part of the host animal, and thus lead to interference with the feeding of the tsetse if not to its actual death. These considerations are important in so far as they suggest the existence of a 'density-dependent' element in the population dynamics of this insect, a suggestion which runs counter to traditional beliefs. But it should be remembered that, since the newly fed flies required for blood meal analysis are not easily found, the experiments described would have had little chance of success had they not been carried out in areas of high tsetse density. The results indicate that 'density-dependent' factors may come into play where populations are heavy, but they scarcely warrant the view that "sometimes, if not always, tsetse use up all their food resources" (p. 182).

Dr. Glasgow's book concludes with a series of criticisms of Andrewartha and Birch's theory of animal numbers, which is rejected on somewhat slender grounds. A detailed discussion of the points raised would serve no purpose except to state a difference of opinion between author and reviewer; it is better that the reader be left to cast his own vote. Since the data are inadequate to support an unequivocal conclusion, the decision must remain at the level of opinion. The fault lies not so much with the author as with the tsetse. Two things are required for evaluation of the effect of environment on animal numbers—accurate estimates of the effect of physical factors on fecundity, and accurate estimates of the numbers of tsetse in the natural habitat. From one we are debarred by the difficulty of rearing tsetse in the laboratory; from the other, by the fact that we are unable to collect an unbiased sample of a tsetse population, and population estimates have therefore to be based on the difficult, laborious and often error-ridden technique of marking, release and recapture. Thus it is not surprising that Dr. Glasgow has failed to provide a rigorous test of a particular theory of animal numbers; but in the attempt he has produced a stimulating account of the tsetse which will repay the careful consideration of animal ecologists.

The book contains one or two errors (for example, "indigenous African mammals appear to take no harm from trypanosomes", p. 102) and a few misprints, of which perhaps the most unfortunate is 'Wrigglesworth'.

E. BURSELL