

and most of the authors emphasize the need to respond quickly before particular habitats or species are lost. Unfortunately, the data on the abundance and distribution of most species are rather meager, which makes it difficult to evaluate trends and set conservation priorities except in extreme cases. Willis presents interesting ideas on new approaches to conservation problems in Brazil, but many of them seem farfetched. Most authors place little emphasis on the need for research on the effects of grazing and human activities on the birds in these areas. One exception is the chapter by Bucher and Nores, who both acknowledge the problem and note that this type of research is now underway in Argentina.

There are five chapters on European countries, which include Britain (and other islands, especially the Falklands), the Netherlands, Spain, Italy, and an overview of Europe, the Mideast, and North Africa. In a chapter on the grassland birds of the Netherlands, Beintema summarizes the relationship between breeding productivity and land use practices. He reviews policies that the Dutch government has adopted to maintain viable grassland bird populations in the Netherlands. This is one of the few bright spots in the book. Bourne's chapter on the impact of grazing and fire on the moor lands of Britain and other islands points out that maximizing long-term grazing productivity and bird conservation often are compatible in these environments, but ironically these practices are rarely followed.

The coverage of Africa is rather meager with a chapter by Thiollay on the raptors of the Ivory Coast, another by Wilson on the grassland birds of central Mali, and cursory coverage of northern Africa by Gorup. Thiollay's chapter provides an excellent data base on the density of raptors in the Guinean savannah and on their response to human disturbance.

Asia is covered in five chapters: two on India, and one each on Pakistan, Bangladesh, and China. Rahmani provides an excellent discussion of the threats to several rare grassland bird species in India. The chapter by Majumdar and Brahmachari on grassland bird communities in India adds little to Rahmani's chapter and could have been left out with little loss. The chapters by Mian (Pakistan), Khan (Bangladesh), and Hsu (China) point out the poor state of knowledge of the grassland birds of these areas. Most of the data on trends in abundance of birds in Pakistan come from the impressions of hunters and trappers. Hsu provides a very brief overview of the situation in China and cites no references, although he states that research is currently underway on steppe habitats in China.

The final chapter by Fitzherbert and Baker-Gabb gives an excellent discussion of threats to endangered grassland species in Australia and New Zealand, and it includes detailed maps of recent sightings of each species in Australia.

"Ecology and Conservation of Grassland Birds"

provides a timely and sobering view on the state of the world's grasslands and the birds that depend on them. It should be in the collection of every major library, and on the shelf of every range manager and professional interested in bird conservation.—T. LUKE GEORGE.

Peregrine Falcon Populations, Their Management and Recovery.—Tom J. Cade, James H. Anderson, Carl G. Thelander, and Clayton M. White (Eds.). 1988. Boise, Idaho, The Peregrine Fund, Inc. xviii + 949 pp., 68 black-and-white plates, 1 color plate, 100 text figures. ISBN 0-9619839-0-6. \$39.00. (Available through Buteo Books).—This volume is a sequel to the now classic "Peregrine Falcon Populations, Their Biology and Decline," which appeared in 1969 and launched a highly productive era of conservation studies, not only of the Peregrine (*Falco peregrinus*) but also of numerous other raptor species. The 1969 volume, edited by Joseph J. Hickey, summarized presentations at a 1965 conference in Madison, Wisconsin, during which the extent of a massive postwar decline of the Peregrine, both in North America and Europe, first became evident. At that time, causes of the decline were not yet clear, although there were suspicions that contamination of the species with persistent organochlorine pesticides might be a major stress.

The 1988 volume summarizes much of what has transpired in Peregrine investigations since the Madison conference. Based primarily on a 1985 symposium held in Sacramento, California (but also including several papers prepared subsequently), it spans contributions from more than 100 authors. The topics range from recent status surveys to essays on mechanisms of population regulation. Individual papers are organized into 11 sections: keynote addresses; status of Peregrine populations since 1965 in North America; status of Peregrine populations since 1965 in Europe; status of Peregrines in other parts of the world; DDT and other chemical problems; migration and banding studies; captive propagation, reintroduction, and management; dynamics and ecology of Peregrine populations; geographic variation in Peregrine populations; humanity and the Peregrine; and summary and conclusions. Emphasis is given to documentation of a very convincing recovery of many populations that were close to extinction at the time of the 1965 conference. In essence the book serves as a celebration of the many fine efforts to study and conserve the species in a remarkable international mobilization of two decades' duration.

The book covers so much ground that attempting a full review of all aspects is impractical. Instead, I think it is more worthwhile first to call attention to a number of papers that are especially valuable, and then to concentrate on certain focal topics of the book that are especially significant.

Joseph Hickey's keynote address highlights in a most engaging way the early history of intensive efforts to conserve the species, a history in which he played a most crucial role and for which he has gained the special affection of raptor biologists and conservationists worldwide. Other keynote addresses by Derek Ratcliffe and Morlan Nelson provide equally fascinating historical perspectives.

Of the presentations on biology and ecology, I found most informative Jean-Marc Thiollay's study of Peregrine-prey interactions in Tunisia, and the papers by Ian Newton and Grainger Hunt on population regulation. Summaries of recent conservation efforts in the eastern United States and Canada by John Barclay and Richard Fyfe are also of great interest, while the migration studies of Prescott Ward et al. include a wealth of new data.

Probably the topic of most general importance is the reexamination of the causes of the decline in the 1950s and 1960s contained in contributions by Ian Newton, Ian Nisbet, David Peakall, Lloyd Kiff, Robert Risebrough, and the editors. In popular view, the decline of the Peregrine has become the prime example of population dysfunction caused by DDT (more specifically its persistent metabolite DDE). The once-startling revelations by Derek Ratcliffe, Joe Hickey, and Dan Anderson of DDE-induced eggshell thinning and breakage have now been so thoroughly documented in so many raptors that they are no longer controversial. The causal relationship of such effects to population declines of these birds has become conventional wisdom, to be challenged only with some trepidation. Yet the primacy of DDE in the post-war woes of the Peregrine and other raptors has now indeed been challenged. The strength of the challenge is reflected by the considerable space and the involved arguments devoted to the subject in this book.

Most North American raptor biologists first became aware of a serious questioning of conventional assumptions about DDE's effects on raptor populations at the International Council for Bird Preservation conference on birds of prey held in Thessaloniki, Greece, in 1982. At that session, Ian Newton pointed out that in his studies and in studies of Derek Ratcliffe, the declines of the Peregrine and European Sparrowhawk (*Accipiter nisus*) in Great Britain showed a much closer relationship to use of dieldrin (HEOD) and other cyclodiene pesticides than they did to use of DDT. While severe eggshell thinning and breakage were seen in both species immediately after the advent of DDT (DDE) in the mid-1940s, no significant population declines were apparent until the late 1950s, immediately after dieldrin came into use. In fact, the number of breeding pairs of Peregrines actually increased until the late 1950s (following cessation of wartime persecution of the species as a threat to carrier pigeons). Usage of dieldrin and DDT declined in Great Britain during the 1960s (dieldrin faster than DDT), and recovery of both species began in the late

1960s and early 1970s. With the Sparrowhawk it was especially clear that the geographical pattern of recovery closely matched that of the reduction in use of dieldrin and that recovery took place in spite of continued high levels of DDE-induced eggshell thinning and breakage.

Dieldrin is not known to cause eggshell thinning or breakage or to cause other reproductive problems, but its effects on wildlife are potentially great, as it is lethal to many vertebrates at extremely low concentrations. Laboratory studies have shown that for some birds it is more than 100 times as toxic as DDT. Some Peregrines and Sparrowhawks were indeed picked up dead of apparent dieldrin poisoning during the declines, and it is a fair assumption that they might have been only a tiny fraction of those that actually died of such poisoning. So while the effects of DDE on Peregrines were much easier to study than those of dieldrin (because they were mainly sublethal effects), a case can be made that these effects might not have been as important as those of dieldrin, and not just in Britain but in North America as well.

One is reminded of the situation recently documented for the California Condor (*Gymnogyps californianus*). Here a major mortality factor and cause of decline, lead poisoning, had been overlooked simply because studies had not been carried out in such a way that they might have detected it. The importance of lead poisoning did not emerge until the very end of the wild population's existence, when radiotelemetry finally allowed efficient recovery of dead and dying condors.

No widespread radiotelemetry studies of Peregrines were conducted during the postwar declines, and very little was learned directly about what, if any, mortality factors might have been involved. Instead, especially in North America attention quickly became focused on reproductive factors and DDE, once DDE's reproductive effects became known. Once a plausible culprit was in hand, the search for other culprits soon lost urgency. In fact, many studies that were performed after the original ones that implicated DDE did not consider a full range of alternative hypotheses. A significant role for DDE in the declines is not in question, but whether the effects of this substance came close to fully explaining the declines was never determined conclusively.

When the case implicating dieldrin emerged at the Thessaloniki conference, the general reaction was one of surprise and confusion. For some, including me, who had studied the effects of organochlorines on wild raptor populations, there was considerable soul-searching as to how thoroughly earlier conclusions needed to be reexamined. Many of us had detected dieldrin residues in raptor eggs but had found them fairly low in concentration—without apparent importance to reproductive performance or mortality. But we were indeed sampling survivors only, and this may have been a very biased procedure in a larger

sense. Average dieldrin levels in eggs might reveal very little about the percentage of a population receiving lethal doses, and this percentage need not be extremely high to have massive effects on population stability, especially when combined with the effects of DDE. Dieldrin's effects could easily be confused with the effects of DDE if no comprehensive effort was made to monitor rates and causes of mortality.

The soul-searching continues today, as is evident in the present volume. Nisbet's analysis of the potential involvement of dieldrin in the Peregrine declines is especially thorough. His basic conclusion is that this substance may have been important in North America and Britain. Conclusive evidence is lacking, but in both regions there was heavy use of dieldrin (and its precursor aldrin), some Peregrines were found dead of dieldrin poisoning, and many populations declined with sufficient speed to strongly suggest something beyond reproductive problems.

Presentations by Risebrough, Peakall, Kiff, and the editors continue to favor a primary role for DDE, based in part on an impressive worldwide linkage between degree of eggshell thinning and severity of population declines. However, because patterns of dieldrin use have generally been correlated with patterns of DDT use, it seems possible that equally good or better linkages may exist between dieldrin exposure and population declines or between combinations of DDE/dieldrin exposure and population declines (comprehensive data to test such relationships have not been assembled).

Risebrough and Peakall also develop demographic models to determine if rapid declines could result from DDE contamination alone. Although these models represent a great advance over earlier models, the results seem inconclusive. With annual adult mortality set at 16.7–20.0%, first-year mortality set at 66.7%, and productivity set at a DDE-stressed level of 0.3 young per pair, the Risebrough-Peakall models predict a rate of population decline quite similar to the crash actually observed in eastern North America. However, dropping adult mortality slightly to 15% and first-year mortality to 50% would sufficiently delay the decline that it no longer would resemble what was observed. Evidently the effects of DDE-lowered productivity depend crucially on what mortality rates characterize a population.

Unfortunately, there is little reliable information to suggest what mortality rates might be considered "normal" for the Peregrine, although various authors in this volume present mortality rate determinations. Newton and Mearns, for example, found an annual adult loss rate very close to 10%, based on retrapping of marked breeders in a recovering population in Scotland. Using similar methods, Enderson and Craig found 16% annual adult mortality for a depressed but relatively stable (because of releases?) Colorado population. Ambrose and Riddle found somewhat higher (23%) adult mortality for a recovering Alaskan pop-

ulation, again by similar methods. All these determinations were in fact maximum estimates because of the potential confounding of undetected dispersion with mortality. Enderson and Craig, for example, estimated that true annual adult mortality for their Colorado population might have been in the range of 10–15%. Moreover, all these determinations may have included greater or lesser amounts of "nonnormal" (i.e. human-caused, including pesticides) mortality.

Although Risebrough and Peakall suggest that the crash of the Peregrine in eastern North America might plausibly have been due to DDE-lowered productivity alone, the 16.7–20.0% adult mortality rate necessary to achieve this result in their models may have included at the outset a substantial component of excess mortality. In fact, if "normal" adult mortality is on the order of 10% in many regions (a reasonable possibility, judging from the above data), one could conclude that there may have been a near doubling of normal adult mortality rates during the crash years (mortality that could be attributed, at least in part, to dieldrin). Likewise, the estimate of 67% first-year mortality used by Risebrough and Peakall may have included substantial excess mortality, judging from the data of Newton and Mearns. These latter researchers calculated a total of only 56% mortality of Scottish Peregrines through their first *two* years.

Unfortunately, the amount of credible data on mortality rates of Peregrines is still too small to allow safe generalizations (most mortality-rate calculations based on general band-recovery data are highly suspect), and unfortunately there is no good direct documentation as to what dieldrin was actually doing to wild raptor populations in the 1950s and 1960s. Excess mortality in those years could have been produced in part by factors other than dieldrin (including DDE, despite its relatively low toxicity). So while the circumstantial evidence for an important role for dieldrin is considerable, both for North America and Britain, exactly what happened to the Peregrines of that era may never be known. Crucial data on rates and causes of mortality were never collected. Very likely, both DDT and dieldrin contributed to the declines, and their relative importances probably varied from place to place and year to year.

Uncertainties about causes of the Peregrine's decline are not limited to debates over dieldrin versus DDE. In fact, although they receive little consideration in the present volume, certain populations were in decline before either DDE or dieldrin appeared on the scene. For example, James Rice documented in the earlier volume a precipitous pre-DDT decline of the population in Pennsylvania and New Jersey. Between 1939 and the mid-1940s nearly one third of the nesting pairs in this population disappeared, an effect that Rice attributed primarily to human disturbance, especially by falconers. He attributed earlier declines mainly to egg collectors. Whatever the full causes

were, they must have been factors other than DDE and dieldrin in those years. Furthermore, in examining Rice's territory desertion curve, one is impressed that there is no sign of a sudden acceleration in abandonments with the advent of the DDT era, just a steady linear continuation (with some minor annual variations) of the steep downward trend already in progress! Yet aspects of the demise of this Peregrine population are still repeatedly regarded as examples of the effects of DDE alone, as if the causes of the pre-DDT decline suddenly became inoperative with the advent of DDT.

The contributions of various positive influences to recovery of the Peregrine are also somewhat uncertain. There can be no reasonable doubt that the phase-out of both DDT and dieldrin (and other organochlorines) was highly beneficial to many populations. This should not lead us to forget the contributions of reductions in shooting and falconry, or the contributions of population enhancement by the reintroduction programs documented in this book. Large scale releases of captive-bred Peregrines have been carried out in many regions in North America and Europe, and have succeeded both in urban and more natural settings.

How crucial have reintroduction programs been for overall recovery? Many populations, such as those of Great Britain, Arizona, and arctic Alaska, have already recovered almost fully without such programs. It is further reasonable to suppose that populations such as these could eventually serve as source populations for natural reestablishment of other populations. Nevertheless, few observers would deny that recovery in many regions was speeded greatly by release programs, and that certain populations that were wiped out (eastern United States, East Germany) or are still under heavy pesticide stress (southern California) owe their very existence to such programs.

Moreover, those who discount the value of release programs often fail to appreciate the enormous benefits of these programs in terms of public education and training of personnel for future conservation battles, probably the most important values of the programs in the long run. The hundreds of alumni of the Peregrine efforts will occupy roles of influence in wildlife conservation for many decades. Those who have led the efforts—Tom Cade, Richard Fyfe, James Anderson, Brian Walton, and many others—deserve special commendation for their efforts in an overall sense and especially for their perseverance in spite of many political discouragements and at times actual harassment from governmental and other officials.

"Peregrine Falcon Populations, their Management and Recovery" is a valuable book, makes intensely interesting reading, and will undoubtedly serve as a major reference for raptor and conservation biologists for many years. Failings of the book are minor and few. The most noticeable is an uncomfortable tendency for the editors to append their own opinions

to presentations without providing authors with an opportunity for rebuttal or further discussion. In addition, the reader is occasionally left without an opportunity to hear a full exposition of all sides of an argument. In particular, responses by Ian Newton and Derek Ratcliffe to the points raised on the dieldrin-DDE debate by Risebrough, Peakall, and the editors would have been most appropriate and would surely have enhanced the value of the book significantly.

Finally, it is worth noting, as was pointed out in the conference summary by Nisbet, that despite the massive investment of resources in Peregrine research and conservation in the past two decades, and despite a massive number of publications dealing with this species (more than 1,500 titles), there are still substantial gaps in our knowledge of its basic biology. For example, basic Peregrine demography is still little understood, and virtually no data on growth rates of nestlings have been published. Little has yet appeared on biological aspects of the release programs—for example, survival rates of released birds, their dispersal from release sites to breeding sites, or the comparative success in establishment of different racial stocks in various areas. Now that many populations of the species have clearly emerged from a severely threatened condition, it seems appropriate for Peregrine studies to evolve from a long-standing emphasis on status surveys and eggshell thinning to an emphasis on a variety of biological questions that have as yet received little attention.—NOEL F. R. SNYDER.

Waterfowl in Winter.—Milton W. Weller, Ed. 1988. Minneapolis, Minnesota, University of Minnesota Press. xx + 624 pp., 96 text figures. ISBN 0-8166-1570-5. Cloth, \$49.50. ISBN 0-8166-1571-3. Paper, \$19.95.—It comes as something of a surprise to a European waterfowl researcher to learn in the opening paper of this book that basic wintering waterfowl biology in the New World is poorly known. It is all the more surprising when 47 contributions follow which clearly show this not to be the case! In Europe, we have a great deal of information relating to wintering wildfowl, but until recently lacked access to major breeding areas. This is in considerable contrast with the experience in North America, where the emphasis has always been on the study of breeding stocks.

This work is extremely impressive and is the result of a symposium held in Galveston, Texas, in January 1985, the distillation of more than 100 paper and poster presentations on the broad subject of waterfowl during the nonbreeding season. The symposium was one of the largest gatherings of North American waterfowl biologists, ecologists, and managers this century, and there was never any doubt that the work that was to be presented there would be of considerable moment.