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Endangered Species **UPDATE**

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Cover: Barn owl in hacking pen. Photo courtesy of Paul Salvaggio.

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Guidelines for Developing Status-Determining Criteria

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Abstract

Currently, the Endangered Species Act (ESA) employs a two-tier system, listing species either as endangered (in danger of extinction) or threatened (likely to become endangered). One approach, to reassert scientific objectivity in the classification process, has been to develop status-determining criteria for each ESA category. When developing criteria, however, it is important that they be not only credible but also legally defensible and fair. In addition, status-determining criteria should provide clear, predictable, repeatable results. The absence of objective guidelines in the listing and reclassification process has left the entire ESA classification process open to subjective decision making that is often inefficient, inequitable, and not legally defensible in the court system. It is recommended that status-determining criteria should be developed that are consistent with existing regulations, objective, equitable (i.e., based on risk of extinction), efficient (i.e., relatively easy to implement with available data), and designed to incorporate uncertainty appropriately.

Resumen

Actualmente, la ley de especies en peligro de extinción (ESA en Ingles) usa una sistema de dos categorías, listando especies en peligro (de extinción) o amenazadas (con probabilidades de llegar a estar en peligro de extinción). Un método, para reestablecer la objetividad científica en el proceso de clasificación, es el desarrollo de criterios que determinan el estado para cada categoría de la ESA. Los criterios que se desarrollen deben ser no son solamente creíbles, pero también defendibles legalmente y justos. También, deben facilitar resultados claros, predecibles, y repetibles. La ausencia de directivas objetivas en el proceso del listado y reclasificación ha dejado el proceso entero abierto a decisiones subjetivas las cuales son ineficaces, injustas, y sin defensa legal en el sistema judicial. Recomendamos desarrollar criterios que sean consistentes con regulaciones existentes, objetivos, justos (con base en el riesgo de extinción), eficaces (de relativamente fácil implementación con los datos existentes), y diseñado para incorporar la incertidumbre de manera apropiada.

The thrust of the U.S. Endangered Species Act (ESA) is the conservation of species at risk of extinction. To meet this mandate, the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (hereafter referred to as the Services) must determine levels of vulnerability based on scientific data. Currently the ESA employs a two-tier system, listing species either as endangered (in danger of extinction) or threatened (likely to become endangered). The lack of objective guidelines to direct listing decisions has led to inconsistencies and inequities in the listing process. Agencies often make decisions based on limited resources and under the influence of "other social, environmental, or economic objectives" (Taylor et al. 1996). Mangel et al. (1996) recommend establishing procedures to guide decision making to reduce these influences. One approach to reassert scientific objectives has been to develop some form of status-determining criteria for each ESA category (e.g., Taylor et al. 1996, Gerber and DeMaster 1999, Shelden et al. 2001).

When developing criteria, however, it is important that they be not only credible, but also legally defensible and fair. Listing and reclassification decisions must be rationalized to the best extent possible. They should reflect the substantive policy goals of equity and efficiency (Weimer and Vining 1992) and must appear to be predictable, consistent, and sound. It may help to consider the following guidelines or "criteria for criteria" when selecting thresholds for endangered and threatened status (Table 1). To be consistent with the ESA, criteria should work within the framework of the five factors and the status definitions (Table 1, Point 1). Listing and reclassification actions on the List of Endangered and Threatened Wildlife (50 CFR 17.11) are based on five factors (Table 2), of which only one need apply for a species to be listed as either threatened or endangered. These five factors consider the circumstances under which species are more vulnerable to extinction. The factor(s) that contributed to the listing of a particular species should be addressed within the status-determining criteria developed for that species. The status definitions of endangered and threatened should also serve as a guide, albeit a broad and vague one, for establishing thresholds or benchmarks for the categories of endangered, threatened, and recovered.

Table 1. "Criteria for criteria"

1. Consistent: status-determining criteria should be consistent with the conventions that currently exist under the ESA such as the five factors (see Table 2) and the status definitions.
2. Objective: criteria should be objective in the sense that they minimize interpretation and judgement.
3. Equitable: classification decisions should be equitable, guiding research and funding toward those species in greatest need, not those that are more charismatic.
4. Efficient: decisions should be made efficiently, status-determining criteria should help to expedite the listing and reclassification process by providing thresholds for each status level, and help to focus funding and research in areas that are data deficient.
5. Address Uncertainty: status-determining criteria should include a "safety factor" for uncertainty in the form of conservative criteria, by using models to incorporate uncertainty or by including policy alternatives that allow flexibility in the decision process.

Status-determining criteria should provide clear, predictable, repeatable results. To be objective, criteria cannot be open to multiple interpretations or judgements; they need to minimize the subjective nature of current listing decisions (Table 1, Point 2). Classification criteria should provide a clear decision path for managers based on what is known, as well as not known, about the species. Developing thresholds for endangered and threatened status links the prohibitive and protective measures of the ESA to a goal: recovery of the species. Emphasizing the concept of recovery and removing the ad hoc approach to classifying species should help regulators and those in the regulated community to focus on "problem-solving" rather than the ESA's prohibitions (Cheever 1996).

The absence of classification criteria within the ESA and within the regulations promulgated by the Services makes comparisons of level of endangerment across taxa difficult (Easter-Pilcher 1996). This has led to inequities in project funding where "charismatic mega fauna" (high-profile vertebrates) have benefited more than other species (Mann and Plummer 1992) (Table 1, Point 3). From 1981 to 1986, 5% of listed U.S. species received approximately 45% of the funding available for recovery plan development and implementation (S. Rep. No. 204, 100th Cong., 1st Sess. 9 (1987)). The General Accounting Office (GAO) noted that the USFWS disproportionately allotted resources toward "either high profile, low-priority species, or on low priority tasks for high-priority species" (GAO 1988). This fiscal discrepancy continued in 1990 despite criticisms by the GAO and Congress. Of $102 million appropriated for 591 taxa, $55 million went to 12 species, while $28 million was shared among 570 "low-charisma" species (Winckler 1993). Species-specific status-determining criteria should clearly define the level of endangerment, enabling managers and decision makers to direct resources and funding toward those species in greatest need of protection. Criteria should also aid wildlife managers by revealing where gaps in data exist (Table 1, Point 4), allowing managers and decision makers to focus their research and monitoring efforts. The result would be the more equitable and efficient use of an already limited USFWS budget (Vig and Kraft 1997).

According to Holt and Talbot (1978), "management decisions should include a safety factor to allow for the facts that knowledge is limited and institutions are imperfect." These safety factors would consider the levels of risk associated with decisions that are based on incomplete data (e.g., Ralls et al. 1992, Maguire 1994, Taylor et al. 1996). It is of critical importance to spell out the consequences of scientific ignorance to policy makers, particularly when assessing potential threats to species survival (Taylor 1993, Dovers et al. 1996, Mayer and Simmonds 1996). Otherwise, decision makers may use uncertainty

1. The present or threatened destruction, modification, or curtailment of habitat and range.
2. Overutilization for commercial, recreational, scientific, or educational purposes.
3. Disease or predation.
4. Inadequacy of existing regulatory mechanisms.
5. Other natural or manmade factors affecting its continued existence.

Table 2. Five factors used in ESA listing and reclassification actions to consider in forming status-determining criteria.

as an excuse to avoid action. Criteria may be developed by adopting conservative thresholds, using models that incorporate uncertainty, or including a range of alternative policy responses to encompass the range of evaluation outcomes (Table 1, Point 5).

The scientific process is fraught with uncertainty; it is the objective of science to incrementally reduce the level of uncertainty through hypothesis testing. Causes of uncertainty range from investigator error and poor data collection to environmental stochasticity, indirect effects, non-independent effects, and cumulative space effects (Meffe and Carroll 1994). These perceived weaknesses in scientific analyses and data are often exploited, even distorted, in the courtroom (e.g., northern spotted owl litigation: see Noon and Murphy 1994). In these instances, the "burden of proof" is placed on the scientists proposing listing rather than those planning actions that will modify habitat or harm a vulnerable species (NRC 1995). Adopting scientifically defensible criteria might reverse this trend in the courts by "rationalizing" the listing decision.

> "...a decision may be rational if it can be tested or "verified" against criteria or data determined independently and if it satisfies a goal thought, on a priori grounds, to be appropriate for that science. The criteria and the data used are supposed to be "objective" in the sense that they minimize interpretation and judgement so that, at least in principle, anyone who applies the same criteria to the same data will get the same result... ." (Sagoff 1987:308).

The absence of objective guidelines in the listing and reclassification process has left the entire process open to subjective decision making that is often inefficient, inequitable, and not legally defensible in the court system. Considering the five points provided in Table 1, status-determining criteria should provide decision makers with the tools they need to make defensible decisions that support best management practices in the face of scientific uncertainty.

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Rodent Pest Control Through the Reintroduction of an Extirpated Raptor Species

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Abstract

Zoos, by nature, are breeding grounds for high numbers of rodents. The use of poisons and traps has been the main tool for rodent control. By acquiring and reintroducing avian predators, specifically barn owls, into a zoo setting, the rodent population could be controlled naturally. Barn owls (*Tyto alba*) once flourished in Pennsylvania and surrounding areas, particularly in old wooden barns, but the development of new prefabricated barns has left the owls with fewer places to nest. This study focuses on installing several man-made nest boxes for three avian predators on the grounds of the Pittsburgh Zoo & PPG Aquarium and surrounding areas. In time, it is hoped that the owls will begin to breed and higher densities will be achieved, as well as a suppressed rodent population.

Resumen

Los zoos son tierras de reproducción para muchos roedores. El uso del veneno y trampas son los métodos principales para controlarlos. Con la adquisición y re-introducción de predadores naturales, específicamente el búho de granero, en un zoo, la población de roedores puede ser controlada naturalmente. Los búhos (*Tyto alba*) fueron muy abundante en Pennsylvania y sus alrededores, particularmente en los graneros viejos de madera, pero el desarrollo de graneros pre-fabricados ha dejado a los búhos con menos lugares para criar. Este estudio se enfoca en la instalación de tres criaderos artificiales para tres aves predadoras en el Pittsburgh Zoo & PPG Aquario y sus alrededores. Con el tiempo, esperamos que los búhos se empiecen a procrear y lleguen a una densidad mas alta, además de suprimir la población de roedores.

Introduction

The Pittsburgh Zoo & PPG Aquarium is a 77-acre natural habitat that lies within the confines of the city and surrounding development. It is adjacent to a major city park, Highland Park, which serves as a refuge for all types of wildlife. Due to large amounts of available food, year-round heated buildings, and the varied ground cover, there is an unusually high rodent population at the Pittsburgh Zoo. Rodent control is an ongoing concern because of the loss of grain and structure damage these rodents can cause. Mice and rats are also potential vectors of various diseases.

Mark Browning, an animal trainer and researcher at the Pittsburgh Zoo & PPG Aquarium, has always had an interest in environmental concerns as well as a passion for birds. In 1996, he proposed a plan to place nest boxes throughout the zoo for three avian predators: the barn owl (*Tyto alba*), screech owl (*Otus asio*), and the sparrow hawk (*Falco sparverius*). The goal was to achieve an increase in the population of those predators by providing the nest boxes, and to some degree, that increase could effect rodent control. Many studies have shown positive correlation between the numbers of prey and their predators. Serventy and Whittel (1950) determined that a significant increase in the average clutch size of three raptor species occurred when the recently introduced rabbit moved into their range in Australia; and Welty (1975) comments: "Hawks and owls generally have larger clutches in years when mice are abundant." Mark Browning was inspired to conduct his study by projects that used barn owls as pest control in vineyards throughout the United States and palm oil nut plantations in southeast Asia. Also, he saw the importance of trying to reestablish barn owls in an area where they had once been extirpated because of deforestation, urbanization of rural areas, and the use of pesticides.

Methods

Mark Browning's study will compliment the Integrated Pest Maagement (IPM) program already established by the Horticultural Department at the Pittsburgh Zoo & PPG Aquarium. They are focusing on plant insect pests along with mice, roaches, and ants in the indoor amazon rainforest exhibit.

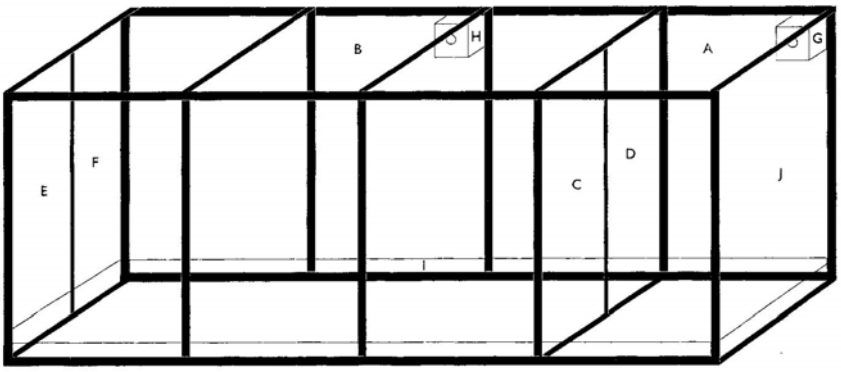
With the zoo's high densities of rodents (deer mice, white-footed mice, house mice, shrews, moles, and Norway rats), a relatively high density of rodent predators could be achieved. To do this, a large number of nest boxes were erected and mounted to trees on zoo grounds, to provide a safe haven for and attract the certain raptor species. Frank Pizzi, Curator of Horticulture and Grounds at the Pittsburgh Zoo & PPG Aquarium, donated the material used to build 20 screech owl and kestrel boxes. These are approximately 10" deep, 16" high, and 10" wide. In addition, a total of five barn owl boxes were built. They are 18" cubes with a 4" entrance hole. All of the nest boxes have ventilation holes on the sides and top and a hatch to open for viewing and cleaning. The 20 screech owl boxes, along with three barn owl boxes, were placed randomly around the zoo grounds. Two of the barn owl boxes were placed in a 30' x 12' x 12' hacking pen (figure 2). A hacking pen is an open flight cage that is traditionally used to rear or rehabilitate a raptor for release back into the wild. It is a

Figure 1. Barn owls in a nest box.

means of introduction, breeding, and to simulate a home for the bird to recognize and feel comfortable in. Also, within the pen, young owls can learn to hunt. Unlike other hacking pens where rehabilitators use dead mice, Mark uses live mice and places them in the pen for the owls to naturally find on their own. The hacking pen used in this study was divided in half for breeding purposes. Mark acquired 13 barn owls (pairs and babies) from Flamingo Gardens in Florida, two from the Bronx Zoo, and one male from Elmwood Park Zoo in Norristown, Pa. One breeding pair is housed on one end of the hacking pen, while one male occupies the other end awaiting a female. One pair was given to a private land owner with a breeding facility, not far from the zoo. Another pair was given to The National Aviary in Pittsburgh, where the babies from that pair are destined to come back to the zoo to be released. In early 2004, Mark did release four adult barn owls; one has been seen hunting on zoo grounds. As well as the boxes set up at the Pittsburgh Zoo & PPG Aquarium, West Deer High School became involved and set up an additional 13 barn owl nest boxes in the West Deer District, a few miles from the zoo.

Throughout the breeding season, which begins in the late winter/early spring, the boxes are checked regularly for use. This is done by the naked eye, through binoculars, and by checking the ground beneath for signs of use (pellets, droppings, etc.). Nest boxes in use will be visited and checked at a point some time after the babies have hatched and prior to their fledging to determine the number of successful young. Each year, the number of breeding pairs and successfully reared young will be compared to previous years numbers. Owls have traditionally been counted through broadcasting tapes of their calls to draw them down into a spotlight for individual identification. This study is projected to continue until it is determined that maximum density of avian predators has been established or a desired degree of rodent control has been achieved.

Figure 2. Diagram of a hacking pen.



A. Breeding end of enclosure which can be closed off using C + D panels (8 x 12 x 12)
B. Fledgling section (12 x 12 x 24 when closed off from breeding area)
C. Man-gate panel (12 x 6) hinged to D (removable)
D. Stationary panel (12 x 6) (removable)
E. Outside man-gate panel with padlock (removable)
F. Stationary panel (removable)
G. Breeder nest box
H. Fledgling nest box (removable)
I. 1' high Plexiglas running around entire perimeter on the inside
J. Plywood wall with feeding and watering doors for remote servicing of enclosure

Results

This project has resulted in successfully acquiring and establishing three different breeding pairs of barn owls, the young of which will be released in hacking areas. In 2004, three eggs successfully hatched from the breeding pair in the hacking pen at the zoo, which Mark plans to release in the spring and summer of 2005. The National Audubon Society has encouraged programs like this, since similar efforts to put up nests in Delaware, New Jersey, and Florida have had great success. In Pennsylvania, over 100 barn owl boxes have been

erected in adjacent counties by the Moraine Preservation Fund, which was independent of Mark's project, but led to a cooperative effort.

Conclusions

Mark Browning's efforts, so far, have developed into a two-prong project: to utilize raptors as part of an Integrated Pest Management program and to reestablish barn owls in an area where they had once been extirpated. As far as is known, such an experiment has never been conducted on the grounds of a zoological institution. Positive results could potentially benefit such institutions by using this as a low-cost, natural pest control and the institutions could provide more safe havens to these vulnerable raptor species. On a conservation note, this project could also help reduce or eliminate the need for rodent poisons or traps. Mark Browning wanted barn owls to "get out there and start breeding on their own." With the help of the distributed nest boxes, he believes the animals will essentially establish themselves as local residents and part of the local indigenous wildlife population. This is quite notable, since the subjects studied are probably the first breeding barn owls in Allegheny County in quite some time. Mark hopes to eventually get funding for satellite telemetry, which is a new tool for wildlife research and management. It determines the location of the bird, throughout the world, by transmitters that are attached under its wing. This would help with monitoring the movement of the species, enabling researchers to see the distribution, preferred habitats, and where they feed. The loss of nesting sites and lack of natural habitat has practically wiped out the barn owl population in Pennsylvania and several other states. With Mark's efforts to reintroduce this species to our area, satellite telemetry would definitely benefit this project by making it easier to monitor barn owls in a wider range.

For more information on the owl project, contact Mark Browning at 412-365-2395.

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Amphibian Conservation Strategies: Translocating an Entire Population of Blanchard's Cricket Frog (*Acris crepitans blanchardi*) in Southeast Michigan

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Abstract

The dramatic decline of amphibian populations worldwide is an urgent conservation issue. The root causes underlying many amphibian declines are unknown. One Michigan species of Special Concern, the Blanchard's cricket frog (*Acris crepitans blanchardi*), is declining at an alarming rate in the northern portions of its range. In May 2004, the National Amphibian Conservation Center (NACC) at the Detroit Zoo initiated a translocation project to reintroduce Blanchard's cricket frog to three manmade wetlands at the northern extent of its range. Calling surveys in southeast Michigan revealed several robust populations of cricket frogs including one site slated for development in the fall of 2004. Working with the developer and the Department of Environmental Quality, we successfully removed about 1,050 frogs and tadpoles from the threatened breeding ponds. The animals were released into two Michigan Department of Natural Resource restored lake plain prairie complexes with wetland features, and into a restored wetland near the NACC in fall of 2004. These translocated populations will be monitored in subsequent breeding seasons to assess the success of the translocation project.

Resumen

La drástica disminución de poblaciones de ranas alrededor del mundo es un problema de conservación urgente. Las causas fundamentales de muchas de estas disminuciones son desconocidas. Una especie de preocupación especial en Michigan, el Blanchard's cricket frog (*Acris crepitans blanchardi*), esta decayendo a una velocidad alarmante en el parte norte de su cobertura. En mayo de 2004, el Centro Nacional de Conservación Anfibio (NACC) en el zoo de Detroit empezó un proyecto de traslocación para re-introducir la rana Blanchards en tres humedales artificiales en la parte norte de su cobertura. Estudios de las llamadas en el suroeste de Michigan ha revelado algunas poblaciones robustas de las ranas, incluyendo un sitio planeado para la construcción de casas en el otoño de 2004. En colaboración con el diseñador y el Departamento de Calidad Ambiental, hemos retirado con buen éxito 1,500 ranas y renacuajos de los estanques amenazados. Los animales fueron liberados en dos lagos restaurados del Departamento de Recursos Naturales con características de humedales, y en un humedal restaurado cerca de NACC en el otoño de 2004. Estas poblaciones translocadas serán vigiladas en las etapas siguientes de cría para evaluar el éxito del proyecto de traslocación.

According to a recent global survey of all 5,743 known amphibian species, almost a third (1,856 species) are threatened with extinction (IUCN, CI, and NatureServe 2004). An additional 1,300 other species are probably also threatened, but scientists did not have sufficient data to assess their status (*Ibid.*). Amphibian populations are declining more rapidly than either birds or mammals (*Ibid.*). While many amphibian declines can be attributed to habitat loss and overexploitation, the root causes of other species declines are unknown. The Blanchard's cricket frog (*Acris crepitans blanchardi*), a Michigan species of Special Concern, is declining in some areas of the Midwest, and scientists have not been able to determine why the species is threatened in the northern extent of its range.

Blanchard's cricket frog is a small (0.6 to 1.5 in), warty-skinned frog with long hind limbs and is related to tree frogs, but lacks toe pads on its feet and does not climb. They usually inhabit the more open edges of permanent ponds, bogs, lakes, and slow-moving streams or rivers (Harding 2000). Blanchard's cricket frog is one of three subspecies of the northern cricket frog (*Acris crepitans*) and ranges from southern Michigan, Wisconsin, and southeastern South Dakota south through Texas, west to northern Mexico, and east to northern Tennessee. The call of this cricket frog resembles a series of metallic clicks, similar to the sound made when two pebbles are tapped together (Harding 2000). Blanchard's cricket frog was named in 1947 after distinguished University of Michigan herpetologist Frank Nelson Blanchard.

Since the late 1970s and 1980s, populations of Blanchard's cricket frog have declined drastically in the northern portions of its range (Harding 2000). These declines have been documented in Ontario, Iowa, Wisconsin, Indiana, Illinois, Michigan, Ohio, and Minnesota. While the species has been extirpated from some areas, such as Ontario and most of southeast Michigan, the cricket frog remains common in the southern and western parts of its range. Potential causes for this decline include contamination of wetlands and waterways by pesticides or other pollutants, successional changes in habitat characteristics, climatic fluctuations, competition and predation from other frog species (e.g., bullfrogs and green frogs), drought, acid rain, and habitat loss and fragmentation (Lehtinen 2004, Harding 2000). Some life history characteristics of this frog, such as a short life span and limited dispersal, might make it especially vulnerable to periodic extinctions at the periphery of its range. To test the hypothesis that cricket frogs are declining in southeast Michigan due to the loss of migration corridors, which allow for recolonization in new areas, Kevin Zippel, former curator of the National Amphibian Conservation Center (NACC), initiated a translocation project to try to establish a self-sustaining population of cricket frogs in a restored wetland at the Detroit Zoo.

Ariana Rickard, a summer intern at NACC, conducted the initial population surveys to identify viable local populations that could be used as source animals for the translocation project. Rickard followed up on population surveys done by Richard Lehtinen on the distribution of Blanchard's cricket frog in southeastern Michigan

Figure 1. *Acris crepitans blanchardi*

(Lehtinen 2002). Between May 18 and July 9, 2001, Lehtinen surveyed 60 sites that historically hosted cricket frog populations. Only two of these sites in southeast Michigan, Ypsilanti and Tecumseh, had cricket frogs and full choruses of males. Lehtinen concluded, "Blanchard's cricket frogs are not only declining, but are nearly extirpated from southeast Michigan." On May 18, 2004, Rickard visited the same site Lehtinen surveyed in Ypsilanti and heard cricket frogs calling from three different sites near Ford Lake. One property, Lakewood Farms, seemed to host the largest population of cricket frogs in the area.

After Rickard located the cricket frog populations from nighttime calling surveys near Ford Lake, she identified the owners and development plans for the breeding ponds. The developer of Lakewood Farms had plans to build condominiums and single-family homes on the property, and intended to fill in the cricket frog breeding ponds for the entrance driveway into the complex. The company had hired a consultant, Applied Science and Technology, Inc. (ASTI), to survey the site for cricket frogs and two threatened plant species. After ASTI concluded that there were no cricket frogs on the property, the developer stated that it didn't "make sense" for them to give NACC permission to relocate the frogs.

ASTI surveyed the site three times in April and May 2004 and concluded, "the site does not contain the preferred habitat for the subject species . . . . None of the subject species were encountered during the assessment" (ASTI Threatened and Endangered Species Survey 2004). However the consultants' survey was performed without proper consideration for the annual cycle of the cricket frogs, and the surveys were conducted when the Blanchard's cricket frogs were unlikely to be found during visual encounter surveys. Calling surveys conducted during this frog's breeding season would have provided a more reliable assessment of the size of the cricket frog population at Lakewood Farms.

Zoo staff contacted the Department of Environmental Quality (DEQ) and a DEQ representative, James Sallee, served as a liaison between NACC and the developer. Sallee convinced the developer to allow NACC to remove the frogs from the property before development began. Representatives of all parties involved surveyed the site in July 2004 and confirmed a significant numbers of cricket frogs. With this information, the DEQ mandated that Edi Sonntag, Senior Zookeeper at NACC, must approve plans for the required mitigation site. Sonntag is researching the habitat requirements of this species and was surveying the extant southeast Michigan populations. This survey information was then applied to the design of the mitigation

Lakewood Farms rescue site.

site to assure replacement of appropriate cricket frog habitat.

Sonntag also began recruiting volunteers for the frog rescue effort. After the Department of Natural Resources (DNR) approved emergency collection permits for the cricket frogs and the Zoo's veterinary staff completed health assessments on the Lakewood Farms frogs to verify that there were no contagious diseases present in the population, groups of volunteers led by Sonntag began collecting frogs 2–3 times a week in August through October 2004. About 1,050 frogs and tadpoles were removed and released into two DNR parks and the wetland near the NACC in September 2004. These sites were selected after careful consideration of habitat qualities, such as shoreline vegetation and water quality, and after health assessments of resident amphibian populations revealed no problematic diseases or parasites.

Sonntag, Zippel, and Rickard visited the three introduction sites approximately one month after the frogs were released and found numerous cricket frogs basking or moving through their new homes. About 10% of the released frogs were seen at all the introduction sites, an encounter rate similar to what we have observed at Lakewood Farms. From our population surveys at Lakewood Farms, we know that the number of individuals seen at any one time is about 10% of the total population. Sonntag and Rickard plan to continue to monitor the translocated populations in the spring of 2005. Hopefully, the cricket frogs will thrive in their new homes, and we will hear strong choruses at all three of the introduction sites next May.

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Using Conspecific Attraction to Conserve Endangered Birds

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Abstract

Conspecific attraction, the tendency for individuals of a species to settle near one another, may provide managers and conservationists with a new tool for the recovery of many bird species. Conspecific attraction has been used in the recovery of colonial birds for over 20 years, and recent research suggests that conspecific attraction may occur in a number of territorial birds. Cues suggesting the presence of conspecifics can potentially be used to attract individuals to previously unoccupied sites that are managed for the species' benefit. In this article, we discuss the ecological issues surrounding the use of conspecific attraction for managing birds, including which cues should be used to attract birds, when these cues should be used, which species are likely to exhibit conspecific attraction, and other factors that should be considered before attempting to attract individuals to a site.

Resumen

La atracción de coespecies, o tendencia de individuos de una especie para establecerse cerca de otros, puede facilitar un método nuevo para la recuperación de diferentes especies de pájaros. El metodo ha sido usado en la recuperación de pájaros coloniales por los últimos 20 anos, y estudios recientes sugieren que la atracción de coespecies puede ocurrir en algunos cuantos pájaros territoriales. Posiblemente, las señales que sugieren la presencia de coespecies pueden ser usadas para atraer individuos a sitios previamente desocupados y manejados para el beneficio de la especie. En este articulo, discutimos las cuestiones ecológicas sobre el uso de la atracción de coespecies por el manejo de pájaros, incluyendo cuales señales deben ser usados para atraer pájaros, y otros factores que se deben considerar antes de intentar atraer individuos a un sitio.

Introduction

Conspecific attraction is the tendency for animals to settle near other members of their species. This behavior is most conspicuous in colonial species that settle in close proximity to one another and eschew living alone (Burger 1988). Colonial species presumably benefit from the presence of conspecifics through improved ability to locate food or ward off predators. Territorial animals, on the other hand, actively defend space against conspecifics. Furthermore, as the density of territorial animals increases, reproductive success often decreases due to density-dependent effects (Sinclair 1989; Newton 1998). As a result, until recently, few ecologists considered the possibility that conspecific attraction may also occur in territorial animals, including the vast majority of birds (Lack 1968). In contrast to predictions based on theory, a series of studies by Stamps showed that lizards actually prefer to settle near conspecifics, even when unoccupied habitat is available nearby (Stamps 1987; 1988; 1991). She termed this behavior conspecifc attraction and suggested that animals show it because the presence of conspecifics in an area is a reliable cue of habitat quality. Now, many of the best examples of conspecific attraction in territorial animals come from birds (Graber 1961; Sherry & Holmes 1985; Herremans 1993; Muller et al. 1997; Poysa et al. 1998).

If this behavior is widespread in territorial birds, it may have important implications for how birds use space and, therefore, for their conservation and restoration (Smith & Peacock 1990). Animals that prefer to settle near conspecifics may be unlikely to settle in empty or newly created habitat patches. Conservationists could potentially use this preference for previously settled sites to "fool" animals into settling at unoccupied sites by artificially introducing the cues naturally produced by conspecifics (Reed & Dobson 1993). To test whether or not territorial birds are attracted to conspecifics when settling, we conducted an experiment on the federally endangered black-capped vireo (*Vireo atricapilla*)(Ward & Schlossberg 2004). During spring 2000 and 2001, we played vireo vocalizations at sites in Central Texas with appropriate habitat where either one or no pairs of vireos had been present during the previous year. At each site where we played vireo songs, the population of vireos increased during the first year of playbacks. In a few cases, results were striking, with up to 30 vireos settling at previously unoccupied sites. Birds attracted to these playback sites paired, bred, and in most cases had high reproductive success. These results provide experimental confirmation that conspecific attraction occurs in at least one territorial songbird. Furthermore, the results suggest that conspecific attraction can provide a powerful tool for managing and conserving birds. The purpose of this article is to discuss some of the ecological factors that need to be considered when using conspecific attraction as a management tool for birds.

Cues to Attract Birds

Two types of cues could potentially be used to attract birds to a site: vocalizations and models. Birds produce a variety of vocalizations that could be used for playbacks. Avian vocalizations include songs (complex, learned vocalizations produced only by passerines)

and calls (relatively simple, unlearned vocalizations produced by all types of birds). For songbirds, we suggest primarily broadcasting songs for two reasons. First, songs are the most conspicuous vocalizations given by most birds, and second, they indicate the presence of an occupied territory, which could make an area attractive for birds. Other vocalizations such as chip notes, flight calls, and alarm calls can be included as well to increase the variety of vocalizations and reduce habituation by birds. In our research with black-capped vireos, we used CDs with approximately 50 min of vireo songs and 5 min of other vireo calls. For non-passerines, we suggest primarily using territorial advertisement calls, as these are the calls most frequently given by these birds.

While models may be important cues for attracting colonial birds to new breeding sites (Podolsky & Kress 1992; Kress 1997), models may not always be important for territorial species. This should be especially true for small, cryptic birds or for those that inhabit dense vegetation because these species would be unlikely to rely on visual cues to determine the presence of conspecifics. In contrast, conspicuous birds that use open habitats may be more likely to use visual cues and would be better candidates for the use of models. We tested whether models and playbacks were necessary to attract the shy black-capped vireo as well as the large, conspicuous yellow-headed blackbird (*Xanthocephalus xanthocephalus*) to new sites. Not surprisingly, vireos did not respond to conspecific models at all (Ward & Schlossberg 2004). In contrast, yellow-headed blackbirds were attracted to sites where models and vocalizations were used but failed to occupy sites that had either models alone or vocalizations alone (Ward unpubl. data).

Timing of Playbacks

Although most songbirds are diurnal, they primarily migrate at night (Kerlinger & Moore 1989). This raises the important question of what time of day to broadcast vocalizations. Playing songs continuously may be unwise or impractical because continuous play could stress settlers and create greater energy demands than the power source for the playback system can provide. Early morning may be the key time to play vocalizations to attract new settlers as recent research suggests that settling males assess sites at dawn, during the dawn chorus (Amrhein et al. 2004). Since songbirds migrate at night and settle at or before dawn, we suggest playing vocalizations from late night through early morning. For instance, in our study of black-capped vireos, we played songs from roughly two hours before dawn until four hours after and for one to two hours each afternoon because occasional playbacks during the day may reinforce the perception that a site is occupied. To attract nocturnal species, we suggest playing their vocalizations throughout the night because, like diurnal birds, nocturnal species migrate at night.

In addition to the time of the day, the seasonal timing of playbacks may also be important. To maximize the number of potential settlers exposed to playbacks, we suggest beginning playbacks a few days before the typical first arrival date for the target species at a study location. Continuing playbacks through the breeding season is rec-

ommended because many individuals disperse or prospect within the breeding season. In our research with black-capped vireos, the number of vireos on each site increased gradually through the first 2 months of each breeding season (Ward and Schlossberg unpubl. data). Furthermore, many species prospect for potential breeding sites at the end of the breeding season (Reed et al. 1999), so playbacks near the end of one breeding season may help to attract birds the following year.

Species that May Exhibit Conspecific Attraction

Given the small number of species studied to date, little is known about which species exhibit conspecific attraction. Since we completed our original study on black-capped vireos, subsequent research has found that several species did not settle in response to playbacks at unoccupied sites (Schlossberg and Ward unpubl. data). These species include yellow-headed blackbird, prairie warblers (*Dendroica discolor*), and wood thrush (*Hylocichla mustelina*). In contrast, Henslow's sparrow (*Ammodramus henslowi*), grasshopper sparrow (*Ammodramus savannarum*), and cerulean warbler (*Dendroica caerulea*) did not settle in response to playbacks at unoccupied sites. We suggest that candidate species likely to respond to playbacks can be identified based on their behavior and ecology. Characteristics of species likely to respond to conspecific attraction include being migratory, singing nocturnally, and having a clumped distribution.

Migratory vs. nonmigratory species. Migratory species are likely to be better candidates for conspecific attraction than nonmigratory species. Because migratory species move en masse each spring, a large number of birds is likely to move through any given area over a relatively short period of time. Playbacks, therefore, can be targeted to a time when many birds may potentially hear the playbacks. Furthermore, because migratory birds exhibit low natal philopatry (Weatherhead & Forbes 1994) many migrating birds will be yearlings searching for breeding sites for the first time. These younger birds may be especially susceptible to artificial cues (Ward & Schlossberg 2004), which makes them a good target for using our methods of attraction. In contrast, dispersal in nonmigratory species often involves only a small percentage of the total population and can take place over an extended time period (Greenwood & Harvey 1982). This could make playbacks for non-migratory species relatively inefficient.

Nocturnal singing. Several diurnally active bird species call or sing at night. Examples from North America include marsh wren (*Cistothorus palustris*), sedge wren (*Cistothorus platensis*), northern mockingbird (*Mimus polyglottos*), yellow-breasted chat (*Icterina virens*), and cuckoos (*Coccyzus* spp.) (Barclay et al. 1985; Merritt 1985; Walk et al. 2000). The function of nocturnal singing in these species has not been determined, but one possibility is that males sing to attract night-migrating females (Merritt 1985). Bird species in which males sing nocturnally may be predisposed to settle at sites where they hear vocalizations during nighttime hours.

Clumped distributions. Many territorial birds show clumped distributions in otherwise homoge-

neous habitats (reviewed in Stamps 1988). Bird species known to cluster their territories include loggerhead shrike (*Lanius ludovicianus*), house wren (*Troglodytes aedon*), acorn woodpecker (Melanerpes formicivorus), and least flycatcher (*Empidonax minimus*) (Burgess et al. 1982; Muller et al. 1997; Etterson 2003; Perry & Andersen 2003). Obviously, clumped distributions could be caused by underlying variation in resource abundance or quality but in a few cases, authors have been unable to find such variation when they specifically looked for it (Etterson 2003; Perry & Andersen 2003). Clumped populations in homogeneous environments suggest that the birds simply prefer to establish territories near conspecifics.

Choosing Suitable Habitat

Selecting appropriate species and playback methods are only the first steps in establishing a new population with conspecific attraction. Perhaps the most important consideration for this technique is that sites must be managed to ensure that newly attracted birds can survive and reproduce well enough to be a source population. Simply attracting birds to a new site has little conservation value in itself; only if the population is productive will this technique be a benefit to the species. This was well demonstrated in our own research on black-capped vireos. The main threat to the vireo is the brood-parasitic brown-headed cowbird (*Molothrus ater*), which lays its eggs in vireo nests, reducing their productivity (U.S. Fish and Wildlife Service 1991). Most of our research sites were on government-owned land at Fort Hood, Texas, where cowbirds were controlled by shooting and trapping (Eckrich et al. 1999). As a result, birds that were attracted to playback sites in this area had low brood parasitism rates and high nesting success (Ward & Schlossberg 2004). In contrast, at an experimental site on private property where no cowbird control was undertaken, birds had high brood parasitism rates and produced no vireo young. This illustrates the importance of active management when using conspecific attraction.

Determining playback locations can be difficult, and many ecological factors may affect the suitability of a habitat. One factor that should be considered when using conspecific attraction is the potential for interactions between the target species and other bird species in the area. Many birds are interspecifically territorial, showing aggression towards another species (Sherry & Holmes 1988; Robinson & Terborgh 1995). In such cases, the presence of the competing species at playback sites could reduce the effectiveness of playbacks. For instance, in our research we found that black-capped vireos were displaced from some territories by the larger, more aggressive Bell's vireo (*Vireo bellii*).

Some knowledge of the target species' ecology can help to determine which factors are likely to limit its survival and reproduction at the playback site. Thus, we strongly suggest that managers be aware of the relevant literature describing how avian demography varies with local and landscape-level habitat factors in their region. Census data can be used to select sites that lack the potential competitors. To a great extent, managers may be able to control limiting factors by selecting appropriate sites.

Factors that can be controlled directly include predators, brood parasites, diseases, and disturbances (e.g. road or foot traffic). For instance, for forest-dwelling species, choosing large patches of habitat or extensively forested landscapes should lead to reduced levels of nest predation and brood parasitism for songbirds (Wilcove 1985; Robinson et al. 1995).

Establishing a Population

If playbacks attract birds to a site, and they successfully reproduce, managers must decide whether to use conspecific attraction in subsequent years. Assuming one's goal is to establish a population that will persist over the long term, there are two possible courses of action. One could forgo playbacks and allow the birds attracted in the first year to return, since most birds show site fidelity after reproducing successfully (Greenwood & Harvey 1982). On the other hand, if the target species does not have high site fidelity or has low reproductive success, few individuals may return. This could create the need to use playbacks in subsequent years. For black-capped vireos, we found that birds initially attracted to playback sites had relatively high site fidelity (approximately 50%). In the second year of our experiment, not knowing if the vireos would return, we used playbacks on some of our occupied sites but not on others. On all of the sites, there was little change in population sizes between the first and second years, suggesting that playbacks may be unnecessary to maintain established populations (Ward and Schlossberg 2004).

Conclusion

If endangered birds use the presence of conspecifics when determining where to settle, then the protection or restoration of suitable habitats may not be sufficient for the site to be colonized. Birds may avoid unoccupied habitat, hindering recovery efforts (Scott et al. 2001). In such cases, conspecific attraction could be a significant tool, aiding in the recovery of bird populations at suitable but unoccupied sites. Several federally endangered or candidate species (e.g. willow flycatcher [*Empidomax traillii*], yellow-billed cuckoo [*Coccyzus americanus*], and golden-cheeked warbler [*Dendroica chrysoparia*]) exhibit behaviors that suggest conspecific attraction could be used in their conservation.

Although conspecific attraction has the potential to be an important tool for conservation, little data exists on its prevalence in territorial birds. For conspecific attraction to be of value in the recovery of endangered species, it is important that managers have as much information on this behavior as possible. If, therefore, managers do attempt to use conspecific attraction as a tool in conservation, it is imperative that both positive and negative results be published.

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Puerto Rican Plain Pigeon Food Intake in a Captive Breeding Program

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Puerto Rican Plain Pigeon at the aviary of the Puerto Rican Plain Pigeon Project, Humacao Campus of the University of Puerto Rico. Photo courtesy of Fr. Alejandro J. Sánchez Muñoz, Puerto Rico.

The Puerto Rican Plain Pigeon (*Columba inornata wetmorei*) is one of the endangered species in the island of Puerto Rico. A captive breeding program was established from 1984 to 2001 at the University of Puerto Rico (UPR) Humacao Campus as a way of combating the decline of this species. The captive breeding program in UPR Humacao had the objective of establishing appropriate techniques for reproducing the species and produce individuals to be freed in the state forests. The captive program has been successful in its use of pigeon milk to feed the hatchlings by a surrogate mother or by hand. This led to the successful breeding of 44 pigeons in 1989, a record in captive breeding programs (Perez 2004). Despite the longevity and successes of the program, specifics for this particular race of plain pigeon are not well known. For the first time in this study we measured the amount of feed that the pigeons consume in captivity to determine their caloric intake and needs in case daily feeds are not available or illness arises in an individual.

The plain pigeon is the size of a domestic pigeon with a pale blue-gray color, and dark red beak and legs. Historically, it was widespread in the western foothills and valleys of Puerto Rico. General habitat types used include lowland swamps and woodland, open woodland and cultivated land in the mountains, limestone karst, and coffee plantations in upland hills. The main source of food for the Plain Pigeon are day jasmine seeds (*Cestrum diurnum*), but they also feed on royal palm (*Roystonea borinquena*), mountain immortelle (*Erythrina poeppigiana*), West Indies trema (*Trema lamarckiana*), and white prickle (*Zanthoxylum martinicense*). (USFWS 2004)

Extensive destruction of natural forest habitat and overhunting are given as causes for the decline of the species. We can see this pattern manifested in the development history of Puerto Rico. By 1912, Puerto Rico had been largely cleared for agriculture and other purposes with one estimate placing the amount of remaining forest at no more than 5,000 acres of virgin or slightly-culled timber. By the middle 1930s the plain pigeon population was considered to be extinct, until, in 1963, a population was rediscovered in the town of Cidra, also following the pattern of forest regrowth in the island. Studies of that population between December 1973 and September 1975 attributed the majority of nest failures observed to human-caused disturbances. Habitat loss due to the rapid development of the Cidra area is the most serious threat to the species' existence. Though breeding occurs throughout the year, this species only lays one egg, and a maximum of 3 broods has been recorded. This contributes to decreased population growth when its nesting areas are reduced every year. Furthermore, it is thought that establishment of new populations has been limited by the bird's reluctance to colonize new areas. (USFWS 2004)

For this study, the diet for the captive individuals usually consisted of grains, supplemented with day jasmine (*Cestrum diurnum*) seeds, when in season. For the captive program, the amount of feed was determined based on the estimated protein and fat requirements of the family *Columbidae* (Baer 1984). However, such estimates are not precise and despite of the lon-

gevity of the captive program, the exact dietary requirements of the plain pigeon and the effects of captivity on its feeding behaviors are largely unknown. As the nature of captive programs make daily feedings difficult, insights into dietary requirements of the plain pigeon are critical, not only to evaluate the health of captive individuals, but also to make necessary adjustments to avoid food deficits.

Our objective was to determine the average caloric intake of the Puerto Rican plain pigeon in captivity. Each pigeon was kept in individual cages, and we chose 8 individuals for this study from the smallest cages in the captive breeding project, due to ease of handling. The daily feed for the captive plain pigeons consisted of grains, containing 15% protein, 2.5% fat, and 10.5% fiber, well within the range of proteins (12-28%), and fat (1%) suggested by Dierenfeld (Dierenfeld and Kreger 1992). Each bird was given 45-55g of feed each morning in a marked cup. A small carton box was placed under each cage to collect the feed spilled during the day. Unconsumed feed was collected from the cup and the carton box and weighed each day between 6 and 7pm to determine the daily consumption of each of the birds (the original weight of feed minus the weight of unconsumed feed). To determine the daily caloric intake the weight of feed consumed was then converted to a caloric equivalent. This procedure was repeated each day of every other week from February through April in 2001.

We found that the captive Puerto Rican plain pigeon consumes an average of 11.425 grams of feed daily or 54.383 cal. This average daily caloric intake is considerably smaller than the average for the *Columbidae* family (Perez 2004). Approximately one third of the pigeons would had no food intake for days, despite readily available food, and when they did eat, it was in very small quantities. On average, the older plain pigeons ate much less than expected under normal conditions for *Columbidae*.

Some possible reasons for these results are 1. Plain pigeons in captivity eat less than pigeons in the wild because they don't have to spend energy on flying, looking for food, and/or mating rituals 2. Food consumption of the pigeons decreases with age, and this was a likely factor in this study (pigeons on average were 10 years old). Further studies are needed to determine if the effect of captivity, age, or an interaction of these two factors caused the decrease in food intake of the captive individuals. Potential future research may include monitoring of wild individuals parallel to a similar set-up of this study with younger actively breeding captive individuals. Further research may help us to better understand and improve the health of the captive individuals and the success of the captive breeding program.

Agradecimientos al ex-personal del ex-aviario de Humacao y a Christian Espinoza-Pino.

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Book Review

Keepers of the Wolves by Richard Thiel

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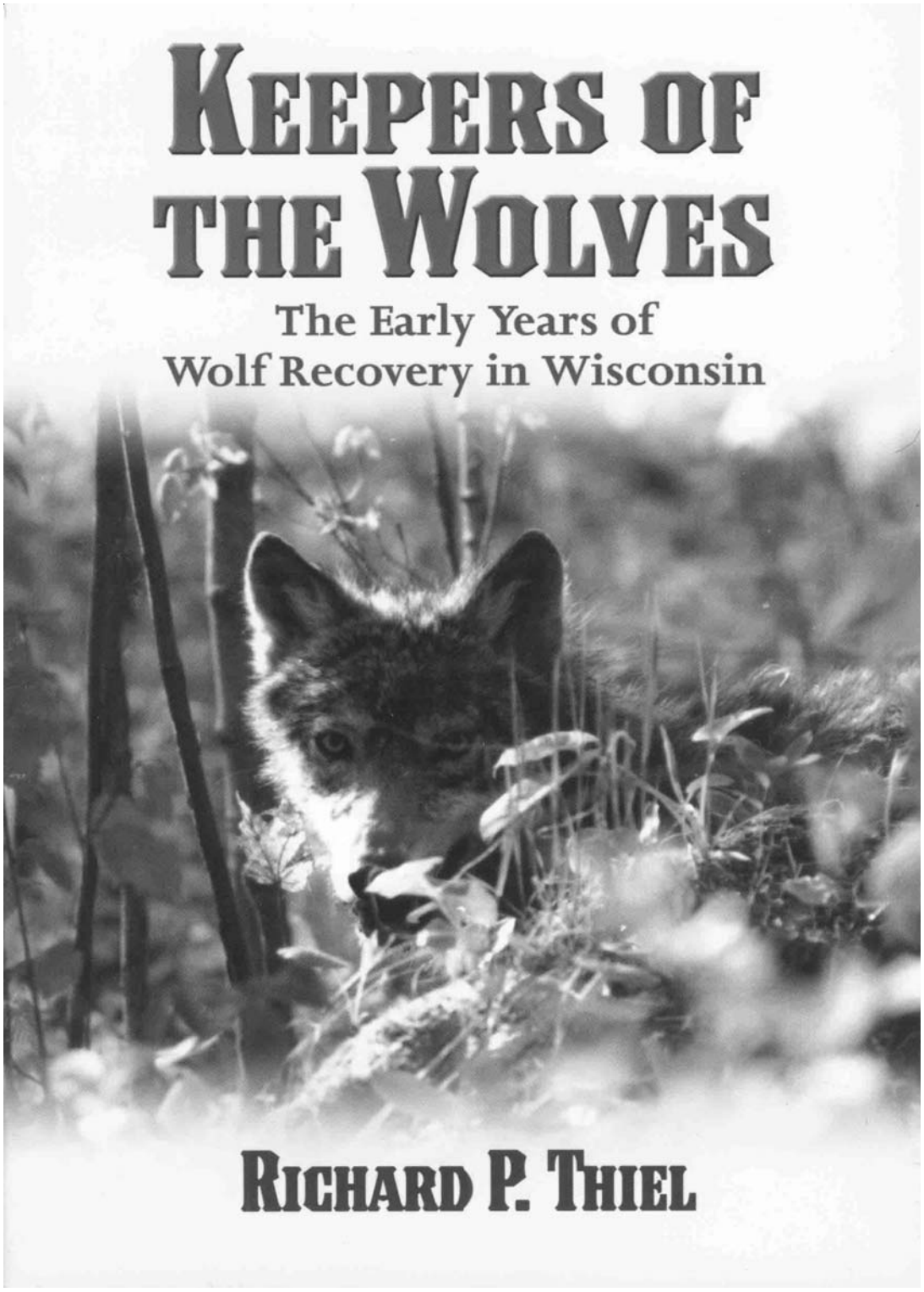

The proposed federal delisting of Midwestern gray wolves from the ESA

The status of the gray wolf, Canis lupus, under the Endangered Species Act (ESA) is currently under review. This short synopsis of the historical and current status of the species, with a focus on the Midwestern population, will review the proposed regulation changes and delisting. The proposed rule changes are available on the United States Fish and Wildlife Service's (USFWS) Region 3 homepage (http://midwest.fws.gov/wolf/). Following this is a book review of *Keepers of the Wolves*, by Richard Thiel. This book makes a fun, quick, and informative read on the reestablishment of the gray wolf in Wisconsin.

Historically, the gray wolf was found throughout most of the contiguous United States and parts of Central Mexico, but was extirpated soon after European settlement in most areas. The forests of the Northeastern United States and the Upper Midwest were the gray wolf's last refuges. The wolf population in the Northeast is believed to have been extirpated around 1900 (Federal Register 69), while Wisconsin's population was eliminated around 1958 (Thiel 2001). Minnesota maintained the only extant population in the contiguous US, as it remained connected to the Canadian wolf population.

Historically, there were several subspecies of gray wolf in North America (Federal Register 69). There is also an ongoing debate about whether the eastern timber wolf, *Canis lupus lycaon*, still exists, and if so, whether it is a subspecies of the gray wolf or a separate species from *Canis lupus* (Wilson et al. 2003). Currently, it is listed as a subspecies of the gray wolf, but if it is described as a separate species in the future, the listing status for both the gray wolf and timber wolf could be affected.

Today, the U.S. population of gray wolves is limited to three disjunct groups in the lower forty-eight: a population of gray wolves in and around Yellowstone National Park, a population of Mexican wolves, *Canis lupus bailey*, in Arizona and New Mexico, and a population of gray wolves in Minnesota, Wisconsin, and the Upper Peninsula of Michigan. The populations around Yellowstone and in the Upper Midwest are both connected to the Canadian population, which is estimated at 44,000–51,000 individuals, however, they are not directly connected to each other (Musiani and Paquet 2004). As such, the ESA manages these groups separately without consideration of the Canadian animals as the Act only applies to animals on US soil. Alaska also supports a wolf population of 7,500–10,000 individuals that is not covered by the Endangered Species Act since the population is not in danger (Musiani and Paquet 2004).

The gray wolf was listed as a federally endangered species in 1967 by the USFWS and listed again in 1974 when the ESA came into law (USFWS 2004). At the time, gray wolf populations were limited to northern Minnesota in the contiguous US and believed, like the coyote and white-tailed deer, to need unfettered wilderness to survive. During gray wolf recolonization of the Upper Midwest, wolf biologists learned that this was not the case: the gray wolf is capable of living in human-dominated landscapes. In 1992, Mladenoff et al. estimated that

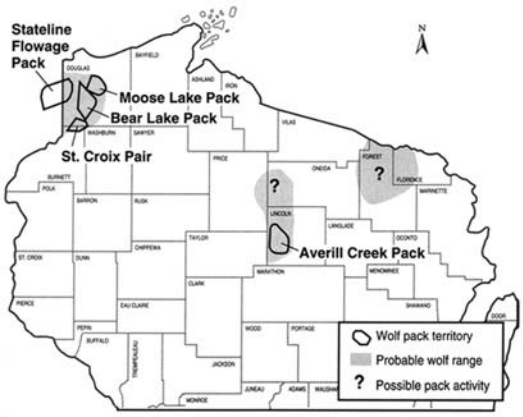

Figure 1. Wisconsin wolf pack locations and boundaries, 1979. (Thiel 2001)

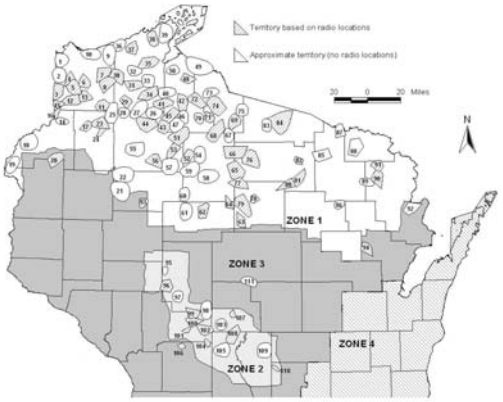

Figure 2. Wisconsin wolf pack locations and boundaries, Winter 2003-04. (Wydeven and Wiedenhoeft, 2004b)

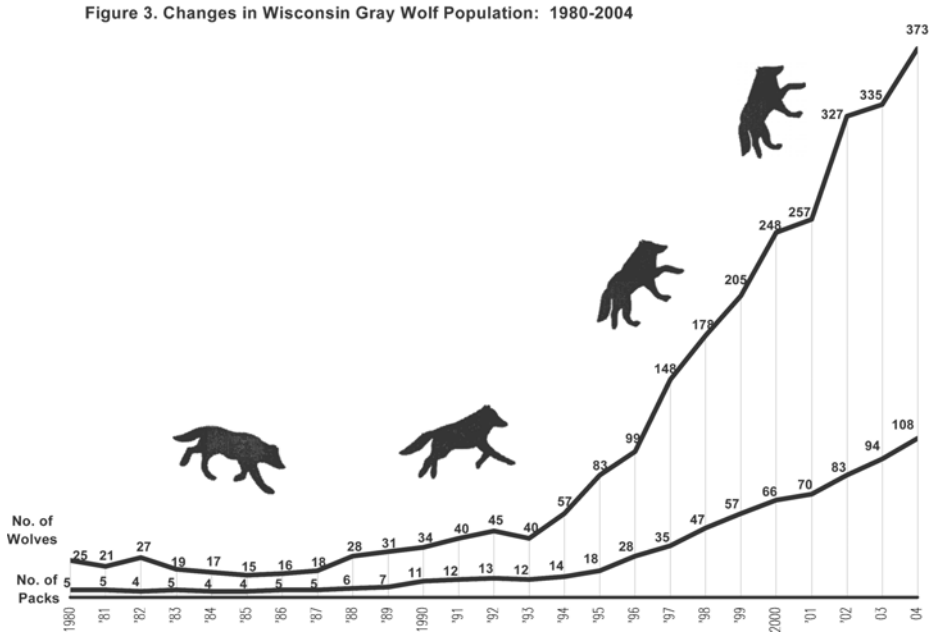

Figure 3. Gray wolf population and pack number in Wisconsin. Wydeven and Wiedenhoeft, 2004b)

Minnesota, Wisconsin, and the Upper Peninsula of Michigan harbored over 94,000 km^2 of forest that had a greater than 50% probability of being suitable gray wolf habitat. A later study (Mladenoff et al. 1995) concluded that as the gray wolf population increased, so would wolf use of substandard habitat; this would then lead to increased contact of wolves with humans and the associated problems. This statement is hard to quantify, because the majority of gray wolf interactions with humans are never reported. Evidence exists, however, to support the idea. The Wisconsin Department of Natural Resources (WIDNR) reported that 13 cases of wolf depredation were reported in 2000, while 31 cases were reported in 2004 (Wydeven and Wiedenhoeft 2000, 2004a). Additionally, wolf sightings were reported in 30 Wisconsin counties in 2000 and in 40 counties in 2004 (Wydeven and Wiedenhoeft 2000, 2004a). Finally, in 2003, 66 wolves were found dead or had to be euthanized in Wisconsin, more than the estimated 1994 state wolf population (Wydeven and Wiedenhoeft 2000, 2004a).

Gray wolves naturally recolonized Wisconsin from Minnesota and Canada in the mid-1970s and naturally recolonized the Upper Peninsula of Michigan from Minnesota and Wisconsin in the mid-1990s (Federal Register 69). In 1979, shortly after recolonization of Wisconsin by the gray wolf, pack locations were limited to sparsely-roaded areas in the northern forests of the state on, primarily, public land (Figure 1). By 2003-2004, the gray wolf was found throughout the northern and central forests of Wisconsin on public, commercial, and private land. Wolves inhabit not only remote areas, but also areas in close proximity to densely populated urban and agricultural centers (Figure 2). Population and pack numbers have also increased dramatically since recolonization in Wisconsin, which suggests a continued spread of wolves to areas of non-idyllic land in close proximity to humans (Figure 3).

Since 1974, gray wolf populations have increased dramatically throughout the Upper Midwest. During the winter of 2003–04, Minnesota had 3,020 wolves (Erb and Benson 2004), the Upper Peninsula of Michigan had 360 wolves (up from zero in the early 1990's), and Wisconsin had 373 wolves (Figure 3) (Federal Register 69). These numbers represent healthy population levels in terms of the number of individuals needed to sustain the current density of wolves according to the state and federal recovery plans. Additionally, in late October 2004, a gray wolf collared in the Upper Peninsula of Michigan was captured in a coyote trap

in the northern Lower Peninsula of Michigan, the first since gray wolves were extirpated in 1910 (Matthews 2004).

In Wisconsin, the gray wolf was listed as an endangered species in 1975 (WIDNR 2004a). In 1989, the state enacted a recovery plan for the gray wolf, which intended to have a state population of at least 80 wolves over three consecutive years. If this goal was met, then the gray wolf would be considered for state delisting (WIDNR 2004b). The plan's goal was met and then surpassed by 1997 (Figure 3).

In Michigan, the gray wolf is listed as endangered. In 1997, Michigan enacted a gray wolf recovery plan; at the time Michigan's gray wolf population was 112 individuals (excluding the Isle Royale population) (Federal Register 69). The plan calls for a population of 200 wolves over five consecutive years to consider the gray wolf recovered in Michigan (Michigan 1997). This goal was met and surpassed in 2004 (Federal Register 69).

The federal recovery plan for the gray wolf in the Upper Midwest, as amended in 1992, called for two separate populations: the first was a stable to growing population of 1,251– 1,400 wolves in Minnesota; the second was either a) a population of greater than 100 wolves if located within 100-miles of the Minnesota population or b) a population of greater than 200 wolves if located greater than 100-miles from the Minnesota population. This second population had to be stable or growing for five consecutive years in order for the gray wolf to be considered for delisting (USFWS 1992). The 1992 federal plan estimated that wolf populations in the Upper Midwest would meet this goal by 2005.

In 2000, federal gray wolf management goals were modified to coordinate population, habitat, and management goals. Three distinct management areas were created, each of which corresponds to an extant gray wolf population (Figure 4). The currently considered delisting plan affects only the Eastern Distinct Population Segment (EDPS), where the gray wolf is currently listed as threatened (Federal Register 68). It does not affect the Western or Southern Distinct Population Segments (WDPS and SDPS). The WDPS includes both a population around Yellowstone National Park (classified as a nonessential experimental population (NEP)), and a population along the Canadian border that is classified as threatened (Federal Register 68). The SDPS contains an NEP that is part of an ongoing bi-national reintroduction program with Mexico (Federal Register 68).

In 1999, Wisconsin "downlisted" the gray wolf to a state threatened species; federal downlisting in Wisconsin followed in

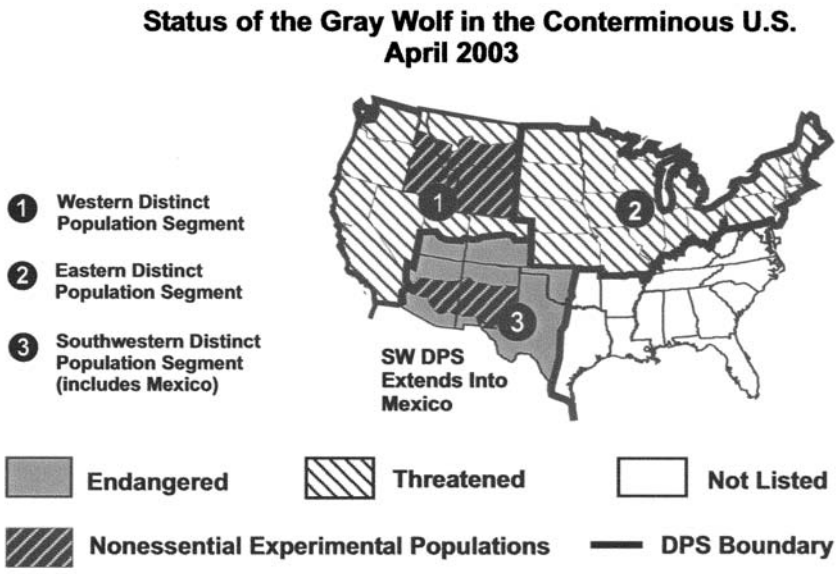

Figure 4. Federal gray wolf management zones. (Federal Register 69)

2000 (WIDNR 2004a). Other state and federal listings differed because of state management plans and management areas. In 1978, Minnesota state and federally downlisted the gray wolf to threatened (MNDNR 2001). Michigan downlisted the gray wolf to threatened in 2002 and it was federally downlisted in 2003 (MIDNR 2004).

The current proposed revision of gray wolf ESA status asks for complete delisting of the gray wolf within the EDPS (Federal Register 69). This would remove all federal protection for the gray wolf within only the EDPS and leave further protection to individual states and Indian tribes. The USFWS argues that this is warranted based on the recovery goals set forth in the 1992 federal management plan (Federal Register 69). These federal goals were met in 1999, when the Wisconsin wolf population numbered over 100 wolves for a fourth year. Exceeding 700 individuals, the current wolf population in the Michigan-Wisconsin region continues to grow and appears to be expanding its range. The current state management plans of Michigan, Minnesota, and Wisconsin would not be legally affected by federal delisting, which would ensure continued protection of the gray wolf within state boundaries.

If delisting occurs, there will be a mandatory five-year monitoring period following delisting according to the ESA. This would be undertaken only in Michigan, Minnesota, and Wisconsin, in conjunction with state monitoring (Federal Register 69). If during any period of the five-year monitoring "a significant downward change in the populations or an increase in threats to the degree that population viability may be threatened" are detected normal or emergency listing can be undertaken (Federal Register 69). After five years of monitoring, the gray wolf will be reevaluated, and at that time, it can be considered for listing, continued monitoring, or discontinued monitoring.

The period of public comment on delisting of the gray wolf closed on November 18th, 2004, 120 days after the original listing in the federal register. The date of the final decision has not been released at publishing.

In light of the proposed gray wolf delisting from the Endangered Species Act, I suggest reading *Keepers of the Wolves*. This book is written by Richard Thiel, a wolf biologist for the Wisconsin Department of Natural Resources who was closely involved in the reestablishment of the gray wolf in Wisconsin.

Keepers of the Wolves starts approximately 20 years after the last gray wolf was extirpated from Wisconsin in January of 1958. At that time, the gray wolf once again had a chance, however slim, to survive in the state. One of the first people to see evidence of this return was a young Wisconsin Department of Natural Resources (WIDNR) employee named Richard Thiel. In his memoir, *Keepers of the Wolves*, Thiel recalls over 20 years of joint effort to bring the gray wolf back from the brink of extinction. As a result of these efforts, the gray wolf is undergoing the process of delisting from the Endangered Species Act (ESA). Based from Thiel's own field notes, memories, and contemporary conversations with past conspirators, *Keepers of the Wolves* offers a refreshing perspective on the reestablishment of the gray wolf in Wisconsin–that of a state wildlife

biologist who has interacted with the wolves, public, and government on a daily basis (I'll let him tell you which is the most dangerous).

Written for the general audience, the first person narrative style draws the reader right into the action and emotion of the story. The reader gets to know the wolves, landscape, and people in the book on a personal level. They will learn about the tedium, disappointment, and frustration of the field as Dick finds the third skunk of the day in the trap-line and learns that his funding is (once again) inadequate. But the reader will also share the accomplishments as Dick flies over a pack's den site and discover support from people he would least expect.

Keepers of the Wolves will also be informative on the general process, problems, and excitement of species reintroduction. While the specifics are those of the gray wolf in Northern Wisconsin, the experiences Thiel relates will work as examples to anyone interested in reestablishing threatened and endangered species. However, if you are looking for a cookbook on charismatic mega-fauna reintroduction, you will have to keep searching.

Keepers of the Wolves follows in the footsteps of Aldo Leopold's *A Sand County Almanac*; by relating personal experiences, Richard Thiel brings the interaction of wolves, the land, and the people together. As in Leopold's book, someone with any level of scientific indoctrination can read, understand, and enjoy this work. The scientific and field jargon are explained well; the writing flows well and the illustrations are helpful. Thiel covers numerous and various topics including wolf-deer ecology, basic animal tracking, wolf home territory mapping, and how not to warm a frozen AMC Renault (the company car).

An important aspect of *Keepers of the Wolves* is that it is a quick and entertaining read on a very important and serious subject. The story follows the issues that surround the reestablishment of a historically denigrated large carnivore and presents them in an honest, if at times opinionated, manner. The gray wolf is currently under review by the United States Fish and Wildlife Service for delisting from the Endangered Species Act. Even though gray wolf populations have rebounded, they still face many of the same problems and threats as when they crossed into Wisconsin in the late 1970's. *Keepers of the Wolves* presents an entertaining review of these issues, especially in light of the federal delisting of the gray wolf.

Keepers of the Wolves, by Richard Thiel, is 227 pages long and is available through the University of Wisconsin Press.

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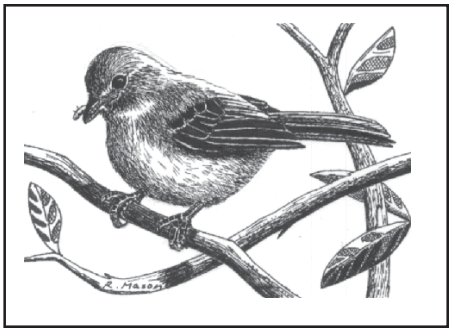
FOCUS ON NATURE ™ *by Rochelle Mason*



The chicks sure are growing fast thinks the **LEAST BELL'S VIREO** (*Vireo bellii pusillus)*. Instead of raising 3 small, delicate chicks she is caring for 3 giant, voracious chicks. *Its happened again*. These chicks are brown-headed cowbirds. The cowbird parents tricked the vireo into raising *their* young. This is a problem for the endangered vireo's survival but a brilliant strategy for the prolific cowbird. The nearly-exhausted female leaves her nest in search of yet another meal. She flits around in the dense, riparian foliage growing along the Amargosa River here in Inyo County, California. A wiggling larva on a leaf of a willow tree catches her eye and is quickly consumed. When maternal responsibilities are over and the signals of changing seasons approach, the least Bell's vireos will fly to warmer climes south of the border to relax. *Artwork and text by Rochelle Mason. Copyright 1998-2003 www.rmasonfinearts.com (808) 985-7311*

Instructions to Authors

The Endangered Species UPDATE is committed to advancing science, policy, and interdisciplinary issues related to species conservation, with an emphasis on rare and declining species. The UPDATE is a forum for information exchange on species conservation, and includes a reprint of the U.S. Fish and Wildlife Service's *Endangered Species Technical Bulletin*, along with complementary articles relaying conservation efforts from outside the federal program.

The UPDATE welcomes articles related to species protection in a wide range of areas including, but not limited to:

-Research and management of rare and declining species;
-Theoretical approaches;
-Strategies for habitat protection and reserve design;
-Policy analyses and approaches to species conservation;
-Interdisciplinary issues;
-Emerging issues (e.g., wildlife disease ecology).

In addition, book reviews, editorial comments, and announcements of current events and publications are welcome.

Subscribers to the UPDATE are very knowledgeable about endangered species issues. The readership includes a broad range of professionals in both scientific and policy fields including corporations, zoos, and botanical gardens, university and private researchers. Articles should be written in a style that is readily understood but geared to a knowledgeable audience.

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The Endangered Species UPDATE accepts several kinds of manuscripts:

1. Feature Article — on research, management activities and policy analyses for endangered species, theoretical approaches to species conservation, habitat protection, and interdisciplinary and emerging issues. Manuscripts should be approximately 3000 words (8 to 10 double spaced typed pages).

2. Opinion Article — concise and focused argument on a specific conservation issue; may be more speculative and less documented than a feature article. These are approximately 450-500 words (About 2 double spaced typed pages).

3. Technical Notes/Reports from the Field — ongoing research, application of conservation biology techniques, species conservation projects, etc., at the local, state, or national level. These are approximately 750 words (3 double spaced typed pages).

4. Species at Risk — profiles of rare and declining species, including the following information: taxonomy, distribution, physical characteristics, natural/life history, conservation status, and economic importance. These profiles are approximately 750-1500 words (3 to 6 double spaced typed pages).

5. Book Reviews — reviews should include such information as relevant context and audience, and analysis of content. Reviews are approximately 750-1250 words (3 to 5 double spaced typed pages). Please contact the editor before writing a book review.

6. Bulletin Board — submissions of news items that can be placed on the back page. These items can include meeting notices, book announcements, or legislative news, for example.

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Manuscripts should be typed, double-spaced, with ragged right margins to reduce the number of end of line hyphens. Print must be in upper- and lower-case letters and of typewriter quality. Metric measurements must be given unless English measurements are more appropriate, in which case metric equivalents must be given in parentheses. Statistical terms and other measures should conform to the *Council of Biology Editors Style Manual.* All pages should be numbered. Manuscripts must be in English.

Initial acceptance of a proposal or manuscript does not guarantee publication. After initial acceptance, authors and editors work closely on all revisions before a final proof is agreed upon.

Citations, Tables, Illustrations, and Photographs

Literature citations in the text should be as follows: (Buckley and Buckley 1980b; Pacey 1983). For abbreviations and details consult the Editor and recent issues of the Endangered Species UPDATE.

Illustrations and photographs may be submitted as electronic documents or as hard copies. If hard copies are submitted, the author's name and the figure number should be penciled on the back of every figure. Lettering should be uniform among figures. All illustrations and photos should be clear enough to be reduced 50 percent. Please note that the minimum acceptable resolution for all digital images is 300dpi.

Author credit instructions for each author of the article should accompany the manuscript.

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