the benefit to our fisheries of the future would justify this. Though in the list of authors E. E. Jones is said to be referred to on page 105, he is unfortunately missing from the table (pages 104/105) and the text.

A list of theories about the function of the olfactory sense in fishes is followed by the conclusion of the author that a combination of a number of mechanisms which he has outlined may form the basis of olfactory perception. In fact, as Sain-Hilaire said in 1825, "with respect to olfaction, physiology merely notes the phenomenon but does not explain it" may still be true though we are now nearer to arriving at some explanations.

The second chapter deals with behavioural responses of fish to olfactory stimulation, in particular in relation to feeding, social behaviour, defence, parental behaviour and orientation. The homing behaviour of salmon is discussed adequately, though regrettably no mention is made of Scottish work on this topic. It is said that eels taken from water and released in wet grassland are able to travel towards the nearest body of water without visual aid over considerable distances. I would like to see a repeat of these experiments.

In the appendix there is a fascinating account of some of the ingenious methods used by the author for observing and recording locomotor pattern in fishes.

I thoroughly recommend this excellent book to all fishery biologists, as many of us pay too little attention to the physiology of fishes. In this book there may be answers to many of our management problems, especially those concerning salmonids. J. W. JONES

BREEDING OF MAMMALS

The Ecology of Reproduction in Wild and Domestic Mammals

By R. M. F. S. Sadleir. Pp. xii+321. (Methuen: London, April 1969.) 75*s*.

DR SADLEIR has the commendable aim of bringing together the ecologist and physiologist in the hope that such an academic union would lead to greater understanding of the breeding of mammals. The first four parts of his book deal with the influence of nutrition and of the physical environment (ambient temperature, day length, altitude, precipitation) on four aspects of the reproductive life of mammals—puberty, breeding seasons, pregnancy, and the immediate post-natal period. A fifth part is concerned with the role of social factors in mammalian reproduction, and the sixth, comprising just two and a half pages, deals with "Human Interference".

Sadleir makes it clear that complex ecological problems are amenable to experimental investigation, and it is apparent that in future work greater attention should be given to R. A. Fisher's view that very often Nature will only answer clearly when several questions are asked simultaneously. The numerous graphs and tables emphasize the quantitative approach but do not always have adequate captions and are sometimes insufficiently discussed. There has been some sacrifice of analysis in depth for the less critical presentation of numerous examples. Naturally we are told a good deal about the significance of the various physical and biotic factors for reproduction in rats, mice, voles of one sort or another, lemmings, muskrats and ferrets, besides a host of other mammals. The taxonomic index is three pages long. But what I found particularly valuable was the presentation of the results of important, interesting, thorough work done in Australia on the physiological ecology of sheep, rabbits, and, especially satisfying, several species of kangaroo. It becomes clear that intensive study of the manner in which the physical environment in northern temperate regions influences, for example, seasonal breeding may have little relevance in general and in detailed terms to the biology of mammals (such as kangaroos) living in more arid zones closer to the equator.

The book is written enthusiastically if somewhat inelegantly, and has a number of minor errors and ambiguities which detract from the author's admirable purpose. Thus we have gestinin for genistein; parameter for factor, effect or event; correlation confused with regression; "blood values" for I do not know what; Baker and Ranson conducting their important vole experiments at 5° F rather than at 5° C. On page 96 the ferret is erroneously bracketed with the sheep as a short day animal, in spite of extensive evidence quoted earlier that its sexual development is hastened by lengthening days. Sadleir is inclined to write involved sentences such as (page 227), "These two extremes are thus of a direct and indirect effect of the nutritional regime on lactation effectiveness", which I simply cannot understand. Yet the overall aims and achievements of the book are important. The ecologist and the physiologist will be reminded of the possibility for an experimental approach to the complex problems of mammalian ecology, while at the same time having a convenient, comprehensive summary of the ecology of reproduction. JOHN CLARKE

BREAKDOWN OF HERBICIDES

Degradation of Herbicides

Edited by P. C. Kearney and D. D. Kaufman. Pp. xi+394. (Dekker: New York, April 1969.) $18.75; 178*s*.

THE persistence of pesticides has occasioned widespread public concern and the appearance of this volume is therefore opportune. In twelve chapters, specialists have explored the contributions of the many factors responsible for the disappearance from the environment of all the principal types of herbicides. Careful editing has ensured that the fates of chemical substances of different types in soil, plants and animals can be readily compared, for, with minor variations, each chapter is arranged in the form: introduction; chemical properties; degradation *in vivo*; conclusions. The final chapter is different, being devoted to the subject of photodecomposition.

Several authors refer to the still fragmentary nature of information about the fate of herbicides and especially of data relating to the relative contribution, for individual compounds, of physico-chemical factors (volatilization, leaching, hydrolysis, photodecomposition) and of enzymatic degradation by soil organisms or by enzymes in higher plants. Many of the steps leading to biochemical degradation and conjugation often, but not always, resemble the systems present in animals. The processes of N-dealkylation and of aromatic ring hydroxylation, for example, are strikingly similar to those brought about by microsomal systems in animals, at least one of the dealkylation systems being NADPH-dependent. Whether the rate at which biochemical degradation of herbicides proceeds in tolerant plants is sufficient to provide significant short-term protection is, however, doubted by more than one contributor.

Information contained in this volume will also assist workers concerned with the causes of selective toxicity and, to a lesser extent, those interested in the mode of action of herbicides. For example, considerable evidence suggests that sensitive plants metabolize certain herbicides less rapidly than do tolerant species, but, as a comparison of the contents of the first eleven chapters demonstrates, this is by no means always the case. One author suggests that selectivity, as well as depending on such obvious factors as uptake and distribution, may be more related to the time which elapses before significant metabolism begins than to the extent or route of the metabolism once it has commenced. For several herbicides, no well defined biochemical degradative route has yet been discovered in higher plants.

Degradation in soil is, for some herbicides, more important than their degradation within plants. In this con-