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Restoring the Bald Eagle

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Despite Benjamin Franklin's persistent lobbying on behalf of the wild turkey, our founding fathers chose the bald eagle (*Haliaeetus leucocephalus*) as our national symbol. A common resident throughout much of North America in the eighteenth century, the bald eagle was viewed as a symbol of strength, courage, beauty, and freedom. Ironically, populations have plummeted over the past two centuries, so that today the bald eagle also symbolizes the effects of environmental contamination, habitat loss, human persecution of wildlife, and the impending free-fall of biological diversity throughout the world (Lewin 1986). Since the banning of DDT in 1972, populations have shown encouraging signs of recovery (Grier 1982); nevertheless, today over 90% of the remaining nesting pairs are confined to relict populations centered in Florida, the Chesapeake Bay area, Maine, the Great Lakes, and the Pacific Northwest (Green 1985).

Ancient falconry techniques, animal husbandry, and modern ecological theory are aiding the recovery of the bald eagle

Over the last 15 years, nationwide conservation efforts have been focused on restoring the bald eagle to portions of its former range. For the most part, these efforts have involved the reintroduction of birds into the few remaining fragments of suitable habitat. Often these habitat islands are imbedded in a landscape highly modified by man's activities, where, without direct intervention, there would be little likelihood of natural recolonization.

The foundation of most projects to reintroduce birds of prey is the ancient falconry technique known as hacking (Sherrod et al. 1981). The term comes from the *hack*, the board on which the hawk's meat was laid and to which the hawk returned. Hacking, formerly used with great success for restoring populations of the peregrine falcon (*Falco peregrinus*), has more recently been applied to bald eagles (Cade and Temple 1977; Nye, in press). Centuries ago, falconers discovered that most birds of prey are philopatric—that is, they form an attachment to the place where they are raised and tend to return to that location when they are ready to breed. The irony of this philopatric tendency is that it makes wild birds unlikely to recolonize vacant habitats. For example, although over 2,500 bald eagles migrate from the northern United States and Canada to winter in southeastern states, few, if any, stay to breed in what appears to be suitable and vacant habitat. Thus despite a large yearly influx of birds, there currently are only about 120 active nests of bald eagles in the southeastern United States outside of the state of Florida (Bagley 1987). Current populations of the southern bald eagle are estimated to be about one-third of their historic size (Fig. 2). Young bald eagles released into suitable but unoccupied habitat will tend to return to that habitat to nest when they reach adulthood at four to six years of age. Thus, hacking has proved to be an effective tool of wildlife management, because it establishes birds in the scattered islands of remaining suitable habitat, and it overcomes the population inertia that results from philopatry.

The goals for the restoration of the species are determined by the US Fish and Wildlife Service and outlined in a document entitled the Recovery Plan (Murphy et al. 1984). This plan has established a goal of 90 new nests in the Southeast, increasing the regional nesting population to approximately 40% of its estimated historic level. At that point the population would no longer be viewed as in danger of extinction, and consideration would be given to changing its status from endangered to threatened. Although most of the 14 eagle hacking projects under way in the United States are in their early stages, the results have been encouraging, and to date, at least seven new nesting territories have been established by hacked birds (Nye, in press).

Finding a suitable source of birds for reintroduction is an obstacle for all hacking projects. This problem is particularly acute in the case of the southern bald eagle. While hacking projects in the northern United States have used chicks removed from healthy populations in Canada and Alaska, southern bald eagles are considered by many to be a distinct subspecies (King 1981). They show several unique adaptations to their environment, all of which are believed to have some genetic basis.

Figure 1. A program to restore the southern bald eagle (*Haliaeetus leucocephalus*) to its historic range attempts to reestablish the eagles in an area by placing fledglings that have been hatched in captivity into artificial nests. The eagles will return to these nests to be fed until about 6 months of age, when they can hunt for themselves entirely. The eagle shown here on the Mississippi River is a juvenile about a year old. The restoration program relies on the fact that when eagles reach adulthood and are ready to breed—at 4 to 6 years of age—they return to the area where they were raised. (Photograph by Frank Oberle.)

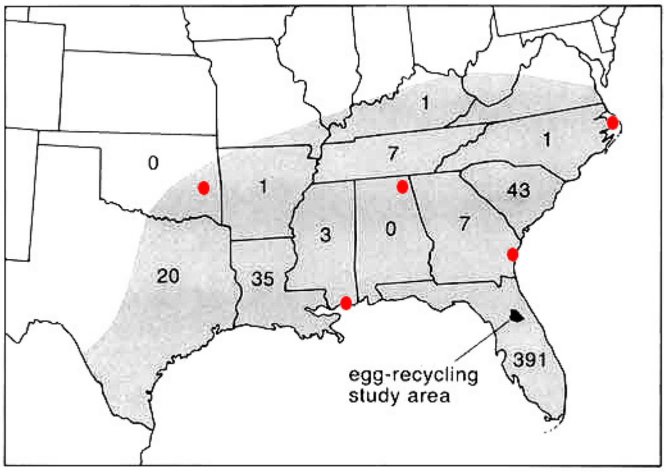

Figure 2. The population of the southern bald eagle has declined from an estimated 1,500 breeding pairs, historically distributed from eastern Texas to the Carolinas, to about 500 pairs today. Over 80% of the remaining birds are concentrated in central and southern Florida. The restoration program seeks to reestablish breeding birds across the Southeast through a combination of egg-recycling, captive propagation, and hacking at strategic sites (*red dots*) in five states.

Southern birds are smaller (presumably an adaptation to the warmer climate), less migratory as adults, and, in contrast to their northern counterparts, winter breeders. Our work, a large cooperative project involving the Sutton Avian Research Center, the states of Florida, Georgia, Alabama, Mississippi, Oklahoma, and North Carolina, the University of Florida, the US Fish and Wildlife Service, and the National Park Service, is an effort to develop a restoration program that takes into account the unique characteristics of southern bald eagles. The first and most important stage of this project was an attempt to determine whether we could use the relict Florida population, which contains over 80% of the birds remaining in the Southeast, as a renewable source of eagles by employing a technique called egg recycling.

Egg recycling

The technique of egg recycling relies on a female bird's ability to lay a replacement clutch of eggs—to recycle. This ability, presumably an adaptation to the loss of eggs to predators, storms, and other hazards, had been demonstrated in related species, such as ospreys (*Pandion haliaetus*) and falcons, but not in wild bald eagles (Kennedy 1977; Morrison and Walton 1980). However, if Florida bald eagles could be induced to recycle, and if they could do it without a significant reduction in their breeding success, our plan was to use that surplus production as a source of birds for hacking projects throughout the Southeast.

We set out to examine this question in 1985 with four objectives: to determine whether recycling occurs in southern bald eagles; to determine how egg removal affected subsequent nesting success and productivity; to determine how the timing of clutch removal influenced recycling; and to determine whether there were any differences in behavior or survival between late-fledging eagles from donor nests and fledglings from undisturbed control nests.

Donor and control nests were located in two areas of north-central Florida (in Alachua and Marion counties, and in the Ocala National Forest) where there are large numbers of nesting bald eagles (Fig. 2). Aerial surveys during the breeding seasons from 1985 to 1987 were initiated prior to egg-laying (in October and November) and repeated approximately every week until nearly all eggs hatched (mid-March). From mid-March until the eaglets fledged, surveys were conducted approximately every two weeks to monitor chronology and productivity at all nests.

A substantial amount of time and persuasion was required to locate accessible nests for egg collecting and to obtain permission from landowners to visit the nests. A total of 42 suitable donor nests were eventually located, and 87 eggs were removed over three breeding seasons. One egg-collecting trip was made in 1985, and two in 1986 and 1987. Eggs were removed from the nests by climbers and quickly dispatched to the Sutton Center in Oklahoma (Fig. 3).

We found that the rates at which eggs were recycled were high, ranging from 70.6% in 1987 to 100% in 1985, and averaging 78.6% (Table 1). Although none of the adult birds we studied was marked or banded, we are confident about our estimates of recycling, which were based on the chronology of egg laying, on the proximity of alternate nests, and on the history of eagle nesting in the area. Of the 33 birds that recycled over the three years, 21 did so in their original nests, and 12 recycled in nearby alternate nests.

The age of an egg at the time of collection was estimated by subtracting the 35-day incubation period from the hatching date (Bent 1937). During the three years of the study, the ages of the eggs when collected varied widely, averaging 15.9, 16.2, and 15.8 days old, respectively. Although our sample sizes are small, it does appear that the probability of recycling decreases as the nesting season progresses—recycling did not occur readily at nests from which eggs were taken late in the egg-laying period (mid-January).

Recycling intervals (the number

Table 1. Recycling data for nests of the southern bald eagle

Year	Nest type	n	n recycled	% recycled	Mean recycling interval (days)	% nests fledging young	Fledglings per active nest
1985	Donor	9	9	100.0	32.4	77.8	1.22
	Control	31	—	—	—	71.0	1.19
1986	Donor	16	12	75.0	31.0	56.2	1.00
	Control	47	—	—	—	66.0	0.98
1987	Donor	17	12	70.6	26.2	70.6	1.24
	Control	54	—	—	—	68.5	1.17
1985-7	Donor	42	33	78.6	29.9	66.7	1.14
	Control	132	—	—	—	68.2	1.11

of days between the removal of eggs and subsequent laying of replacement eggs) averaged nearly 30 days, ranging from 20 days to 57 days. Overall, there was no relationship between the age of the clutch when removed and the recycling interval.

The ultimate impact of removing eggs was judged by comparing the productivity of donor and control (i.e., unmanipulated) nests. We found no significant differences between these two groups in the percentage of nests fledging young or in the number of young fledged per active nest. We believe that if precautions are taken to collect eggs early in the season, Florida bald eagles will recycle readily and produce young at normal rates.

Captive propagation

Preparations for the captive propagation phase of the project began at the Sutton Avian Research Center a full year before any eggs were collected. A chick-raising laboratory with facilities for the production, preparation, and storage of food was built. Specialized equipment, such as cannisters for holding eggs in the field, portable field incubators, and a motor home to be used as a field laboratory also had to be built and tested. Redundancy, backup, and monitoring capabilities were incorporated into each phase of the project to ensure against the inevitable problems caused by bad weather, power outages, equipment malfunction, and human error.

Once eggs are removed from a nest, they are put into a protective cannister, lowered to the ground, and placed in a portable field incubator. This incubator, powered by a portable generator, is fitted inside with netting to cradle the eggs and protect them from vibration and shock. It is designed to maintain internal temperatures within 0.25°C in the face of ambient temperatures that range between freezing and 27°C. The eggs are then taken to the motor-home field laboratory and placed in a larger incubator that also has been specially cushioned against road vibration and equipped with backup power and temperature alarms. About two days are required to obtain the approximately twenty eggs normally taken during a collecting trip. During that period, and the nonstop 33-hour ride back to the Sutton Center, the eggs are monitored carefully and turned by hand every three hours around the clock.

At the Sutton Center, the eggs are placed under Cochin sitting hens. These hens, which are kept "broody" by exposure to long photoperiods, make excellent surrogate parents, and their attention greatly increases hatching success. Prior to hatching, at about 35 days of age, the eggs are transferred back to an incubator to minimize the possibility of transmitting diseases to the newly hatched chicks.

After hatching, chicks are brooded on thermostatically controlled hot water bottles until they are capable of thermoregulation, at about 3½ weeks of age. For the first several weeks chicks are fed with a latex eagle-head puppet to ensure the proper stimulus for imprinting (Fig. 4). By three weeks they are able to feed themselves from trays of ground food left in their individual artificial nests, and by six weeks they are capable of tearing up whole food on their own. As soon as the chicks' vision begins to sharpen, at about one week, all feeding is done from

Figure 3. Climbers who collect eggs wear surgical gloves and masks to protect the eggs from contamination. The overhanging nest edge can make access to nests precarious, but most clutches are removed in less than fifteen minutes. (Photograph by M. A. Jenkins.)

Figure 4. A latex bald eagle puppet is used to feed a three-week-old eaglet. Birds are observed through one-way mirrors and are kept isolated from human contact to prevent imprinting. (Photograph courtesy of the Oklahoma Department of Wildlife.)

Figure 5. These four-week-old eagle chicks are kept separated from their siblings to prevent them from attacking one another—a source of mortality in wild chicks. (Photograph by G. McKee.)

behind one-way mirror dividers. This is one of the precautions taken to minimize the chicks' awareness of their human caretakers, so that the birds do not imprint on their foster parents and lose the instincts necessary for survival in the wild.

The staple of the young eagles' diet consists of Coturnix quail, raised year-round at the center. Eagle chicks, which weigh about 85 g when they hatch, weigh 3.5 to 5 kg some eight weeks later and consume the equivalent of 800 quail (125 kg) in that interval. Only about half that number are fed to each bird, however, with the balance of their diet made up of venison, rabbits, chickens, rats, and a supplement of multiple vitamins.

Sibling aggression, a common behavior in birds of prey, must be controlled in birds reared in captivity. During the first month of development, although chicks must be kept within sight of their nest mates to permit proper imprinting, they must also be kept physically separated to prevent them from attacking and killing each other (Fig. 5). This aggressive behavior—called the "Cain and Abel" conflict (Stinson 1979)—appears to be an adaptation to eliminate competition in the nest during periods of food shortage, and it persists until chicks are about a month old. Until that time, the mere presence of a dominant sibling close by may inhibit a subordinate chick's feeding and development. In the wild this behavior often means that fewer chicks survive to fledging than actually hatch. By preventing sibling chicks from killing each other in the laboratory, and by providing optimum conditions for hatching, nutrition, and development, we have achieved productivities up to 60% greater than are normally attained by wild birds (Tables 1 and 2).

Table 2. Captive rearing and hacking of southern bald eagles

	Annual breeding season			*Total*	
	84–85	*85–86*	*86–87*	*84–86*	*84–87**
Eggs collected	18	34	35	52	87
Viable eggs**	17	33	32	50	82
% Eggs collected that are viable	94.4	97.1	91.4	96.2	94.3
Chicks hatched	17	30	24	47	71
% Viable eggs that hatched	100.0	90.9	75.0	94.0	86.6
Chicks reared to hacking age	13	28	20	41	61
% Hatched chicks reared to hacking age	76.5	93.3	83.3	87.2	85.9
Chicks that were hacked successfully	12	28	19	40	59
% Hatched chicks that were hacked	70.6	93.3	79.2	85.1	83.1
% Viable eggs resulting in hacked birds	70.5	84.4	59.4	80.0	72.0
% Collected eggs resulting in hacked birds	66.7	82.4	54.3	76.9	67.8

* 1987 was an atypical breeding season in Florida because of unusually warm, wet weather during the incubation period. These conditions apparently fostered the growth of bacteria in the birds' nests and the infection of many developing embryos (Sherrod et al., in press). The result was an abnormally low hatching success in eggs reared both in the wild and in captivity. Therefore, the 84–86 statistics are probably more typical of the results that can be obtained under average conditions.

** Viable eggs are fertile eggs that showed some sign of development.

At six weeks of age, the chicks, now nearly fully grown, are moved from the temperature-controlled laboratory to a "hardening yard," where they are acclimated to ambient temperatures. After about two weeks of acclimation, their sex is determined, they are banded, and they are then flown to the hack sites.

Hacking

There currently are four hack sites in the program, and a fifth, in North Carolina, will be added in 1988 (Fig. 2). The criteria for selecting a site are illustrated by the Horn Island hack site located 15 km off the Mississippi coast. Historic data indicate that the bald eagle was once a fairly common breeder on the barrier islands and adjacent coastal areas (Burleigh 1945). The species was extirpated by the early 1950s, and today only a single coastal nest can be found along the northern Gulf Coast. The Horn Island site will serve the important function of reconnecting the relict populations in Louisiana and Florida. This strategy, a basic tenet of conservation biology, will promote genetic exchange between the subpopulations and reduce the probability of local population extinctions (Wilcove et al. 1986). Additional evidence of the area's suitability for eagles is provided by the abundance of ospreys, an ecologically similar species. And finally, protected public lands, such as Gulf Islands National Seashore and nearby Bon Secour National Wildlife Refuge, ensure the long-term preservation of those habitats. These characteristics (evidence of historic nesting, high-quality protected habitat, and the potential for reconnection of relict populations) are shared by all the release sites.

The hack tower consists of a platform about 9 m high, with cages, artificial nests, and an adjacent room from which the birds can be observed and fed (Fig. 6). Here, as in the earlier stages of the program, great care is taken to ensure that the birds have no direct contact with people. The birds are nearly full grown when they are placed in the hacking tower, and they require about one kilogram of fresh whole fish, rabbits, or other meat a day.

Before release, each bird is fitted with a lightweight radio transmitter that allows us to monitor the birds for about six months. The device is attached with a backpack-style harness made of tubular Teflon ribbon and falls off within a year. Regular observations are stepped up when the birds reach ten weeks of age in order to pinpoint the best time for release. Nestlings become noticeably more restless just prior to fledging, and it is important that they not develop an aversion to the hack tower by being confined too long. If released properly, young eagles usually return to the tower to feed within 72 hours and continue to do so for up to three months as they sharpen their hunting and flying skills. This gradual transition to independence is probably crucial to their survival, especially in light of recent evidence that most fledglings embark on a long nonstop northward migration when they are about six months old. Hacked birds are not expected to establish breeding territories until they are four to six years old. Nevertheless, we already have two records (one in Oklahoma and the other in Alabama) of hacked birds returning to their release sites a year or more after release.

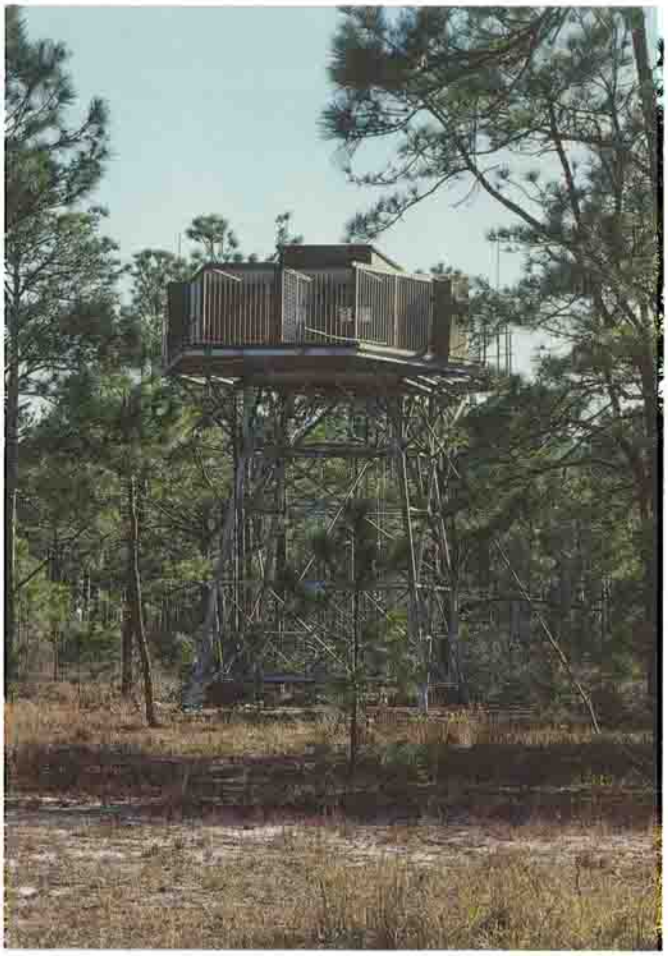

Figure 6. Hacking towers, this one on Horn Island, Mississippi, are placed in isolated patches of vacant habitat in an effort to reconnect the relict populations remaining in the Southeast. Cages containing artificial nests surround a central observation room from which the birds, unaware of their human caretakers, can be fed and observed. (Photograph by T. Simons.)

Management strategy

Once the viability of a restoration program based on egg recycling was demonstrated, the next step was the development of a management strategy that addressed the objectives of the recovery plan. This was not a simple matter, in large part because of a lack of good demographic data. The current state of our knowledge about bald eagles illustrates that wildlife management today is an imprecise science at best. Although they are one of the most conspicuous and intensively studied of all North American birds, and in spite of the fact that they have received special attention as our national symbol and as an endangered species, we still know very little about the population biology of bald eagles. The characteristics of a population are determined by both fecundity and survival. At present, almost all that we know about bald eagles comes from studies conducted during the breeding season. As a result, we have a fair understanding of fecundity in these birds, but we can only make rough estimates of juvenile and adult survival rates, and can only guess at the percentage of adult birds that attempt to breed each year (Newton 1979).

One approach to these shortcomings has been the use of stochastic population models to determine the most sensitive aspects of a species' life history. These models, which incorporate random fluctuations in life-history parameters, have been used recently to understand better the population dynamics of several endangered birds, including California condors (*Gymnogyps californianus*) (Mertz 1971); bald eagles (Grier 1980a, b); and dark-rumped petrels (*Pterodroma phaeopygia*) (Simons 1984). The patterns are similar for each of these long-lived, low-productivity ("k-selected") birds (MacArthur and Wilson 1967). Modeling has shown that populations of these and many other endangered species are extremely sensitive to changes in adult survival rates (Grier 1980b); their populations are less sensitive to changes in juvenile survival and are rather tolerant of variations in reproductive success. In addition, a low intrinsic rate of population increase subjects small populations of these species to high probabilities of extinction (Fig. 7). When applied to the conservation of bald eagles, these models indicate that even under optimum conditions, population recovery will require several decades; that founder populations established by hacking should be fairly large (at least 30 birds) to minimize the chances that random events will send a population to extinction; and that future conservation efforts must be based on a better understanding of survival rates, because unless adult survival rates are high (above 85%), efforts that focus on fecundity, such as hacking, may be futile.

Our plans for future work have been shaped by the results of this modeling, by the work on egg-recycling, captive propagation, and hacking, by the recovery plan objectives, and by the need for better information on survival rates.

The egg-recycling results indicate that the Florida eagle population can withstand a harvest of 100 eggs per year. About 20% of the eggs we collect in Florida will produce breeding adult birds. This estimate is derived from modeling, captive-propagation results, and the success of hacking efforts to date (Nye, in press). Population modeling predicts that for a given number of birds, hacking all of the birds in one year will, on the average, yield the same results as hacking smaller numbers of birds over many years. Other factors suggest that the optimal way to hack birds would be as one large group. First, the economics of hacking strongly favor larger releases. Second, it is reasonable to assume that birds released into vacant habitats as part of a single large cohort will be more likely to find a mate when they reach breeding age, than birds in small cohorts. On the other hand, caution argues that putting all of one's eagle eggs in one basket may be risky, given the uncontrollable effects on survival of weather and food supplies.

Our plan for the management phase of this project is an attempt to strike a balance between these biological and economic factors. It will run for at least five years and involve release sites in a minimum of five states (eventually with several sites per state). Each year, beginning in 1989, the sites in the target state will release a large cohort of up to 75 birds, while the remaining birds will be distributed among the sites in the other states. This effort should realize the recovery-plan goal of 50 to 60 new nests in the five target states, about two-thirds of the regional objective. Assuming the results are favorable, the program will then be shifted to the remaining southeastern states and will continue for another three to five years.

The expanded restoration program has been coupled with new field studies intended to broaden our understanding of the biology of bald eagles. This work

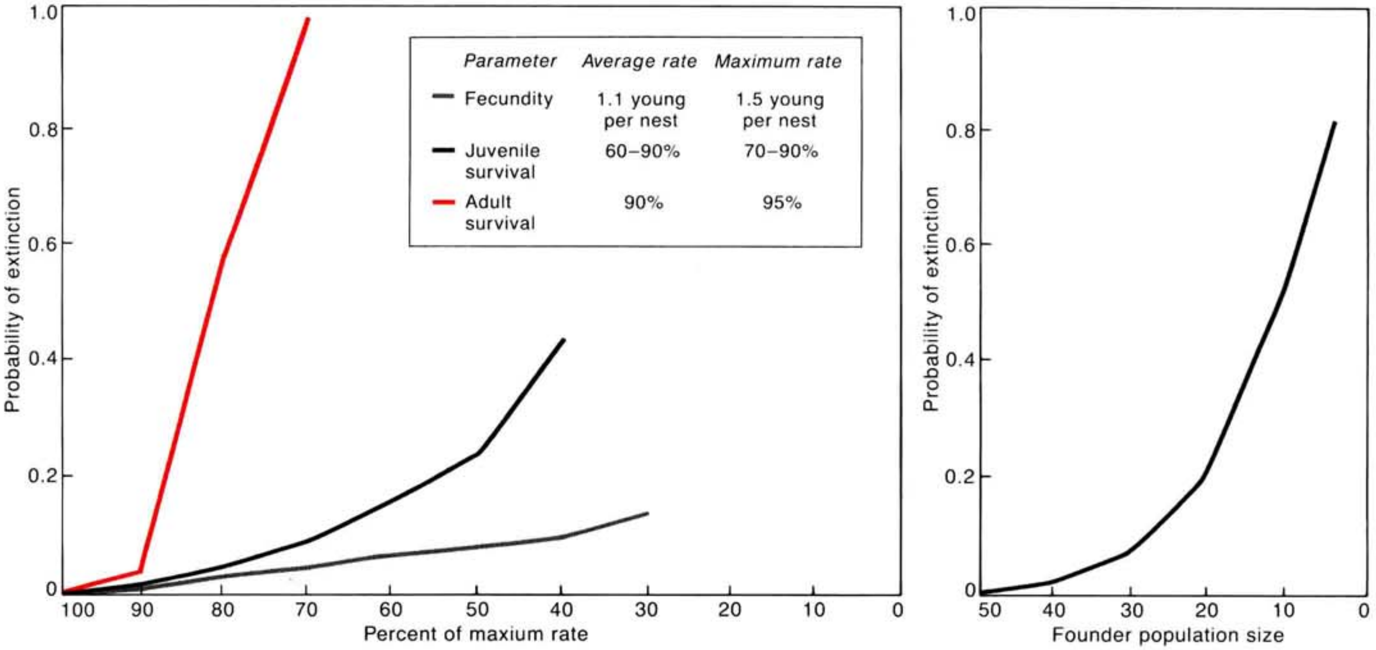

Figure 7. Mathematical modeling, based on data derived from the field studies of the southern bald eagle (summarized in Table 1 and Grier 1980b), shows that the probability of established populations becoming extinct increases as the rates of fecundity, of annual survival among juvenile birds (1–4 years old), and especially of annual survival among adult birds (5 years and older) decrease (*left*). The simulations depict each parameter as a percentage of the maximum rate, assuming the average rate for the other two parameters, and assuming a founder population of 50 birds. (See Grier 1980a, b and Simons 1984 for details of the model.) The modeling also shows that small populations of eagles have a high probability of becoming extinct (*right*), because of a low rate of fecundity combined with random fluctuations in the annual rates of fecundity and survival; this simulation assumes rates of fecundity and survival that fluctuate around average values.

includes the close monitoring of donor nests in Florida and the initiation of a long-term population study aimed at determining the dispersal patterns and survival rates of wild birds. Radio telemetry will be a valuable tool for much of this work.

Recent advances in the technology of batteries, miniaturization, and solar cells have made radio-telemetry studies of eagles both feasible and affordable (Kenward 1980). Miniature battery-powered transmitters weighing less than 30 g and capable of air-to-air ranges of up to 100 km are now available at a reasonable cost, as are slightly heavier solar-assisted transmitters with life spans of several years or more. Studies begun as part of this program have documented the dispersal and survival patterns of hacked eagles in Oklahoma and of fledglings from donor and control nests in Florida. Ten Florida chicks were radio-tagged in 1987 and tracked for several months. Preliminary data indicate that the age at which nestlings disperse does not differ between control (128 days) and donor (131 days) nests. Several Florida fledglings were located again after migrations to the Chesapeake Bay area, and Oklahoma birds also have been located after migrating to northern Wisconsin and Minnesota. In one instance, a combination of ground and aerial tracking was used to follow a bird flying from the Oklahoma hack site on a continuous 11-day migration to southern Canada in 1987. Surprisingly, the bird did not feed or follow rivers or other natural features during migration. Instead, it flew due north each day—even over downtown Omaha—only varying from that course as a result of the strong westerly winds it encountered en route. The bird was located again in early August on a lake in northern Wisconsin, and a second bird from the Oklahoma hack site was found on a lake in northern Minnesota about the same time. The Minnesota bird was resighted on the Fourche La Fave River in western Arkansas in mid-February, less than 100 km from the Oklahoma hack site. Sadly the bird was shot, and died on 28 February 1988. Unfortunately, shooting is still a major form of unnatural mortality in bald eagles and other large birds of prey.

The development of lightweight satellite telemetry transmitters holds the greatest promise for understanding the population biology of eagles. Employed for almost a decade on a variety of larger animals, including caribou, sea turtles, whales, and grizzly bears, the transmitters work with a Doppler positioning system carried aboard the National Oceanic and Atmospheric Administration's TIROS-N satellites. Researchers from the Applied Physics Laboratory at Johns Hopkins University were the first to refine the technology to the point where it could be applied to large free-flying birds (Strikwerda et al. 1985, 1986). They attached a prototype transmitter weighing 170 g to a young male bald eagle in July 1984 and tracked the bird for almost eight months over a distance of 4,554 km. The results, an unprecedented record of movement patterns and habitat selection in a free-flying eagle, provided a glimpse of the technology's potential. The weight of satellite transmitters will have to be reduced by about 50% before they become practical for large-scale applications, but such a reduction is thought to be feasible, and commercially produced transmitters are expected to become available within the next two years (Tomkiewicz and Beaty 1987). When they are, and we begin to understand the movement patterns and survival rates of bald eagles, we will for the first time be able to make the best possible use of the limited resources available for the conservation of this and other wide-ranging wildlife species.

Conservation programs targeted at species like the bald eagle can be extremely effective mechanisms for preserving biological diversity. The acquisition and preservation of breeding and wintering habitats for a particular species promote the conservation of untold other species that piggyback on this process. In addition to these direct benefits, there are many others that are less tangible. In some ways, this project is as symbolic as the birds it is attempting to conserve. Bald eagles are not on the verge of extinction, and when viewed in the context of global conservation needs and of other critically endangered species, the attention may seem misplaced. In fact, it is precisely the symbolic nature of widespread species like the bald eagle—with their ability to capture the imagination of the public—that makes them such worthwhile conservation investments. As symbols of wilderness and of the freedom wilderness represents, bald eagles have the unique capacity to inspire people and to foster a sympathetic attitude toward the needs of other threatened species and toward related environmental issues such as habitat destruction and water quality. Clearly, without that sympathy and the political will it engenders, the needs of more obscure species will go unmet. It may be trickle-down conservation, but in light of the ever-increasing pressure on global resources, it may prove to be one of the more fruitful conservation strategies available in the years ahead.

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