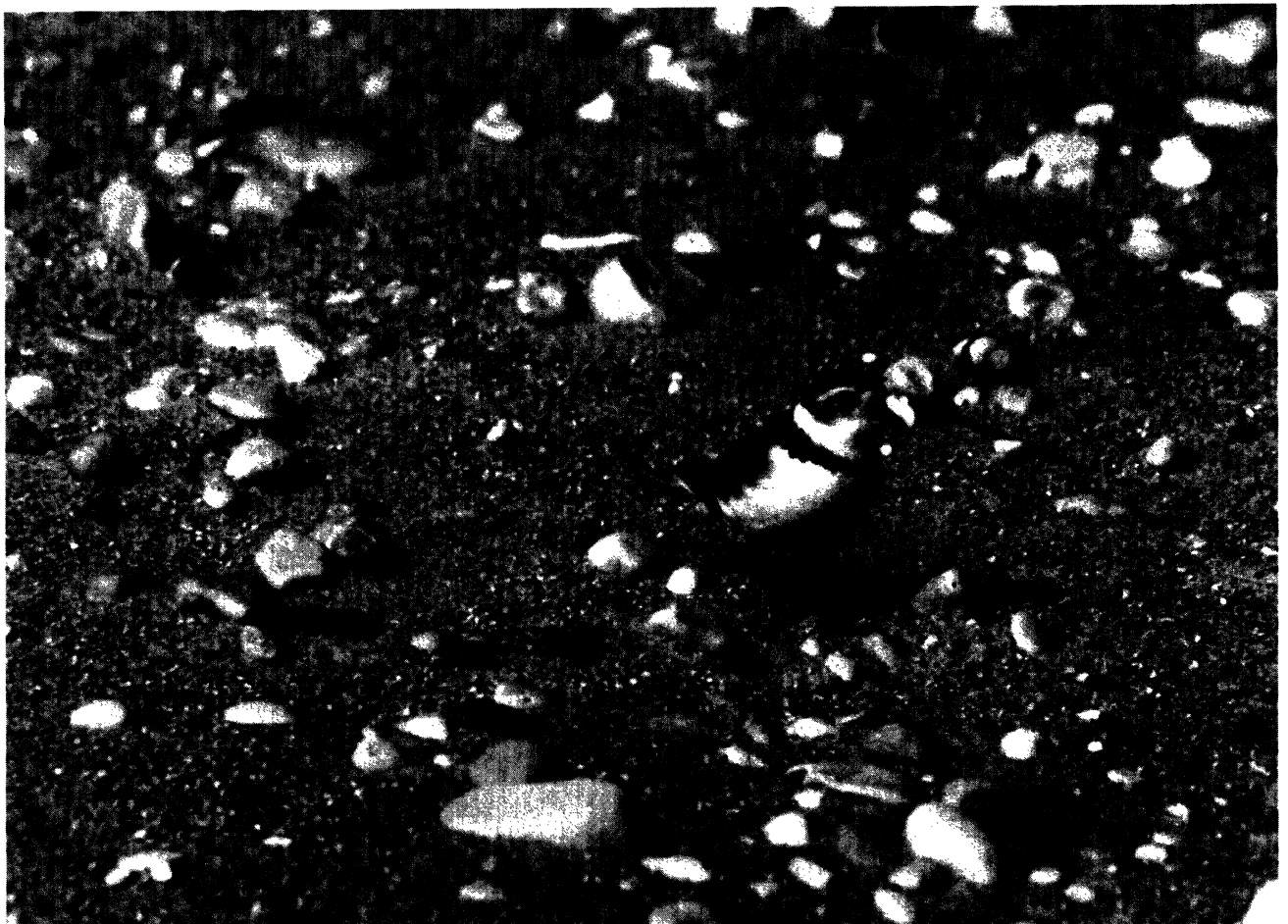


# Endangered Species UPDATE

*Including a Reprint of the latest USFWS  
Endangered Species Technical Bulletin*

*July/August 1991 Vol. 8 No. 9 & 10*

THE UNIVERSITY OF MICHIGAN  
School of Natural Resources



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# Great Lakes Piping Plovers: Recovery or Extirpation?

by

Abby N. Powell

The Great Lakes piping plover population (*Charadrius melodus*) was listed as federally endangered in January 1986 (USFWS 1988). At the same time, the Great Plains and East Coast piping plover populations were granted threatened status. By the time listing occurred, plovers in the Great Lakes region were nesting only at sites within the state of Michigan. Piping plovers previously nested at locations in Michigan, Minnesota, Wisconsin, Illinois, Indiana, Ohio, Pennsylvania, New York, and Ontario, Canada. The Duluth Harbor, Minnesota nesting site along Lake Superior supported nesting piping plovers as recently as 1985, but no plovers have bred there in the past six years. Piping plovers historically nested along the shorelines of all the Great Lakes, but estimates of pre-development population sizes are limited. However, it is speculated that piping plovers were once locally common throughout the region (Cottrill 1957, Russell 1983).

The Great Lakes piping plover population had decreased to 38 pairs in Michigan by 1979, and to 17 pairs by 1986 (Lambert & Ratcliff 1981, USFWS 1988). The population has remained relatively stable since its listing in 1986 (Table 1). In 1990 the population decreased to 12 pairs of adults and one of these pairs was lost to great-horned owl predation (Powell & Cuthbert 1992). The population is now extremely vulnerable to stochastic events that may occur throughout stages of the life cycle and may have reached a size where natural recovery is unlikely.

## Reasons for Decline

Current nesting sites used by piping plovers are protected, and reasons for the decline in recent years are difficult to elucidate (USFWS 1988). Piping plover nesting habitat in the Great Lakes region typically consists of wide sandy

beaches with little vegetative cover. The nesting sites are usually characterized by wide dune systems interspersed with flat cobbled areas located inland from the foredunes. Often piping plovers construct their simple nest scrapes on the inland side of the foredunes (Pike 1985, Powell & Cuthbert 1992). After the precocial chicks hatch, they move to the lake side of the foredunes. Adult plovers defend both nesting territories and brood rearing areas. Both adults and young feed primarily on invertebrates along lakeshores and ephemeral wetlands (Brown 1987, Powell & Cuthbert 1992). Interdunal wetlands are often included in piping plover breeding territories and are important sites for brood rearing and general foraging. These small wetlands are largely ephemeral and duration of inundation is dependent on lake water levels, rainfall, and changes in dunes.

It is believed that the Great Lakes piping plover population declined dramatically following commercial and recreational development along the lakeshores forty years ago (Russell 1983). The development of beaches for summer homes and recreation not only restricted piping plover breeding sites, but also exposed nesting birds to higher levels of disturbance by people and domestic animals. Piping plovers are known to be sensitive to disturbance and often have low reproductive success in areas of high human activity (Cairns & McLaren 1980, Flemming et al. 1988, Patterson et al. 1991). Changes in both quantity and quality of dune vegetation following planned sand stabilization or general development may also result in changes and loss of interdunal wetlands. Another factor influencing habitat availability in the Great Lakes is wide fluctuation of water levels. Periods of high water can reduce available nesting habitat by inundating previously wide beaches and by eroding beach habitat.

When optimal habitat is scarce, plovers may nest in alternate sites where they may be exposed to higher pressure from predators and human activity and poor-quality feeding areas. In years of low water, plover nesting habitat availability may increase. However, some islands may become connected to the mainland during periods of low water levels, exposing plovers to mammalian predators, off-road vehicles, and increased human disturbance. Water levels in the past several years have been relatively low in the Great Lakes, and good-quality plover habitat has been available at isolated, protected sites (Nordstrom 1990). Some of the best habitat is located on several islands in northern Lake Michigan. For the most part, these islands have not been developed, have little human disturbance, and few mammalian predators (Powell & Cuthbert 1992).

In the past two decades, there has been a substantial increase in the Great Lakes populations of ring-billed gulls and American crows. Both avian species are potential predators of piping plover eggs and chicks. Other potential plover predators, such as coyotes, foxes, skunks, and raccoons may have expanded their ranges with increased human activity. All of these species may be attracted to trash accumulated on beach areas that are used intensively for recreation.

Great Lakes piping plovers winter along the Gulf of Mexico; on the coasts of Texas, Louisiana, Mississippi, Alabama and Florida. Presently, plover wintering habitat is being degraded by industrial and urban growth, and increased recreational beach use (Nicholls & Baldassarre 1990). These areas may also be at risk from off-shore oil spills. An additional threat to wintering habitat is dune stabilization, which may result in encroachment of unsuitable amounts of vegetation (USFWS 1988, Nicholls & Baldassarre 1990). The effects of human disturbance on piping plovers on

the wintering grounds are unknown but may influence behaviors that affect survival during the nonbreeding season (Johnson & Baldassarre 1988, Haig 1991).

### Recovery Goals

The federal recovery plan for the Great Lakes piping plover population calls for the following actions before downlisting to threatened status can be considered: (1) increasing the population to 150 breeding pairs (100 pairs in Michigan, 15 in Wisconsin, and 35 in other Great Lakes states) and (2) maintaining the stated population goals for 15 years (USFWS 1988). Goals for delisting completely are not stated. It is unclear from the plan as to how the target population sizes were determined, and a Population Viability Assessment for piping plovers was not devised when the plan was written. The recovery plan lists protection of known piping plover nesting and wintering habitat as a primary means to achieve recovery goals. In addition, the recovery plan calls for the restriction of human and vehicular access to nesting sites, the evaluation of predator impacts, survey and census of winter populations, and the identification of wintering habitat as actions necessary to prevent extirpation (USFWS 1988). The recovery plan for Great Lakes piping plovers will undergo re-evaluation and revision within the next year. A Population Viability Assessment is to be developed in 1992.

### Current Management

Since official listing in 1986, the management of the remaining piping plover population in Michigan has been primarily the responsibility of the Michigan Department of Natural Resources (DNR), and funded by the U. S. Fish and Wildlife Service (USFWS). However, many other agencies, including the USFWS, National Park Service, and The Nature Conservancy have been involved in piping plover protection. For example, the National Park Service closed a large beach area on North Manitou Island, Michigan; part of Sleeping Bear Dunes National Lakeshore. Although this area has not

been used by piping plovers for several years, the National Park Service continues to close the area during the breeding season and provide educational materials about piping plovers to people using the park. Park Service biologists survey the National Lakeshore for piping plover activity during the breeding season. Several of the breeding sites used by piping plovers in recent years are on Michigan State Park property. Wilderness State Park in Emmet County is a particularly important area and has consistently supported 4 to 5 nesting pairs of plovers annually. The state parks are under pressure for heavy recreational use but beaches with nesting plovers are closed, and a "piping plover protection person" patrols the nesting areas. Other protected areas where plovers have nested since 1986 include Vermilion Station (owned by Lake Superior State University) and High Island (owned by the state of Michigan). Both of these sites have seasonal biologists in residence to monitor and protect piping plovers. In addition, piping plovers have nested on private property in Grand Marais on the eastern upper peninsula, and Cross Village and Beaver Island on the northeastern lower peninsula.

Since the Great Lakes population was listed, efforts have been made to locate every piping plover nest in Michigan, and to document habitat use by piping plovers during migration and the breeding season (April through August). Once nests are located, they are closely monitored to determine hatching success or cause of failure. Piping plover families are observed until the chicks fledge or disappear. Nesting areas are posted and fenced as soon as they are located to prohibit access by recreational beach users. Usually fencing is "psychological" and consists of plastic bailing twine. Areas fenced are large enough to allow plovers to incubate eggs without being disturbed and for chicks to forage after hatching. The workers that monitor plover nesting activities also patrol nesting sites to discourage humans and predators from entering sensitive beach areas.

Special emphasis is given to public relations and education in areas where piping plovers nest on private property. To date, landowners in Michigan have

## Endangered Species UPDATE

*A forum for information exchange on endangered species issues*  
July/August 1991  
Vol. 8 No. 9 & 10

*Alice Clarke and Joel Heinen*...Editors  
*Terry Root*.....Faculty Advisor  
*Jon Jensen*.....Staff Advisor

### Instructions for Authors:

The Endangered Species UPDATE welcomes articles related to species protection in a wide range of areas including but not limited to: research and management activities for endangered species, theoretical approaches to species conservation, and habitat protection and preserve design. Book reviews, editorial comments, and announcements of current events and publications are also welcome.

Readers include a broad range of professionals in both scientific and policy fields. Articles should be written in an easily understandable style for a knowledgeable audience. Manuscripts should be 10-12 double-spaced typed pages. For further information, contact the editors at the number listed below.

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### Cover:

Piping plover (*Charadrius melodus*).  
Photo by F. J. Cuthbert.

The views expressed in the Endangered Species UPDATE are those of the author and may not necessarily reflect those of the US Fish and Wildlife Service or The University of Michigan.

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been enthusiastic about plovers nesting on their property and often assume a critical role as stewards in protecting the areas from human disturbance. Beach communities become involved in piping plover protection and may spread the conservation ethic to others. In 1986, the Michigan DNR designated the piping plover as "bird of the year", and in 1990, a piping plover was featured on Michigan's Coastal Dunes poster advertising the state's Nongame Wildlife Fund. In addition, researchers working on piping plovers distribute Michigan DNR and USFWS pamphlets to local citizens. Slide shows and informal talks about piping plovers are given in local communities and state parks by various people.

In 1988, Tom Allan of Lake Superior State University initiated a project to protect piping plover nests along the Lake Superior shoreline. He constructed exclosures designed to safeguard plover eggs from both avian and mammalian predators, and to shield nests from disturbance by humans, domestic animals, and off-road vehicles where psychological fencing has failed. Exclosures are made from 2 X 3 inch wire fencing, which allows the adult plovers to walk freely in and out (Figure 1). The tops of the exclosures are covered with a grid of monofilament line that keeps out avian predators. The success of Dr. Allan's efforts led to the use of predator exclosures on nearly all piping plover nests in Michigan by 1991. Use of exclosures has significantly increased hatching success of piping plover eggs over the past three years by reducing loss from predation (Table 1).

This year, the Great Lakes/Northern Great Plains Recovery Team coordinated the 1991 International Piping Plover Census. Volunteers, researchers, and state and federal agencies in the U.S. and Canadian provinces counted piping plovers at all Atlantic Coast and Interior/Great Plains breeding areas, and all Atlantic Coast and Gulf of Mexico/Caribbean wintering areas. Efforts were made to coordinate the censuses so that they took place during specific time periods in January and June. This enabled the participants to provide a more accurate count by reducing the chance of count-

ing the same individuals more than once. Data collected will be used to determine a comprehensive population estimate for the species as well as for the three regional populations. The final results

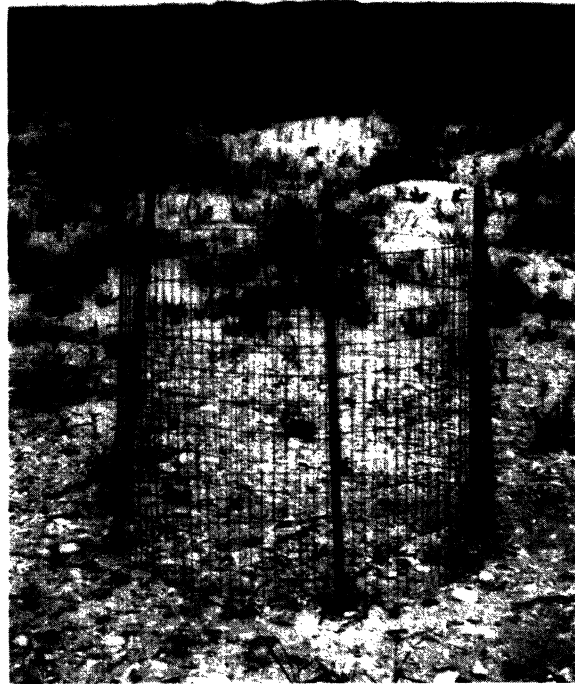


Figure 1. Exclosures are used in Michigan to protect piping plover nests from avian and mammalian predators. Photo by A. Powell.

will be used as a basis for revision of piping plover recovery plans.

### Recovery or Extirpation?

Overall reproductive success (survival to fledging) of piping plovers in the Great Lakes has been similar or higher than that reported for plovers in the Great Plains and East Coast populations (Prindiville-Gaines & Ryan 1988, Wiens & Cuthbert 1988, Patterson et al. 1991). However, the number of young fledged per nest each year is highly variable. This variation in reproductive success coupled with a decreasing number of breeding adults may not be enough to maintain an already small population. Great Lakes piping plover chicks have not been banded since the population

was listed as endangered, which precludes estimating survival of fledged young to breeding age and their subsequent recruitment. The fate of fledglings remains unknown, but recruitment

into the Great Lakes population as breeding adults is low. Although the causes of the overall population decline are unclear, they may be attributed to environmental or genetic events that affect small populations.

Clearly, the recovery goal of 150 breeding pairs for the Great Lakes piping plover population is not likely to be achieved with current management schemes. With the population already reduced to so few individuals, it is unlikely that the present numbers can be maintained for long. The few breeding adults that were previously banded or individually marked in this population are known to be older birds. The increase in the number of breeding pairs from 11 to 16, combined with good reproductive success in 1991, may offer

false optimism. Fewer than 30 individuals is still an extremely small population. Habitat preservation is an invaluable aspect of piping plover management, and it serves a dual purpose of providing protection to fragile beach and dune communities (which additionally support several endangered, threatened, and special concern plant and insect species). Nonetheless, protection of breeding habitat, basic censusing and monitoring, the use of predator exclosures, and public education have not increased the Great Lakes piping plover population over the past six years.

One major criticism of endangered species recovery plans is the absence of definition of a self-sustaining or recovered population (Culbert & Blair 1989). It is doubtful that the Great Lakes piping

*Continued on UPDATE page 4*

**TABLE 1. REPRODUCTIVE SUCCESS OF GREAT LAKES PIPING PLOVERS**

	1987	1988	1989	1990	1991*
Number of breeding pairs	16	15	18	12	16
Hatching success (%)	37	71	73	76	85
Fledging success (%)	67	72	59	60	67
Number of young fledged/nest	1.0	2.1	1.4	1.6	2.1

\* numbers for 1991 are estimates based on data available as of 1 August 1991

plover population is self-sustaining or recovering. Without a viable piping plover population in the Great Lakes, a gap is created in the distribution of piping plovers across North America. This gap can be detrimental to the species by reducing gene flow among populations and by isolating the Great Plains and East Coast populations from each other (Haig & Oring 1988). To ensure the survival of piping plovers, a comprehensive recovery plan should include coordinated management of all three populations. Population models should continue to be developed and published using current data to estimate the vulnerability of these populations to extirpation. These models can be used to help define and implement recovery plan goals. Habitat protection efforts need to be continued and strengthened. Suitable lakeshore and dune habitats not currently used by piping plovers continue to be under heavy pressure from development. Finally, alternate solutions, such as population augmentation through captive rearing, should be considered in conjunction with the above measures to ensure the continued survival of the Great Lakes piping plover population (Powell 1991).

#### Acknowledgements

I would like to thank T. Allan for providing information and insight, and L. Pfannmuller and

F. Cuthbert for reviewing this manuscript.

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It was with great interest that we read the article by Gary E. Varner and Martha C. Monroe titled "Ethical Perspectives on Captive Breeding: Is It for the Birds?" (*Endangered Species UPDATE* 8(1): 27-29, 1991). While the authors offered a stimulating classification of ethical perspectives, their contention that captive breeding detracts from holistic conservation solutions is a misleading simplification of a complex issue. It has become fashionable in certain quarters to question the efficacy of captive propagation, but few critics have backed their contentions with facts or data. Unfortunately, in this case, an intriguing examination of philosophical perspectives gives way to a sketchy and flawed critique lacking in background research, and reflecting deficient biological and institutional knowledge. As such, the authors come dangerously close to reinforcing Bertrand Russell's statement that: "science is what you know, and philosophy is what you don't know." The authors suggest that captive breeding programs are difficult or impossible to support from each of three ethical perspectives, which they refer to as "anthropocentric, holistic and sentientist." Though we do not disagree with all of the authors' conclusions, there are many statements with which we must take issue. Our purpose in writing this paper is to respond to those which we feel were particularly misleading or even incorrect.

Likemany philosophers, Varner and Monroe seemed more concerned with logical arguments than with practical solutions to real problems. It is not inappropriate for us to view our relationship with nature in moral terms. However, ethical philosophy faces a severe test when it comes to the conservation problem. We agree with E.O. Wilson who wrote that ". . . in ecological and evolutionary time, good does not automatically flow from good or evil from evil. To choose what is best for the near future is easy. To choose what is best for

the distant future is also easy. But to choose what is best for both the near future and distant future is a hard task, often internally contradictory, and requiring ethical codes yet to be formulated." It is important to note that the authors have not formulated any new ethical codes nor resolved any conflicts and, in reiterating existing dogma, they have submitted to the fallacy of "unreal alternatives." The rhetoric of moral causes often voices solutions that overlook the reality of circumstances. An example is the authors' concern that captive breeding programs are hurting efforts to preserve wildlife habitats. The implication is that institutions which pursue captive breeding have the freedom to abandon this activity and divert their budgets to habitat preservation. Because North American zoos and aquariums are supported largely by city or state governments, it is naive to think that their budgets would be used for *in situ* conservation in lieu of captive propagation. Indeed, it is far more likely that such funds would go to repair or construct roads and bridges, build parking lots, or increase welfare rolls.

Captive propagation is a logical endeavor if endangered animals are to be maintained for the education of the public and for valuable conservation research; but, we agree that the cost can be prohibitive. As a result, some difficult decisions must be made regarding which species are allowed to board the "zoo ark." This amounts to a form of species triage—a practice which is likely to become all too common, both in captivity and in the wild. However, arguing that captive breeding programs should be eliminated and the money used for habitat preservation is not only unrealistic, but is also unfair. Indeed, if resources are so limited, then why not cut university programs in environmental science and philosophy and use the savings to buy rainforest acreage? Of course, neither is a viable solution, because both captive breeding and environmental science play

an important role. We are leary of economic analyses of conservation alternatives, because, as in Varner and Monroe's paper, conclusions are usually drawn in the absence of data. All conservation is costly, but in the grand scheme, environmental conservation has received little attention from federal funding agencies. The real tragedy is that the money used to build a single stealth bomber (about \$1,000,000,000) could probably support every North American conservation organization and government-supported wildlife agency for a considerable amount of time. In fact, until national leaders begin to make conservation a priority, there is little that can be done to stem the tide of extinctions about to wash over our world.

The authors also fail to recognize that many vertebrate species are being lost long before their habitats are destroyed and that, despite considerable financial support, attempts to preserve species *in situ* are not always successful. For example, while ample habitat remains in eastern and southern Africa, rhinoceros populations continue to decline because of poaching. Without a holistic program, involving both captive breeding and habitat preservation, some species are likely to become extinct in the very near future. Captive breeding programs are about preserving options. There is no doubt that habitat preservation is crucial to species preservation, but oversimplification lures the public into believing that solutions are relatively easy to achieve. To anyone familiar with the broader problems of conserving biological diversity, the "either-or" debate about captive propagation and wildland protection is a disappointment. In fact, these issues cannot be meaningfully examined without a detailed analysis of the cultural, political, and economic contexts in which conservation must occur. When this is done, it is clear why logic does not always prevail in the business of conservation.



We were particularly disappointed by the section titled "Evaluating Captive Breeding." In it, the authors claim to assess captive breeding programs from three different ethical perspectives. However, one gets the distinct impression that they were supporting their personal viewpoints, rather than providing an objective overview. At one point, they state that "From the perspective of individual sentient animals. . . captive breeding is a moral atrocity. Economic constraints prevent confinement systems from allowing birds and mammals a degree of freedom of movement comparable to the wild—a condition which must be especially distressing to first generation breeders who have known freedom." This statement, expressed as a fact, is highly subjective. Because of its focus on populations and species, rather than on individuals, we agree that captive breeding programs are largely incompatible with sentientist philosophy, but then so are most other forms of wildlife management. However, the authors' statement suggests that zoos are animal prisons when, in fact, modern zoological facilities have made tremendous strides in both exhibition and husbandry techniques. It also suggests that wild animals live in a kind of Eden when, in fact, they are constantly threatened by predators, parasites, diseases, competitors, severe weather, loss of habitat, and starvation. Thus, from the view of the humane moralists, one could just as easily argue that animals are better off in modern, professionally-managed zoos, where they dwell in large, naturalistic enclosures, enjoy regular feedings, and have access to veterinary care.

Varner and Monroe suggest that captive breeding is also incompatible with the holistic perspective as epitomized by Aldo Leopold's *A Sand County Almanac*. They state that ". . . To the degree that the holistic perspective is truly ecosystemic, it will find little value in programs which, like today's captive breeding programs, tend to preserve only the large, impressive mammalian and avian species and consigns the far more numerous endangered species of mollusks, insects, plants, and fungi to extinction." While it is true that captive breeding programs have

tended to focus on the so-called "charismatic megavertebrates," the authors fail to point out the benefits of such a strategy. First, being at the top of their food chains, requiring considerable space to roam, and having relatively low reproductive rates, the larger vertebrates are often more susceptible to extinction than are the smaller invertebrates. Larger mammals such as gorillas, tigers, and rhinoceros also have more public appeal than do spiders, snails and fungi. Such "flagship" species can be used to generate public support for conservation programs whose ultimate goals are more holistic. The golden lion tamarin reintroduction project, for example, not only focused the Brazilian public's attention on these attractive monkeys, but also on the plight of the endangered Atlantic Forest ecosystem in which they live. As a result, much of the remaining forest is now in government reserves or protected by cooperating land owners. These areas provide a haven not only for the tamarins, but also for the myriad of other species with which they coexist. Thus, when viewed in a broader context, captive breeding and reintroduction programs can be highly effective tools in species and ecosystem conservation.

Admittedly, there are many problems facing captive breeding and reintroduction programs, but they are not insurmountable. Furthermore, as more experience is gained, the more successful and economic such programs are likely to become. Captive breeding and reintroduction should not be viewed as a panacea for the endangered species problem, nor as an end unto themselves. However, despite all of the criticisms, we do know that captive breeding and reintroduction can work. The continued existence of species such as the American bison, Bali mynah, red wolf, Asian wild horse, Pere David deer, black-footed ferret, Arabian oryx, and California condor are reminders of the potential power of these techniques. Current predictions suggest that we may lose one to five million species of animals and plants in the next two decades alone. The situation is desperate, and if certain species are to be saved, conservationists will need all of the tools they can get, including captive breeding and reintroduction. Philosophers may con-

tinue to debate their pros and cons, but one thing is certain: a failure to develop these technologies will seal the fate of many familiar and irreplaceable species.

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## Book Review

**Rare Vascular Plants in Canada: Our Natural Heritage.** 1990. Canadian Museum of Nature. Ottawa, Canada.

edited by George W. Argus and Kathleen M. Pryer

The Canadian Museum of Nature has produced a valuable book for the purpose of promoting an awareness of rare plants in Canada and to encourage the preservation of essential habitats and ecosystems. The book begins with a history of the development of regional lists which eventually allowed this national compilation. Included in the list are all native taxa, above the rank of form, that are rare in each of the provinces and/or territories in which they occur. The criteria used for establishing rarity are carefully defined, as are the various ranking and priority assignments given each taxon. Information provided includes scientific nomenclature, documentation of rarity and endemism, Nature Conservancy rankings (global, Canadian, and US), and Canadian Priority ratings for each taxon. Four appendices provide sublists organized by family, endemism, province/territory, and priority ratings. The volume may be purchased from the Canadian Museum of Nature, Direct Mail Section, PO Box 3443, Station D, Ottawa, Canada K1P 6P4.

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Reviewed by Alice Clarke, Co-editor of the Endangered Species UPDATE and Doctoral Candidate in the School of Natural Resources, University of Michigan, Ann Arbor, MI 48109-1115. USA.

# Bulletin Board

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## California Riparian Systems Conference

The University of California, Davis is presenting the third in a series of conferences on California's streamside resources: Progress in Protection and Restoration. The conference will be held in Sacramento on November 14-15, 1991. For further information contact conference coordinator Dana L. Abell, University Extension, University of California, Davis, CA 95616-8727. USA.

## East-West Environment and Policy Institute

Through interdisciplinary and multinational programs of research and training, the East-West Institute seeks to develop concepts and methods for sustainable environmental management and to address major environmental issues of the Asia-Pacific region. Program plans and projects are developed and carried out in collaboration with colleagues from the region and throughout the world. Reconciling development with the environment by bringing social

and natural systems into harmony with one another is the overall objective of the Institute. A list of publications can be obtained by writing the Environment and Policy Institute, East-West Center, 1777 East-West Road, Honolulu, HI 96848. USA.

## Educational Materials

The Botanic Gardens Conservation Secretariat, a world-wide organization promoting plant conservation in botanic gardens, has produced a 22 minute video, "Variety - The Key to Life," as a teaching resource for introducing students 12 years and above to the subject of biodiversity by examining the variety of plants on earth. It looks at the factors responsible for the decline of biodiversity - building developments, pollution, population growth, climatic change, forest clearance - and outlines the essential role botanic gardens are playing in conservation for purposes such as agriculture, medical research, and education. For further information, write: Botanic Gardens Conservation Secretariat, Descanso House, 199 Kew Road, Richmond, Surrey TW9 3BW, England.

## New Publication

*Biodiversity and Conservation* is a new quarterly international journal devoted to the publication of articles on all aspects of biological diversity, its description, analysis and conservation, and its controlled rational use by man. Research papers on biodiversity and conservation, contributions which deal with the practicalities of conservation management (economic, social, and political issues), and with case studies are welcome. The Editors encourage contributions from developing countries in order to realize proper global perspectives on matters of biodiversity and conservation. For subscription information in the United States and Canada, write: Journals Promotion Dept., Chapman and Hall, 29 West 35th Street, New York, NY 10001-2291; elsewhere, write: Journals Promotion Dept., Chapman and Hall, 2-6 Boundary Row, London SE1 8HN, England.

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*Bulletin board information provided in part by Jane Villa-Lobos, Smithsonian Institution.*

*Announcements for the Bulletin Board are welcomed.*

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# Endangered Species UPDATE

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