

Cooperation in Birds

The Florida Scrub Jay. Demography of a Cooperative-Breeding Bird. GLEN E. WOOLFENDEN and JOHN W. FITZPATRICK. Princeton University Press, Princeton, N.J., 1984. xiv, 407 pp., illus. \$45; paper, \$14.50. Monographs in Population Biology, 20.

Cooperatively breeding birds are widely recognized as important subjects for testing many of the fundamental concepts of sociobiology, and studies of one or more such species have been or are being conducted in Australia, Africa, South America, Asia (India), the Middle East, and North America. Among the first and foremost of these is the ongoing project of Glen Woolfenden and John Fitzpatrick and their co-workers on the Florida scrub jay. This study, initiated by Woolfenden in 1969, received early recognition via E. O. Wilson's book *Sociobiology: The New Synthesis*. By virtue of the attention Wilson's book drew to these jays, the early start relative to most similar studies, and the consistently high quality of their research papers, Woolfenden and Fitzpatrick have been the pace-setters among those conducting empirical field studies of avian cooperative breeding systems.

This volume provides about ten years of data on the topics relevant to demography, which is thought, correctly I believe, to be the key to understanding the Florida scrub jay's social system. Following the introduction, a chapter on procedures, and an overview of the scrub jay in Florida, the authors devote a chapter each to the pair bond, helpers, territory, dispersal, reproduction, and the life table, before the highlight of the book, the concluding chapter on the evolution of Florida scrub jay sociality. Each chapter begins with a synopsis and ends with a statement of conclusions; thus the major messages concerning each topic can readily be extracted from the text. Without attempting to provide specific examples, I will simply state that the data and analyses are impressive. Only a handful of bird species of any sort have been studied so thoroughly. The distinctiveness of the book in this regard is due to the sedentary nature of the jays and their low rates of adult mortality, as

well as to the diligence of the researchers. The only critical topic not considered is the resource base within the territories, and this currently is under study.

Woolfenden and Fitzpatrick are strong advocates of the necessity of long-term studies, a point with which few would disagree. Thus it is perhaps noteworthy that many of the important conclusions presented in this book are corroborations of earlier reports. For example, helpers do increase the reproductive success of breeders (reported in 1975); helpers increase reproductive success not by feeding nestlings but probably by reducing predation on juveniles (reported in 1978); breeders survive better if they have helpers (1978); male helpers frequently "bud" off a part of the parental territory (1978); and sexual differences in dispersal create sexual differences in survivorship (1978). The fact that so many major aspects of the Florida scrub jay's social system were correctly ascertained with much less than 10 years of data should be encouraging to those who are fascinated by the phenomenon of avian cooperative breeding but do not have the luxury of many years to study such a system.

One interesting finding not previously described is the strong correlation between the density of older helpers and the mortality of breeders. Woolfenden and Fitzpatrick suggest that competition between older helpers and established breeders (not in the same territories) may be more severe than they had previously suspected. This is the kind of subtle pattern that generally can be picked up only in a long-term study.

For the most part the authors present thorough analyses of their own data and do not review the studies of others. For example, neither of the two previously published papers explicitly describing some demographic patterns of other cooperatively breeding species is cited. However, when they do address other views Woolfenden and Fitzpatrick offer thought-provoking suggestions. One such case involves the concept of per capita reproductive success (reproductive success per group member rather

than per breeding unit). The authors present arguments to show that per capita reproductive measures are not valid measures of comparative fitness. Another important example is their interpretation of the help-vs.-breed "decision" made by would-be helpers. They point out that previous analyses of the costs and benefits of helping focus on single-year comparisons, rather than on lifetime effects on fitness, and that this is a critical point.

John Maynard Smith, who coined the term "kin selection," recently observed that "scientists are obsessed by kinship." If so, probably of greatest interest to most readers of this review is the evaluation of the role of kin selection in the Florida scrub jay's social system. At the outset Woolfenden and Fitzpatrick set the stage for a later assessment of the role of kin selection, providing probably the clearest statement to date of the position of those who have been dubious about all the emphasis given to kin selection. In their final chapter the authors synthesize the various issues and data brought out earlier (survivorship, fecundity, relatedness, dispersal) and present what may be the most thorough and realistic analysis of the decision to disperse yet presented for any social animal. They conclude that the Florida scrub jay's helper system would evolve under present-day demographic conditions even in the absence of the kinship component to fitness. Although Woolfenden and Fitzpatrick clearly demonstrate that young jays should stay at home rather than disperse, and why, they do not synthesize factors involved in helping behavior per se in the same detail. (It is shown in earlier chapters that helpers do gain in several ways from having helped; for example, birds that serve as helpers tend to be more successful as breeders.) The problem is that the authors fail to distinguish clearly and consistently between non-dispersal and helping, although they are aware of the distinction, as when they refer to "helping (or at least delayed dispersal)" (p. 324). Their conclusion about the evolution of the helper system is weakened by this confounding of two phenomena. They do, however, offer a novel and interesting suggestion concerning helpers: that the act of delivering food to dependent young is selectively neutral as far as production of young jays is concerned—that is, this behavior may be simply a hormonally controlled response to young jays. (Heavier fledglings do not survive better than lighter ones.) I would be more skeptical of this proximate kind of suggestion except for my own obser-

vations on captive juvenile western scrub jays. Young scrub jays in a large outdoor aviary along with juvenile gray-breasted (Mexican) and pinon jays matured more rapidly than the other two species and sometimes responded to the gaping and vocalizations of members of those species by feeding them. Helping behavior is unknown in western scrub jays; thus these observations do suggest a basic sort of stimulus-response interaction in this species.

To conclude, I strongly recommend this monograph. The data and analyses are excellent, as are the layout and appearance of the book. Here is a wealth of information that should be of great interest to students of behavior, demography, and sociobiology and in fact to all biologists interested in any aspect of vertebrate life history strategies.

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Geomagnetism

The Earth's Magnetic Field. Its History, Origin and Planetary Perspective. RONALD T. MERRILL and MICHAEL W. McELHINNY. Academic Press, Orlando, Fla., 1983. xii, 404 pp., illus. \$67.50; paper \$30. International Geophysics Series, vol. 32.

This volume records the measure of its authors' success in bridging the gap between theories of the mechanism of generation of the earth's magnetic field (dynamo theory) and the study of paleomagnetism. By insisting that there had been continental drift and by recognizing a historical sequence of reversals of the geomagnetic field, the paleomagnetists of the 1950's set in motion a revolution in the earth sciences that is now essentially complete. This was accomplished by an entirely empirical study of the magnetism of rocks and the inferred behavior of the magnetic field on a geological time scale. It is most unlikely that plate tectonics, sea-floor spreading, and all that follows would yet be widely recognized without paleomagnetism. But nearly four decades of study of the earth's magnetic history have had rather little impact on our understanding of the processes that generate the field.

It is the contention of Merrill and McElhinny that the massive quantity of paleomagnetic data now available contains sufficient information to provide important constraints on dynamo theories. They have therefore set about the

daunting task of writing a monograph that will simultaneously make dynamo theory comprehensible to paleomagnetists and inform dynamo theorists of the possibilities and limitations of paleomagnetism.

Some of the inferences concerning the dynamo that derive from paleomagnetism are widely known and accepted, but it is important not to overlook their significance. Averaged over a period of order 10^5 years, the earth's magnetic field closely approximates a dipole at the center of the earth, with its axis aligned with the rotation axis. On a shorter time scale there is a secular variation that appears as non-dipole features that grow and decay, as well as a wandering of the dipole about the geographic axis and fluctuations in its strength. For the past few centuries of direct observation the non-dipole field has drifted westward at about 0.2° of longitude per year, but the paleomagnetic record indicates that this drift is not a permanent feature. Reversals of the field have occurred irregularly at intervals of order 10^5 years, but there have been some very prolonged periods of constant polarity. During a reversal the dipole field is weakened for a period of about 5000 years (which is comparable to the free decay time for an unmaintained field). The average intensity of the field 2.5 billion years ago was no more than marginally stronger than at present, but for an extended period in Cambrian time (roughly 500 to 300 million years ago) the field was very weak.

Merrill and McElhinny draw attention to some more sophisticated observations that one hopes will suggest means of discriminating between rival dynamo theories. One is that the time-averaged field is not perfectly dipolar. There are systematic higher multipole (especially quadrupole) components that account for the "far-sidedness" of paleomagnetic poles that was first reported by R. L. Wilson. Another concerns the randomness in time of reversals; for periods of order 10^8 years the intervals between reversals appear random and the average frequency is constant (in spectral terms the time series is stationary) but there are sudden changes in frequency. It is not clear what other geophysical effects may be related to these switches between apparently different regimes, but they may coincide with changes in the mantle convection pattern.

It is difficult to imagine that more than a very few highly selected practitioners of paleomagnetism will be able to digest the principles of magnetohydrodynamic dynamo theory, and still less that they will identify details of the alternative

theories that their data may allow them to test. As Merrill and McElhinny recognize, the gap between disciplines must be bridged the other way, by making clear to dynamo theoreticians what paleomagnetism can do and has done. Progress is perceptible, but it is still appropriate to echo the words of W. M. Elsasser more than 20 years ago: "There are too many ways in which the core can be made to convect to permit an unambiguous interpretation."

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Soviet Psychology

Psychology in Utopia. Toward a Social History of Soviet Psychology. ALEX KOZULIN. MIT Press, Cambridge, Mass., 1984. xii, 179 pp. \$17.50.

Although this is not the first treatment in English of the history of psychology in the Soviet Union, it does provide a new approach. Soviet writers on the subject have focused on the relationship of psychology to Marxist-Leninist ideology, and Western scholars have discussed it as part of a general analysis of science in the Soviet Union or have concentrated on psychological theory to the exclusion of historical analysis. Kozulin's book, though not claiming to be definitive, is a broad examination of the major currents in Soviet psychology since 1917 in which the evolution of the field of knowledge is placed in its cultural and political context. As Kozulin succinctly puts it, he has written "a socially informed study of Soviet psychology that [distinguishes] between the actual conditions of its development and those secondary interpretations that are invented in order to present these conditions in ideologically coherent form" (p. 2).

Kozulin approaches his subject by first drawing a portrait of the four generations of Soviet psychologists. He then investigates in greater depth the activities of the leading figures in the field. In particular, a good deal of attention is devoted to the work of Vladimir Bekhterev, Nikolai Bernstein, Lev Vygotsky, Ivan Pavlov, Alexander Luria, and Pavel Blonsky.

Russian psychology was founded prior to the Revolution by a generation of individuals strongly influenced by developments in Europe and America, especially those associated with Wilhelm Wundt, Pierre Janet, William James, and