

of them deserve to be better known to their present American colleagues and are colorful and important personalities in their own right. Yet, perhaps because of the factual approach to history writing used by the author, they do not come alive and remain, as does Wegener himself, figures of ink and paper rather than flesh and blood. On the other hand, in the limited space of these pages the large and often not clearly recognized differences in the development of geology on the Continent and in North America become quite clear. Reading the book is an instructive experience that rewards the effort.

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## Avian Strategies

**Some Adaptations of Marsh-Nesting Blackbirds.** GORDON H. ORIAN. Princeton University Press, Princeton, N.J., 1980. xii, 296 pp., illus. Cloth, \$18; paper, \$7.95. Monographs in Population Biology, 14.

Over the past 14 years the Princeton University Press has published major statements on topics in population biology by senior workers in the field. The latest monograph presents a synthesis of the main ideas and data from a long field study of birds. It is written in a highly personal and readable style. Like several other books in the series, it could have been given the same title as a collection of James Thurber essays: *My World—and Welcome to It*.

Gordon Orians's professional world is the world of blackbirds. There are four species breeding in North America. They show different degrees of coloniality in their breeding habits and, associated with this, different patterns of feeding. For example Brewer's blackbirds are monogamous, redwing blackbirds are polygamous. Some male redwings have one female, others have as many as six, all with different nests in the same male's territory and spaced out apparently without regard to each other. Some blackbirds travel many miles to feed, others feed locally. Such variations as these raise questions about the adaptive basis of breeding and feeding in different ways. Gordon Orians has spent nearly 20 years posing and then trying to answer these questions.

The first two chapters of his monograph describe in ample detail the North American blackbirds, their nesting habi-

tats and food supply. The main result of an extensive sampling of their food, chiefly odonates (dragonflies), is that the emergence of the insects is generally predictable from a knowledge of the data, time of day, and weather conditions. From this it is expected that birds can integrate and use the information to anticipate prey availability and to make their decisions about where to breed and feed without having to sample the foods directly.

The following four chapters are the core of the book. In them Orians tries to discover how individual blackbirds make their decisions. He sets up models of how birds should behave according to simple premises, then tests predictions of the models with field data. In the first of these chapters the question is how males and females choose a particular place to breed. For redwing blackbirds the answer seems to be that both males and females assess variations in habitat quality in terms of food resources and protection from predators and choose the best patch available. Females, in addition, may take into account unknown (to us) qualities of the males, but they do not appear to be much influenced by whether there are four other females already on the territory or none.

Optimal foraging models are then used to predict when blackbirds should switch their feeding from one patch to another, which food items should be sought, and how many should be brought to nestlings. The predictions are tested with data on the amount and composition of food in (i) the marshes and (ii) the nestlings' throats. The predictions have mixed success. For example, according to the theory of central place foraging Orians has developed, birds should bring larger loads of food to their nestlings the further they have to go to get it, in order to compensate for the longer time the nestlings are without food. Gratifyingly, for both the theory and common sense, they do. Also as expected, birds alter their foraging among patches during the day when patch quality is changing. However, although birds should feed only on large, richly rewarding food items when their rates of capture are high, because it is uneconomical to do otherwise, in fact they feed on large and small food items when this condition is met. Nevertheless, despite several equivocal findings like this one, this and the previous chapter are the most incisive and valuable in the book.

The next chapter discusses the effect of resource variability on blackbirds and concludes that redwings and yellow-headed blackbirds respond similarly to

changing resources. But yellowheads are larger than and dominant over redwings, which, apparently as a consequence of competition with yellowheads, are forced to feed in a broader range of places. This leads on to a discussion of community structure and niche overlap and to a comparison of North and South American blackbirds. The intercontinental comparison is particularly interesting for the confirmation it provides of Orians's theory that selection favors a polygynous mating system in areas where habitat quality varies greatly; in Argentina food abundance is much lower and more uniform than in North America, and none of the three blackbird species studied indulge in polygyny as their North American relatives do. The book closes with a survey of bird-supporting marsh habitats around the world and manages to establish a link with the first monograph in the series by treating marsh communities in the context of island biogeography theory.

In providing answers to questions about ecological adaptations the book is only a partial success. It often fails because the questions are complex and the techniques for answering them are inadequate. To test theories of foraging it is helpful to see the forager at work. Blackbirds are not a good choice of organism for such study because they cannot be observed when foraging in dense reeds and marsh vegetation. I suspect that part of the problem, too, is that some of the data were collected for other purposes before the development of the theories they are used to test in this book. A further problem is the sparse use of statistics, which gives rise to uncertainty as to what predictions are definitely supported and what are not. And as an illustration of the inadequacy of study methods, birds were not marked individually, so the interesting questions raised about differences between individuals in foraging cannot be addressed directly.

However, it would be wrong to judge the work solely in terms of clear answers. Its real strength lies in the discussion of adaptations and how they might be studied. In presenting reasons for considering certain questions to be important, Orians has turned a failure to answer many of them into a success by capturing some of the excitement that is felt in discussing recent research results.

Thus the book has something to say about how and why this type of ecological research is done. The use of theory is made explicit. Theory is used in two distinct but complementary ways, to design falsifiable tests and to gain further in-

sights: "It will become evident that this second use of theory has been more important in my studies because available theories concerning the ecological traits I examined are highly simplified and are not readily tested in the complex, uncontrolled field conditions in which I worked." Too often modifying factors not included in the theory made results open to more than one interpretation. But Orians claims that the theories suggested measurements not otherwise thought of, and he gained a greater understanding of blackbird adaptations as a result. He has succeeded in sharing his understanding in this book.

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