REVIEWS

Population of White Stork *Ciconia ciconia* in Poland, Part 1. Zbigniewa Jakubca. 1985. Polaska Akademia Nauk, Warsaw and Krakow, Poland, 262 pp. ISBN 83-01-05943-5.—This monograph documents the past and present status of the White Stork (*Ciconia ciconia*) in Poland. It not only is an interesting exposition in its own right but also illustrates the unique wealth of information available on this single species of stork.

After an introduction by the primary author, the book begins with a comprehensive review, by Piotr Profus, of the previous research on the White Stork in Poland. Although no complete census of the White Stork was undertaken prior to the 1974 study reported in this book, the first attempt to count storks over a wide area began a century earlier, in 1876. Understanding of the status of the stork in Poland benefited from the the First International Census of White Stork Nests in 1934 and subsequent efforts. More recent research has addressed aspects of its biology in the country.

The methods used in the present census are a model of collaborative effort. Over 40,000 questionaires were sent to village officials, over 81% of whom responded. This effort was followed by detailed censuses carried out by volunteers using the field protocoles that have been standardized for the species. The chapter also discusses the credibility of the inquiry data contrasted with the results of a direct censuses. Either methods detected about 75% of the nests.

The book ends with a discussion of the population size and density of the species in Poland during the study year, and the trends implied by those data. The author concludes that, since the 16th century, environmental changes generally have been favorable to the stork, enhanced by its ability to co-habit with humans.

The extensive information base on the populations of this species thus provides nearly incomparable insight into its dynamics. Such long-term collaborative efforts using both government officials and volunteers deserve to be emulated by colonial waterbird conservationists and managers elsewhere.—**James A. Kushlan,** Department of Biological Sciences, East Texas State University, Commerce, Texas 75428 USA.

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Recovery plan for the U.S. breeding population of the Wood Stork. U.S. Fish and Wildlife Service. 1986. Atlanta, Georgia, USA: U.S. Fish and Wildlife Service, 28 pp. Available from Fish and Wildlife Reference Service, 6011 Executive Blvd., Rockville, Maryland 20852, USA.—The U.S. Fish and Wildlife Service, the lead bureau for protection of endangered terrestrial and fresh-water animals in the United States, is responsible for evaluating the status of a species proposed for listing, recommending the establishment of critical habitat, evaluating the effects of development projects having Federal involvement, co-ordinating the recovery effort, and evaluating proposals for delisting. In carrying out its responsibility, the Service has relied on the development of Recovery Plans, written by its employees, contractors, or appointed committees. Despite the expiration of the Endangered Species Act, the Service has maintained its activities to the extent that they have been funded by congressional appropriation.

The Wood Stork is the only North American stork, and the recovery plan cited above has recently been approved in order to channel and direct management efforts. The plan was prepared by Michael M. Bentzien, who is to be congratulated for his attempt to balance differing biological opinions and varying agency policies. He has been able to provide an outline of crucial steps for the recovery of this species, well worth the attention of those concerned with stork conservation worldwide.

In common with all such plans, it outlines specific activities thought to be required to result in the "recovery" of the species within the United States. The population level for this recovery is explictly stated as the ultimate goal of the plan. A

population of 10,000 nesting pairs would lead to delisting, whereas a population of 6,000 breeding pairs should result in its being reclassified as Threatened, if additional information indicated that an upward or stable trend could be maintained.

The Recovery Plan sets out to: 1. establish secure habitat for life cycle of Wood Stork by providing adequate feeding areas and protecting colony sites; 2. develop models for population dynamics and movements; and 3. develop public awareness of the Wood Stork and wetland problems. To meet the habitat goals, it is proposed to: determine feeding areas essential to support colonies and non-breeding assemblages of storks; identify water management necessary to maintain suitable feeding conditions; implement water management practices favorable to Wood Stork productivity; identify other threats to feeding areas and implement appropriate protective or corrective measures; and protect colony sites. All these measures, if carried out, would go a long way to assuring the survival and increase of the stork population in the southeastern U.S. The author has done well in comprehensively applying the recovery planning process to this species of stork.

The plan gives the current U.S. population as 5,000 pairs, which would seem to be very close to the ultimate population goal for down-listing to Threatened. In fact, a present population of 10,000 adult birds seems quite a lot for a species to be considered Endangered, and there exists a substantial argument that, on a biological basis, the U.S. population should never have been listed as Endangered in the first place, and perhaps not even as Threatened. Afterall, populations of this species elsewhere, especially in South America, remain large. Furthermore the overall population decrease is the result almost entirely of the pitifull reproductive success of the several colonies in extreme southern Florida, whereas the population has been expanding both numerically and geographically in the remainder of its North American range. Although there is no doubt that the south Florida subpopulation is in danger of extirpation, there also is no clear sign that a similar fate seriously threatens Wood Stork populations elsewhere.

Perhaps, in retrospect, it would have been more realistic to single out the south Florida population as Endangered, which would have provided incentive to concentrate research and management efforts there. As it is the most valuable recent research on Wood Stork biology has come not from south Florida, but from the fine studies of Drs. James Rodgers and Malcolm Coulter in north Florida and Georgia. Fortunately some of this understanding is transferable to managing the southernmost group of storks.

It is odd that so few specific management practices are explicity called for in the report. One is left with the impression that so little is known about the species that a great deal of research is necessary in order to begin active management. The oddity is that nearly all information called for is available, and has been available for a decade, for the most endangered subpopulation in southern Florida. For these storks, it is possible to say specifically what feeding areas are essential, what water management is necessary to maintain suitable feeding conditions, what management needs to be implemented and how, and how colony sites should be protected. Surely this is a situation that requires immediate management action.

The report notes the research results that demonstrated a correlation between the rate at which the Everglades dries and the timing of Wood Stork nesting, which, barring storms, determines nesting success. The original relation was reported in 1975 (Kushlan et al., U.S. Geol. Survey, Open-File Rept. 75-434, Tallahassee, Florida, USA). Essentially, the faster the Everglades dries the sooner Wood Storks begin to nest. This finding resulted in a one-year study in 1975, during which the water control structures at the upper end of Everglades National park were closed for much of the nesting season, and the result was a sucsessful nesting season (the last to occur in the Park). This massive, puposeful experiment showed that the relationship was sound and that increasing the drying rate (or some other factor correlated with drying rate such as the pattern of prey availability) could produce successful nesting. To further strengthen the finding, a subsequent study in an entirely different system in central Florida

confirmed that drying rate was a primary predictor of nesting success (Clark 1979, Proc. Colonial Water Bird Group 1:178-188).

Few wildlife management relationships have been subjected to ecosystem level experimentation and cross-system verification; yet the report states, "Wetland ecosystems are sufficiently complex that a simple relationship such as water recession rate is unlikely to explain Wood Stork nesting success." The fact is that it does explain nesting success in the southern Everglades, and clearly demonstates the direction that management action could take to save the Wood Stork: insure or create a dry season in stork feeding habitat. Not coincidently, this mangement goal appears totally in concert with how the Everglades seasonal marsh functions ecologically for the benefit of all species (see e.g., Kushlan, 1986, Colonial Waterbirds 9:155-162; 1987, Environmental Management 11:109-119).

The inclusion in the report of a conclusion so at odds with several lines of experimental and correlational evidence should remind conservationists that the recovery process is a thoroughly political one, from listing to delisting and every step in between. Realistic management depends entirely on the co-operation of divergent governmental entities. By history and philosophy, some agencies are not inclined to actively manipulate areas under their control, whether a declining population of Wood Storks requires it or not. It is well to meet the existence of this philosophy head-on and to therefore strive to make the needs of this endangered species better known to citizens and decision-makers. It is certainly the hope of all that bureaucratic considerations do not result in the extirpation of an historically important population of Wood Storks.

Two other aspects of the report inspire comment. The first is the contention that the explanation for the decline the stork is the "reduction in the food base (primarily small fish) necessary to support breeding colonies," and that "wetland drainage and hydroperiod alteration are believed to have lowered the productivity and availability of fishes for the Wood Stork." There are two considerations regarding the food base. One is the loss of habitat to drainage—the primary explanation for the decrease of the Corkscrew colony site in the Big Cypress Swamp (Browder 1978, in Natl. Aud. Soc. Rept. 7, New York). However, there is no evidence that hydroperiod alteration has adversely affected the amount of fish in the Everglades, only its availability. Certainly there is no evidence that drought years after 1970, were "inadequate for optimum wetland health and productivity." If anything it was the lack of drying periods in those years that caused the fish production present to remain unavailable to storks. There is more than enough fish in the Everglades to support hundreds of thousands of storks, if only they could get to it. That is, if only the Everglades dried appropriately.

A second aspect is the puzzling lack of call for development of accurate census techniques. The past and present population estimates have been derived from aerial observations, usually taken once or twice a year, mostly at known colony sites. Such observations suffer from potentially large amount of error, up to 90% in specific instances and not atypically underestimating true nesting numbers by up to 40% (see e.g. Kushlan, 1979, Wildlife Manage. 43:756-760.) First of all, use of such an error-plagued methodology means that even substantial changes in the population cannot be detected statistically. In fact, the degree of potential error does not rule out that the overall population may be almost double the level currently accepted, which would meet the goal for total delisting. If so, all would rejoice at the good news that the stork is not as bad off as we thought. However without an appropriate census technique, the progress of the recovery effort cannot be assessed. The intensive studies of James Rodgers in northern Florida indicate that the only way to monitor Wood Stork colonies is using nest-by-nest ground counts throughout the season, accompanied by data on the reproductive output per nest attempted. Because there are so few colony sites, this is not at all infeasible using State Game biologists and volunteers. A program similar to the Grey Heron censuses in the United Kingdom would be a worthwhile model.

A great benefit of the current report is to present a concrete plan of action, and all participants in the process have made

important contributions. It lays the results and interpretations on the table and permits focused discussions, such as this review, to occur. In the end the process will no doubt serve to benefit the Wood Stork. However, that opportunities to engage in active management to enhance Wood Stork productivity are being lost suggests that naturalists of the next generation might have to plan their stork-watching trip not to the Everglades, but to Georgia.—**James A. Kushlan,** Department of Biological Sciences, East Texas State University, Commerce, Texas 75428 USA.

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