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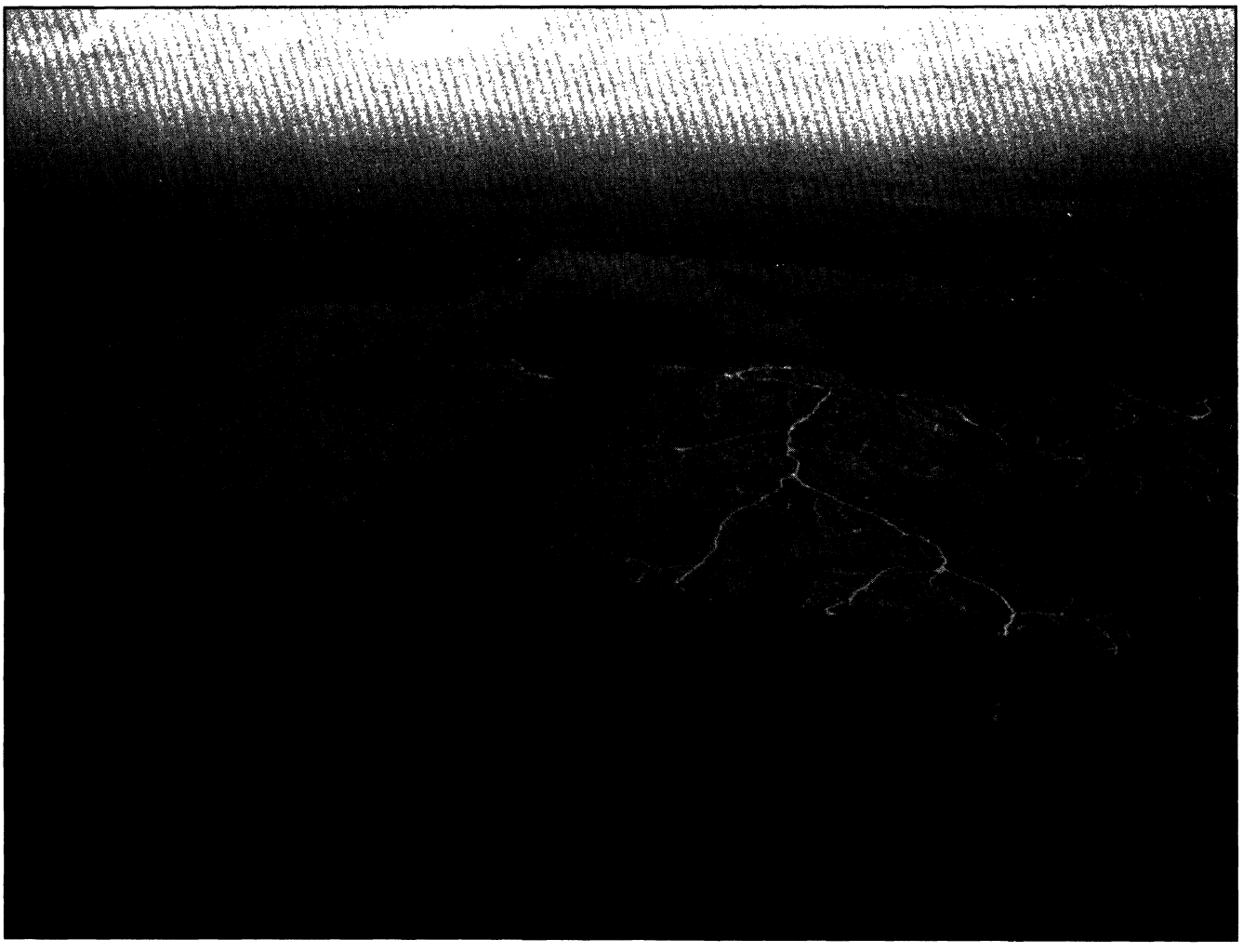

In this Issue

The Wildlife Corridor Controversy: A Review

by

Amy McEuen

If what we have said is correct, it is not possible to preserve in a State or National Park, a complete replica on a small scale of the fauna and flora of a much larger area...the preserved area becomes an isolate, and the number of species that can be accommodated must apparently fall....The only remedy is to prevent the area from becoming an "isolate" by keeping open a continuous corridor with other preserved areas.

-Preston 1962

Habitat fragmentation is one of the principle causes of the present biodiversity crisis (Wilcox and Murphy 1985), and wildlife corridors are the most widely advocated method for countering fragmentation effects (e.g., Noss and Harris 1986). Corridors have been recommended on all scales and for a variety of habitats and species—from road verge (roadside vegetation) connections in the highly developed Wheatbelt of Australia for the Carnaby's cockatoo (*Calyptorhynchus funereus latirostris*) (Saunders 1990), to large-scale networks across North America for large, wide-ranging carnivores (Noss 1992). Corridors also have been recommended for endangered species such as the red-cockaded woodpecker (*Picoides borealis*) (Anonymous 1988 as cited in Simberloff et al. 1992) and Florida panther (*Felis concolor coryi*) (Noss and Harris 1986). The conservation function of corridors, however, remains a widely debated issue (e.g., Simberloff and Cox 1987, Noss 1987, Simberloff et al. 1992). Widespread recommendation and debate makes it imperative that everyone working in the conservation field understand the theoretical and empirical history of the corridor concept. The following is an overview of this history, along with some recommendations for future directions of corridor theory and research.

The Definition Quandary

Various disciplines have defined corridors differently. Biogeographers tend to define corridors as "a route that permits the spread of many or most taxa from one region to another," such as a land bridge connecting two continents (Brown and Gibson 1983:215). However, the large scale of biogeographic corridors makes this definition unsuitable for conservation biology, since some wildlife corridors may be only ten meters wide. In landscape ecology, any linear landscape element, such as a road, ditch, trail, powerline right-of-way, riparian strip, habitat linkage, fencerow, and hedgerow, constitutes a corridor (Forman and Baudry 1984). This definition is not adequate for conservation biology either, since some of these landscape elements may aid while others hinder conservation objectives. The conservation function of these elements is also context dependent—a right-of-way cutting through continuous forest can create detrimental edge effects and be a barrier to movement, but a right-of-way in an urban setting may contain the last remnants of native vegetation and serve as a conduit between habitat patches.

Many early conservation papers discussing corridors did not explicitly define the term (e.g., Simberloff and Cox 1987, Noss 1987, Harris and Gallagher 1989), while others used the landscape ecology definition (Noss and Harris 1986). This resulted in confusion over what was being advocated and muddled the debate (Simberloff et al. 1992). Perhaps because of this, more recent papers have given very precise definitions resulting in a growing consensus regarding what is meant by a wildlife corridor. A "faunal dispersal corridor" has recently been defined as a "naturally occurring or restored native linear landscape feature that connects two or more large tracts of essentially similar habitat and functions as either a movement route for individuals or an avenue for gene-flow among native flora and fauna" (Harris and Scheck 1991:202). Similarly, Soulé and Gilpin (1991:3) define a "wildlife corridor" as "a linear two-dimensional landscape element that connects two or more patches of wildlife (animal) habitat that have been connected in historical time; it is meant to function as a conduit for animals."

Current definitions emphasize that a wildlife corridor (1) is a linear landscape element (Hobbs 1992, Simberloff et al. 1992, and above), which (2) serves as a linkage between historically connected habitat/natural areas (Hobbs 1992 and above), and (3) is meant to facilitate movement between these natural areas (Newmark in press, Soulé 1991, Simberloff et al. 1992, and above). These last two aspects distinguish wildlife corridors from other landscape corridors.

History of Wildlife Corridor Theory

Preston (1962) was the first to suggest possible conservation benefits of linking reserves with corridors. He examined species-area curves for what he termed "isolates" and "samples." Isolates, such as islands, contain complete assemblages of species. Samples, in contrast, are a sample of a larger assemblage (e.g., a park within a continent). Preston found that for any given area, isolates contained fewer species than samples. He reasoned that this was because samples were "at equilibrium" with areas outside their boundaries (i.e., immigration and emigration allowed samples to support species at very low numbers, numbers which would lead to their extinction in isolates). Drawing the parallel between "isolates" and reserve systems, Preston advocated that

corridors be established between reserves to prevent faunal and floral collapse (see introductory quote).

Using Preston's work as a jumping-off point, MacArthur and Wilson (1967) developed the theory of island biogeography, which predicted that any island would maintain an equilibrium number of species due to the counteracting forces of immigration (related to distance from a source population) and extinction (related to island size). By the 1970s, this theory was being widely applied to habitat fragmentation and reserve design issues, with habitat remnants and reserves being treated as "islands" in a sea of development (see Shafer 1990). Several of those applying the theory advocated corridors between reserves (Willis 1974, Diamond 1975, Wilson and Willis 1975). Although not explicitly stated, the reasoning seemed to be that corridors increase immigration rates and decrease extinction rates (due to greater available area), thereby increasing the equilibrium number of species in a given reserve (Newmark in press).

A slight modification of island biogeographic theory occurred in 1977 when Brown and Kodric-Brown introduced the concept of the "rescue effect." They pointed out that immigration could decrease the extinction risk of an isolated population by boosting local numbers and increasing genetic diversity (leading to increased fitness). This concept only slightly modified island biogeographic theory by altering predictions regarding turnover rate. It was an important addition for corridor theory, however, since many would cite the "rescue effect" as a possible corridor benefit (e.g., Soulé and Simberloff 1986).

Reserve design suggestions based on island biogeographic theory (including corridors) were reprinted in a variety of conservation publications in the late 1970s to early 1980s (Simberloff et al. 1992). Some believe this led to a premature acceptance of the corridor concept (Simberloff et al. 1992). In 1984, Harris published "The Fragmented Forest" in which he argued for riparian corridors, wide enough to prevent blowdown, linking proposed "old growth islands." He cited need for genetic flow and immigration, as well as increased diversity, as primary reasons for corridors.

In the early to mid-1980s, the first criticisms of corridors were made, including the following: (1) habitat unsuitability of corridors—noting that riparian corridors will not serve as a conduit for non-riparian species; (2) high rates of poaching or trapping in corridors; (3) the importance of corridor width and habitat variety for use by non-generalist species; (4) fear that corridors would lead to the establishment of smaller reserves; (5) negation of the quarantine effect of isolation (e.g., allowing disease to spread between populations); and, (6) increased exposure to domestic animals harboring disease (Frankel and Soulé 1981, Soulé and Simberloff 1986). Frankel and Soulé (1981) did note, however, that small, closely spaced reserves would need corridors to maintain larger animals.

Frankel and Soulé (1981) were also the first to advocate wider corridors. This followed Wilson and Willis' (1975:529) contention that even thin corridors would serve a conservation function: "extinction will be lower when the fragments are connected by corridors of natural habitat, no matter how thin the corridors." Though Frankel and Soulé (1981:109) advocated wider corridors, they followed this advice with, "Granted, corridors should be established wherever possible," seeming to echo Wilson and Willis' statement that any corridor is better than none, regardless of width.

In the late 1980s, corridor theory shifted away from an emphasis on island biogeographic theory and its predictions of higher species numbers in connected reserves, toward a species-level argument based on metapopulation theory (see below). Perhaps this switch reflected growing criticisms of island biogeographic theory (see Shafer 1990), as well as a growing disillusionment with species number (diversity) as a conservation objective, since one can increase local diversity while decreasing regional diversity (e.g., Noss 1983). Regarding the first point, Miller and Harris (1977) argued that reserve designs arising from island biogeographic theory can be justified by evoking only species-area relationships, indicating that criticisms of

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Cover: A corridor connecting a 100ha reserve (center) to continuous forest in the Brazilian Amazon. Photo by R. Bierregaard.

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island biogeography theory do not directly criticize the validity of these designs.

Unlike island biogeography, metapopulation theory (Levins 1970) applies to individual species and does not have to assume a "source" population. This theory addresses the population dynamics of species with spatially patchy population structures linked by dispersal (Gilpin 1987). Metapopulation structure may occur in a naturally heterogeneous landscape, or may be a result of habitat fragmentation (Merriam 1991). Population survival within such a structure is thought to depend on the rate of local extinctions within patches, and the rate of immigration between patches. If a species is prone to local extinctions and the local extinction rate is greater than the patch recolonization rate, local extinctions will accumulate in the landscape and will eventually lead to metapopulation extinction (in some cases this may be equivalent to species or subspecies extinction). If corridors between patches enhance immigration, then they can (1) allow recolonization of extinct patches, (2) boost local population growth, (3) provide gene-flow (if some immigrants breed), and (4) enhance overall metapopulation survival (Merriam 1991).

Current Wildlife Corridor Theory

Recently, corridor theory has become a very popular issue resulting in multiple publications and the development of the first theoretical models. In 1987, Simberloff and Cox presented the first full-scale critique of corridors. Although they acknowledged that corridors could have all the advantages outlined above, could be important for wide-ranging species, and could constitute important habitat "in its own right," they felt that many of the possible negative impacts had been ignored. Building on the earlier arguments against corridors (Frankel and Soulé 1981, Soulé and Simberloff 1986), they noted the following: (1) the paucity of data on corridor use; (2) the lack of sufficient controls in corridor field studies; (3) the risk of spread of catastrophes through corridors (predators, fire, disease); (4) the potential for corridors to serve as an entry route for weedy or exotic species; (5) economic factors, including higher management cost due to high edge-interior ratio and the cost of building bridges over corridors; (6) the conflict with other conservation acquisitions; and, (7) outbreeding depression. They also suggested that translocations of animals might be as effective as corridors and less costly. Noss (1987), replying to this critique, emphasized the urgent need for strategies to counter fragmentation. The fact that the natural landscape had been connected in the past seemed to him to be the best argument for corridors. He also emphasized that natural connectivity should not result in outbreeding problems, that corridors may enable some species to avoid predation, and that translocations would not be sufficient for suites of species. Other recent arguments for corridors have included accommodation of range shifts due to climate change (e.g., Graham 1988), fire escape function (Noss 1991), and maintenance of process connectivity (Noss 1991). Recent arguments against corridors include (1) the possibility that they will be a demographic sink (Soulé and Gilpin 1991) and (2) the paucity of data on both inbreeding depression and small population risk (Simberloff et al. 1992).

Most recent theorists have sided in favor of corridors despite critiques—the feeling seems to be that they are the best, although by no means perfect, solution to a complex problem (e.g., Harris and Atkins 1991). As hesitation has grown among advocates, an increased emphasis has been placed on the need to design corridors specifically for native, conservation-priority target species (e.g., Soulé 1991). In addition, increasing awareness of the negative impacts of edge effects (Harris 1988, Yahner 1988) and the impact of roads on wildlife, both as barriers and sources of mortality (Bennett 1991), has led most theorists to recommend wide, continuous corridors (e.g., Hobbs and Hopkins 1991, Noss 1987, 1991). Optimum corridor width is a much-raised question, with most claiming it will be situation specific. Harrison (1992) suggested that width be based on home range requirements. Others (e.g., Newmark in press) have used edge effect data to determine minimum acceptable width.

The first theoretical model on corridor capability was developed by Soulé and Gilpin (1991). Scoring "success" as an animal reaching the connected patch, they found that success increased asymptotically with increased width, suggesting that corridors have an optimum width determined by edge effect—narrow corridors had high mortality rates, but animals tended to "wander" in wider corridors. They also found a linear corridor shape to be superior to all other shapes modelled.

Table 1. Species distinctions and related questions relevant to corridor work.

Species Categories	Relevant Questions
1. Edge vs. Interior species	Do residency rates and movement rates through the corridor differ between groupings? How does this change with changing corridor parameters?
2. Exotic vs. Native species	
3. Regionally abundant vs. Regionally rare species	
4. Generalist vs. Specialist	How do habitat requirements and a species' perception of the environment affect the utility of corridors (i.e., a species' ability to distinguish and utilize corridors)?
5. Coarse-grain vs. Fine-grain (see Pianka 1988)	
6. Naturally fragmented vs. Naturally continuous habitat	

Wildlife Corridor Research

Since one of the principle arguments against corridors is that there is no evidence of their utility, a review of the research that has been conducted is of primary importance. Studies have ex-

amined species richness effects, population dynamics, and corridor utilization, as well as gap, width, and composition effects.

Species richness. Few studies have examined whether corridors increase species number in the manner predicted by theory. MacClintock (1977) found high avifauna species richness in a 35 acre fragment connected by a corridor to a larger forest patch (fragment species composition similar to extensive areas). However, this study failed to control for close proximity of the fragment to extensive forest (Margules et al. 1982). In contrast, Dmowski and Kozakiewicz (1990) found no difference between connected and unconnected areas of a littoral zone.

Population dynamics. Many studies have looked at the effect of corridors on population dynamics. Models and field data indicate higher population growth rates for white-footed mice (*Peromyscus leucopus*) in woodlots connected by fencerows versus isolated woodlots (Fahrig and Merriam 1985). Similarly, La Polla and Barrett (1993) found higher meadow vole (*Microtus pennsylvanicus*) densities when corridors were present in their treatments, and Dmowski and Kozakiewicz (1990) found higher abundances of non-littoral birds in littoral areas connected via a corridor. Construction of a rock corridor beneath a road bisecting breeding areas of the rare mountain pygmy-possum (*Burramys parvus*) allowed male dispersal and resulted in higher adult female survival (Mansergh and Scotts 1989). Pygmy-possum use of the corridor was verified by self-triggered cameras. In a laboratory study involving two species of *Drosophila* (*D. hydei* and *D. pseudoobscura*), connections between experimental systems lowered the extinction rate for one species (*D. pseudoobscura*) (Forney and Gilpin 1989).

Corridor utilization. Corridors abutting larger habitat areas are used by certain species. Wegner and Merriam (1979) found high rates of movement between woodlots and adjoining fencerows for birds and small mammals. Johnson and Adkisson (1985) noted that 91% of blue jays (*Cyanocitta cristata*) leaving and entering a woodlot used fencerows. Jays were also observed to fly into fencerows when hawks appeared.

Demonstrating that corridors are used preferentially for movement across the landscape (e.g., between patches) is very difficult (see Nicholls and Margules 1991, Inglis and Underwood 1992). Studies which have attempted to address this have compared corridor with non-corridor sites, examined movement patterns of individuals (radio-collared or trapped), or used presence/absence data to infer utilization of corridors.

Haas (unpubl.) found significantly more interpatch movement by American robins (*Turdus migratorius*) between patches connected by wooded riparian corridors compared to unconnected patches. Similarly, Dmowski and Kozakiewicz (1990) found more bird movement between forest and littoral zones connected by a shrub corridor (66% of movements) than between unconnected zones (29%). In an experimental study with meadow voles (La Polla and Barrett 1993), higher male dispersal occurred between patches with corridors than those without (no difference found for female voles). Tracking verified that this dispersal had occurred via the corridors. Szacki (1987) recorded 50 movements of 31 individual bank voles (*Clethrionomys glareolus*) between a coniferous forest patch connected to a larger forest by a shrub corridor, compared to no movement from an isolated patch. However, the isolated patch was smaller and farther away than the linked area. In the same study, Szacki observed no isolation effect for the yellow-backed mouse (*Apodemus flavicollis*).

A number of studies have examined movement patterns in connected systems to see if movement would occur along corridors. Henderson et al. (1985) simulated a local extinction by exhaustively trapping Eastern chipmunks (*Tamias striatus*) from woodlots. "Extinct" patches were readily recolonized. In addition, 90% of all recorded movements were known to have occurred along fencerows.

In a radio-tracking study (Merriam and Lanoue 1990), white-footed mice preferentially used fencerows for movement (77-92% of distance moved), with higher use of fencerows by translocated animals. Bennett (1990) found that all of the eight small mammals known to occur regionally in Naringal, Australia were present in corridors. In addition, movements between corridor trap sites and sites within patches, as well as movements between patches via corridor sites, were recorded for certain species. This study, however, has been criticized because of its failure to trap outside of corridors (Simberloff et al. 1992). In an experimental study involving enclosures (Lorenz and Barrett 1990), house mice (*Mus musculus*) were found to move along vegetated strips connecting patches of planted oats (*Avena sativa*), with preference for strips containing split-rail fencing. In a bird banding study in the Wheatbelt of Australia, Saunders and de Rebeira (1991) found that movements of 15 out of 17 species that were recaptured appeared confined to the network of verges and reserves.

Clearly, the majority of corridor work to date has focused on ubiquitous and small-sized species that are not "target species" for conservation efforts. An exception to this is the radio-tracking work Beir (1993, Beir and Barrett 1993, Beir unpubl.) has done with mountain lions (*Felis concolor*) in the suburban matrix of southern California. Part of the aim of this work was to examine the use of two intra-range corridors and one inter-range corridor. Beir found that of nine dispersing cougars, five found and used one or more of these corridors. One individual used an intra-range corridor successfully at least 22 times. In a similar study, radio-collared Florida panthers (*Felis concolor coryi*) have been observed to use narrow forest strips connecting larger areas (Maehr 1990).

For some species, corridors may not be necessary for movement across the landscape. Arnold et al. (1991) concluded that although verges were used by kangaroos (*Macropus fuliginosus* and *M. robustus*) for both residency and movement, they were not required for movement between remnants. In a radio-tracking study of translocated and resident koalas

(*Phascolarctos cinereus*), Prevett (1991) found that all translocated individuals, as well as two out of four residents, crossed open areas. Seasonal shifts in the presence/absence of frugivorous pigeons in rainforest fragments led Date et al. (1991) to conclude that "stepping stone" remnants along an elevation gradient were sufficient for the movement of these birds. It is important to note that all of these studies were set in an agricultural matrix; in a less hospitable matrix (urbanization), results may have differed.

Effect of gaps, width, and composition on corridor function. Corridor function is thought to be hindered by the presence of gaps. Some observational data from Lovejoy et al. (1986) supports this theory. They found that ant birds declined and finally disappeared from a 100ha plot of forest when a 300m gap was created in a 2km corridor connecting the plot to extensive forest.

Width and vegetational composition often vary together; Arnold (1987 as cited in Panetta and Hopkins 1991) found that weed invasion in road verges was inversely related to corridor width. Some experimental studies and models, however, have allowed for the separation of these variables. La Polla and Barrett (1993) found no difference in meadow vole densities between treatments with one meter versus five meter wide corridors. However, interpatch dispersal of male voles was higher for the narrower corridor. They postulated that this was due to the wider corridors being perceived as patch extensions and not as corridors per se. Baur and Baur (1992) simulated width effects based on empirical data for the land snail (*Arianta arbustorum*), and found that dispersal distance increased with width.

Studies that have looked at the combined effects of width and composition tend to find preference for wider and more complex corridors. Merriam and Lanloue (1990) found that white-footed mice preferentially chose wider corridors with more complex vegetation for movement. Keals and Majer (1991) observed an increase in the number of species and functional groupings present for ants as the verges sampled increased in width and changed to native vegetation. For birds in the Australian Wheatbelt, a significant positive trend was found between number of remnant-dependent species and road verge width (Saunders and de Rebeira 1991). Lynch and Saunders (1991) also observed that Australian birds dependent on native vegetation tended to be found in wider, more densely vegetated corridors.

A model developed by Henein and Merriam (1990) also provides insight into this issue of width/composition by pointing out the importance of maintaining high-quality connections between patches. They examined metapopulation dynamics with varying corridor "quality," where corridors of lower "quality" had higher simulated mortality rates. They found that for two isolated patches, adding a connection of any quality increased metapopulation size. However, beyond such an addition, increasing the number of high quality corridors increased metapopulation size, but additional low-quality corridors *decreased* metapopulation size (even if this meant adding a new patch to a high-quality network).

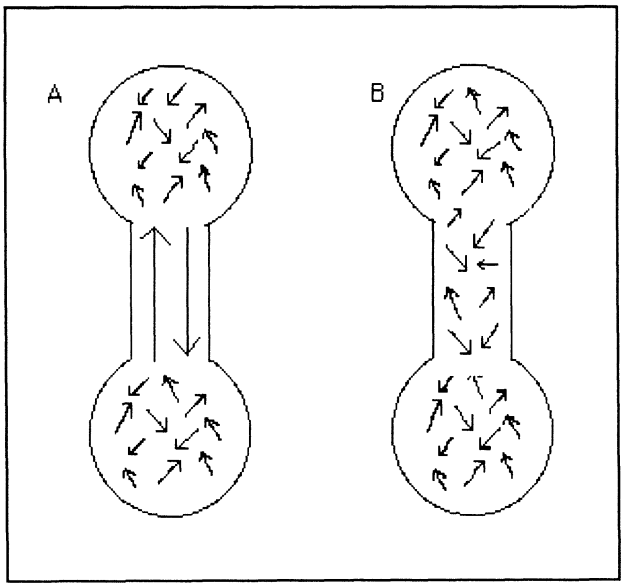

Figure 1. Two models for corridor movement. Model A illustrates movement patterns expected when the corridor is composed of transitional habitat: the corridor facilitates dispersal (long arrows) and migration only. Model B illustrates movement patterns expected when the corridor contains survival habitat throughout: animals establish residency throughout the corridor with home range movements (short arrows) occuring within the corridor.

Where Do We Go from Here?

The first step for corridor theorists and researchers to take is to agree upon a definition for the term "wildlife corridor." If there is agreement that wildlife corridors refer to natural landscape elements linking historically connected habitat patches, then, for example, the fact that roads or trails serve as conduits for exotic species is no longer directly relevant to the corridor debate. Given agreement on a definition, the question will then become: "Under what circumstances will wildlife corridors serve a conservation function?"

The major dispute in corridor theory is not whether corridors will serve a connectivity function, but rather what kind of connectivity they will supply. Will they serve as corridors for exotics and disease, for native target species, or both? Future research should emphasize such distinctions in species type, examining which types of species utilize corridors and how this changes with changing corridor conditions (width, length, composition). The beginnings of such an approach are already evident in certain papers (Lynch and Saunders 1991, Saunders and de Rebeira 1991). Species categories that might be important to study and associated questions that research and theory could address are outlined in Table 1 (page 3). In addition, it will be useful for researchers and designers of corridors to distinguish the type of movement and habitat they are attempting to conserve within a corridor. Stenseth and Lidicker (1992) refer to three types of movement: (1) dispersal—one way movement away from a home site; (2) migration—round trip movements; and, (3) movements—individual movements (e.g., around a home range). In addition, they distinguish between three habitat types: (1) transitional habitat—habitat suitable only for movement of a disperser; (2) marginal habitat—habitat allowing survival and sometimes reproduction; and, (3) survival habitat—"good habi-

tat," in which both survival and reproduction can occur.

Why are these distinctions important for corridor theory? If a corridor provides survival habitat, movement may be as shown in Figure 1, Model B, (page 5), with residents established throughout the corridor and moving within their home ranges. In this situation, the length of the corridor is no longer an issue. There is no need for an individual to reach the other patch, since survival and reproduction can occur in the corridor. If, however, the corridor provides only transitional habitat, only dispersers would be expected to move through the corridor (Figure 1, Model A). In this case length is a critical issue, since dispersers must reach the other patch to reproduce.

The issue of corridor width also is affected by these distinctions. Soulé and Gilpin (1991) postulated that there may be an optimum corridor width since animals would wander in wider corridors and not reach the connected patch. However, animals only need to reach the connected patch if the corridor is transitional habitat. If the corridor provides survival habitat, then getting caught in a corridor is really no worse then getting caught in a reserve.

Conclusion

Many researchers have emphasized that the use of corridors will be species and situation specific. One goal of science, however, is to search for generalities. Finding such ecological generalities or principles for corridor utilization will be the task of corridor workers in the years to come. Preservation of our native biota, particularly the large carnivores, may well depend on our ability to successfully address this issue.

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(Continued on UPDATE page 12)

Georgia's Nongame and Endangered Wildlife Progam

by

Robin Russel and Jim Ozier

Since the birth of the Endangered Species Act (ESA) twenty years ago, nongame and endangered wildlife management in Georgia has undergone many changes. Much of this change has taken place within the government agency responsible for Georgia's endangered species. Originally, natural resource protection and management was the responsibility of four divisions—Coastal Resources; Environmental Protection; State Parks, Recreation, and Historic Sites; and Wildlife Resources (recently changed from Game and Fish Division to better reflect a more holistic approach)—all of which were scattered throughout the state government. Under a reorganization initiative in the early 1970s by then-Governor Jimmy Carter, the Department of Natural Resources (DNR) was established to bring together and house these four separate entities.

In the mid-1970s, an Endangered Species Program and a Protected Plant Program were established for the purpose of managing all the state's endangered animal and plant species, respectively. These programs originally were administered by the Game Management Section within the Game and Fish Division. However, in the early 1980s, responsibility for management of all coastal endangered animals moved to the Coastal Resources Division.

As nonconsumptive recreation relating to wildlife gained popularity, state officials recognized the need to initiate management of nongame wildlife in general. The Endangered Species Program became the Nongame and Endangered Wildlife Program in 1985 when the Nongame Wildlife Conservation and Habitat Acquisitions Fund legislation was passed by the state. This law also provided for a state income tax checkoff to fund the Program. Once this legislation passed, administration of the Nongame Program, along with funds supporting the Program, were moved directly to the office of the DNR Commissioner. [The Protected Plant Program was reorganized to form the Georgia Natural Heritage Inventory. Although funding for this program came from sources other than the checkoff, the program was moved at this time to the Commissioner's Office.]

Within a couple of years, the Nongame Program outgrew its fledgling confines and was moved, as was the Georgia Natural Heritage Program, back to the Wildlife Resources Division. More recently, management of coastal nongame and endangered wildlife was moved from the Coastal Resources Division back to the Nongame and Endangered Wildlife Program.

Georgia's Nongame and Endangered Wildlife Program is unique among efforts within the DNR in that it crosses division lines. Nongame funds are used for projects within the Wildlife Resources, State Parks, Recreation and Historic Sites, and Coastal Resources Divisions. The directors of these Divisions foster and encourage strong, intra-divisional working relationships between DNR associates. Wildlife biologists often find themselves assisting state park managers with wildlife habitat management on park lands, and park interpretive naturalists assist managers of wildlife management areas in constructing wildlife and nature trails on these lands.

Georgia's Endangered Wildlife Act

In 1973, closely following the enactment of the ESA, Georgia passed the Endangered Wildlife Act (EWA) (O.C.G.A. 27-3-130) and the Wildflower Preservation Act (WPA) (O.C.G.A. 12-6-170). These pieces of legislation directed the DNR to identify any plant and animal species determined to be rare, unusual, or in danger of extinction, and to designate these species for protection under the Acts. The Board of Natural Resources, consisting of 15 appointees named by the governor, was directed to issue rules and regulations allowing for the protection of these species and enforcement of the Acts. The rules created by the Board categorize protected species as endangered, threatened, rare, or unusual, and all categories receive equal protection under Georgia's Acts.

The original list of protected species was approved in 1975 and underwent only minor changes until 1991. At that time, a comprehensive revision process was initiated to bring the list up to date. The list then included 58 plants, 2 fish, 1 amphibian, 4 reptiles, 7 birds, and 7 mammals; no invertebrates were included. Input was solicited from academic and professional communities, as well as private citizens, and a list of species to be considered for addition or deletion was developed. The list which finally passed the Board of Natural Resources in 1993 included 103 plants, 10 invertebrates, 55 fish, 7 amphibians, 13 reptiles, 16 birds, and 10 mammals.

During development of the list, several concerns arose that are worth mentioning. Some people were apprehensive that the list would be "too big," and that a more conservative approach should be taken to make the list more politically palatable. Others argued from a purely biological viewpoint that many eligible species deserving protection were omitted. These differing opinions became especially apparent as the DNR debated how to treat species that were rare or of restricted range in Georgia, but were common or widespread elsewhere. In order to help maintain genetic and geographic diversity, a decision was made to protect species in this category.

Another major issue that arose during the development of the list had to do with the definition of public lands. The

EWA of 1973 stipulates that "such rules and regulations shall not affect rights in private property or in public or private streams, nor...impede construction of any nature" and "shall be limited to the regulation of the capture, killing, or selling of protected species and the protection of habitat of the species on public lands." The 1973 WPA defines "public lands" as those "owned by the state or which are subject to the dominion and control of this state and which are not owned and controlled by any private person." Soon after its formation, the Board of Natural Resources issued a rule that expanded the definition of public lands to include those under the control of the United States and local governments. During development of the protected species list in 1993, the DNR encountered resistance from a development company, a timber company, a reptile dealer, and a private landowners' association. Although the finalized list did pass the Board, these interest groups insisted on a number of changes in the rules. One of these changes was to exclude federal and local government lands from the definition of public lands. While proponents of the new list opposed these changes, it was determined from a legal standpoint that the change was indeed necessary, because a Board ruling cannot supersede the authority delegated the Board by law. Thus, the conservative definition of "public lands" found in the WPA was determined to be applicable to the EWA, rather than the rule's more liberal definition.

Funding Sources

The state income tax checkoff, the first in Georgia's history, went into effect with the 1989 tax year. Not wanting to delay nongame and endangered wildlife project work, Georgia's governor issued $325,000 in challenge grants in 1987. An executive committee made up of prominent business leaders and concerned individuals initiated a fundraising campaign that met the Governor's challenge, raising more than $425,000.

Innovative funding strategies were

Sea Turtle Conservation in Georgia

Coastal Georgia, with its offshore waters, largely undeveloped barrier islands, and expanses of highly-productive saltmarshes and estuaries (28 percent of all the marshes and estuaries in the world exist in Georgia), presents an especially diverse array of management needs for listed species. Sea turtles are among these species with special needs.

Five species of sea turtle— the green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), and loggerhead (*Caretta caretta*)—are found in Georgia's coastal waters, with the loggerhead by far the most numerous. The loggerhead is also the only sea turtle to nest on Georgia's barrier island beaches. An average of approximately 1,000 loggerhead nests are laid each year; the recovery goal is 2,000 nests. A number of activities have enhanced the loggerhead's hatching success, such as nest protection through relocation and screening, and feral hog control through trapping and shooting. On one island plagued in past years by heavy hog predation, an intensive control program on the beach resulted in no detected hog predation in 1993. A factor contributing to increased hatching success on developed beaches in particular has been the implementation of local ordinances restricting beach lighting during the turtle nesting period (May-October).

Researchers have been tagging and monitoring nesting sea turtles in Georgia for several years. These studies provide information on movement and migratory patterns, nesting frequency, number of clutches per year, nesting beach fidelity, growth rates, and population parameters such as survivorship, mortality rates, and population size. Georgia also participates in the Sea Turtle Stranding and Salvage Network. Dead, beach-stranded turtles, including loggerheads, leatherbacks, and Kemp's ridleys, are recorded and related to mortality factors. Principal causes of death have included entanglement in shrimp nets and offshore gill nets. Since the enforcement of Turtle Excluder Device (TED) regulations, beach-strandings have been below average. Total annual stranding numbers have ranged from 117 to 805 in recent years. Leatherbacks, however, are often too large to be protected by TEDs on shrimp nets. Aerial surveys out to eight miles at sea this spring detected 42 leatherbacks over a total of 1,560 linear survey miles.

Loggerhead sea turtles (*Caretta caretta*) and their recovery in Georgia are the focus of several Nongame Program projects and studies being conducted in the state. One cause of death for this threatened species is entanglement in shrimp nets. Enforcement of TED regulations has helped reduce loggerhead mortality in Georgia. (Photo by Georgia DNR.)

initiated with the establishment of programs such as Adopt-an-Eagle, which provided the public with an opportunity to support specific projects. Donations are solicited also, with the public encouraged to "earmark" donations for a particular wildlife species or project. These funding campaigns work hand-in-hand with the DNR's public education efforts, a strategy that began paying off in the first checkoff year. With minimal resources for promotion, the Nongame Program managed to raise $350,000, and checkoff proceeds during the first four years have averaged $437,250.

Unfortunately, this money is hardly sufficient to fund the type of nongame and endangered wildlife program Georgia desires. While checkoffs would be a steady funding source in an ideal world, recessions and competing checkoffs reduce their appeal to taxpayers and make long-term planning difficult. Georgia's DNR began supplementing the checkoff immediately with "Weekend for Wildlife," an annual event that has directly raised more than $320,000. Indirectly, "Weekend for Wildlife" has helped build a constituency among private corporations who regularly sponsor nongame projects, business leaders and legislators who willingly assist in fundraising or proposing legislation, and prominent environmental and civic organizations that help promote nongame and endangered wildlife.

More recently, a private group of citizens has formed an organization called "The Environmental Resources Network" (T.E.R.N., Inc.). The sole purpose of this group is to raise money for the Nongame and Endangered Wildlife Program. Some 120 people joined T.E.R.N. during its first six months of accepting memberships, and the group has already begun funding several nongame projects.

Program Obstacles

The largest obstacle facing Georgia's Nongame Program, as with many nongame/endangered wildlife programs, is a lack of sufficient, dependable funding. Surveys indicate that more than 80 percent of Georgians have an interest in state agency involvement with endangered species research and management, but general appropriations have not been made available. Because we depend heavily on donations, a large proportion of our effort is linked to projects that, while not necessarily biological priorities, are perceived to be popular with the public. Raptor hacking, for example, requires a lot of time and money, but also attracts a great deal of public attention and support. We hope that secure state funding becomes available soon, so our efforts can be directed into additional, biologically essential areas of research and management [e.g., freshwater fishes and invertebrates, gopher tortoise (*Gopherus polyphemus*) burrow commensals, biodiversity management in general], and into more comprehensive educational programs.

Lack of funding also limits staff size and capabilities. Until 1993, the Program operated with only one or two field biologists. This year we brought the total at the main office to three, one of whom will be responsible for the Breeding Bird Atlas that is just getting underway. Also, the recently incorporated coastal nongame and endangered wildlife programs added two biologists and a technician to the overall staff.

Nongame Small Grant Program

We depend heavily on outside assistance and have nurtured a highly qualified network of volunteers and scientific advisors. This greatly enhances and diversifies the expertise and capabilities of the Program. In 1989, a small grant program was established to further draw upon outside expertise. Project proposals are solicited and reviewed by a panel before final approval. Awards average approximately $2,000, with those projects that deal with species of concern receiving the highest priority. Recently funded studies have dealt with the gopher tortoise, bog turtle (*Clemmys muhlenbergii*), alligator snapping turtle (*Macroclemys temminckii*), and salamander and fish communities. We also are supporting research on the status and protection needs of the robust redhorse (*Moxostoma sp.cf. carinatum*). This large fish had been vaguely described last century in South Carolina, but had not been reported again until 1980 when one specimen was discovered in Georgia's Savannah River, and again in 1985 when another specimen was discovered in the Pee Dee River in North Carolina. More recently, however, biologists in the Wildlife Resources Division's Fisheries Management Section discovered eight specimens in the Oconee River. The U.S. Fish and Wildlife Service (USFWS) is being petitioned for emergency listing of this species.

Information and Education

The Program's constant need for public awareness and fundraising makes an information and education staff essential. The Information and Education unit has grown from one individual in 1989, to four in 1992. These staff members are responsible for all aspects of the Program's communications, including the following: public relations; media relations; producing brochures, newsletters, posters, and promotional material; writing television and radio public service announcements; fundraising; and, coordinating special events. This unit also works one-on-one with biologists to coordinate most of the surveys and projects that enlist public participation. Although this unit has focused primarily on the need to raise money and public awareness regarding nongame and endangered wildlife, it is creeping toward the goal of making education its main priority.

The **Hummingbird Helper Survey** has been a public relations and biological research success in Georgia. Each year, more than 5,000 requests are made for the Hummingbird Helper Survey and the free Hummingbird Garden Seed Packet distributed by the Nongame Program. When participants return their completed survey forms, the Nongame Program sends them a Hummingbird Helper decal for their participation. The first survey year was 1989; at that time, only the ruby-throated hummingbird (*Archilochus colubris*) had ever been seen in Georgia. Now the black-chinned (*Archilochus alexandri*), rufous (*Selasphorus rufus*), Anna's (*Calypte*

Protected Plants

Botanists with the Natural Heritage Program are currently conducting status surveys for the fringed campion (*Silene polypetala*) and Alabama milkvine (*Matelea alabamensis*). In addition, surveys are being conducted to find new populations of Canby dropwort (*Oxypolis canbyi*), for which management plans are being developed and the effects of habitat disturbance assessed, and dwarf sumac (*Rhus coccinea*), for which attempts are being made to establish extirpated populations. Also, the Program is working in conjunction with the Atlanta Botanical Gardens to reestablish populations of green pitcherplants (*Sarracenia oreophila*) and Florida torreya (*Torreya taxifolia*). Another function of the Natural Heritage Program is to work with landowners interested in managing protected plants on their property. Technical assistance is provided to help ensure perpetuation of protected plant populations, and a computerized database of occurence records helps mitigate development damages.

Wood Storks

Georgia's wetland habitat for wood stork (*Mycteria americana*) nesting and foraging becomes increasingly important to the bird's survival, as habitat in south Florida becomes less suitable due to altered hydrology and development. Biologists with the state's Nongame and Endangered Wildlife Program have been conducting surveys of wood stork rookeries since the early 1980s. In 1993, Georgia had nine rookeries with a total of almost 1,600 nests. Production was very good, with just under three young on average produced per nest. In addition to rookery surveys, biologists maintain a database on reported wood stork foraging sites. This information helps predict potential impacts of development projects affecting particular wetlands. Since the late 1980s, Georgia's Program has worked with the USFWS and the Army CEO in overseeing the restoration of a drained rookery. The project, completed in 1991, was a successfull effort, with a high number of storks returning to the site to nest in 1993.

Wetland habitat in Georgia for nesting and foraging becomes more important to wood stork (*Mycteria americana*) populations as habitat in south Florida becomes less suitable. (Photo by Georgia DNR.)

anna), and broad-tailed (*Selasphorus platycercus*) hummingbirds have been discovered and banded in Georgia. A network of hummingbird helpers have made these discoveries possible.

To encourage Georgians to feed birds during the winter and learn more about bird feeding practices, the Nongame Program has initiated a **Wild Bird Feeding Survey**. Pennington Bird Seed Manufacturers has been recruited as a co-sponsor of this project, and has helped secure commitments from large bird seed distributors—Kroger grocery stores, Home Depot, and Wal-Mart stores—throughout Georgia to put the survey forms on display in their stores. Millions of Georgians will have access to these survey forms.

Several years ago, the Nongame Program initiated a **Nursing Home Bird Feeder Project,** in which civic clubs and organizations were encouraged to participate. These groups adopt a nursing home in their area and make a commitment to maintain a bird feeder there. The Nongame Program provides the feeder and the first 50 lb. bag of bird seed, along with field guides and video tapes to help teach nursing home residents about the birds they see at their feeders. Studies have shown that bird watching is mentally and physically therapeutic for nursing home residents, and with the hope that all nursing and retirement homes here are adopted, the Nongame Program is continuing to promote this project.

On the other end of our constituency spectrum, the Nongame Program has a number of educational projects for school-aged children, the most popular being the **Give Wildlife A Chance Poster Contest**. Co-sponsored with the State Botanical Garden of Georgia, this state-wide contest was designed to encourage school teachers to incorporate nongame and endangered wildlife into their curriculum. The contest provides a fun, educational activity for students. State winners are selected in four categories, and are honored by having their artwork published on a poster distributed throughout all Georgia public and private schools. More than 12,000 students participated in 1992.

To augment the "Give Wildlife A Chance Poster Contest," the Nongame Program is working with primary school teachers to produce **educational units** in accordance with the Department of Education's curriculum guides. The units consist of information and learning activities for teachers to use in their classrooms, and will be designed for kindergarten through the fifth grade. The Nongame Program is producing a series of 15-minute films on endangered species for children, the first of which was an award-winning film entitled "Talking About Sea Turtles." The units and films will be packaged together and made available to any school teacher wishing to use them.

To enhance urban wildlife habitats, the Nongame Program has developed a new program called the **Community Wildlife Project**, in which a commu-

nity—a city or town of any size, a subdivision, or neighborhood—can be certified as a wildlife community. The Nongame Program is developing a set of criteria by which communities will be judged, and the Garden Club of Georgia has been enlisted to promote and lead this project within these communities throughout the state.

Bald eagle shootings have become a terrible problem for Georgia—more than five eagles were shot during 1992. The Nongame Program worked with the Division's Law Enforcement Section to develop a new poster with the message **"Hunters Don't Shoot Eagles, Criminals Do."** These posters have been distributed to hunting license dealers and DNR offices throughout the state. A technical bulletin on eagles and other raptors also was produced for instructors of Hunter Safety courses. The poster and technical bulletin serve two purposes: (1) to inform non-hunters that eagle shootings are not condoned by ethical hunters, and that these shootings are not necessarily committed by hunters; and, (2) to teach young hunters about the seriousness of shooting raptors, to teach them how to identify raptors in the wild, and to foster in them ethical hunting practices.

Habitat Loss

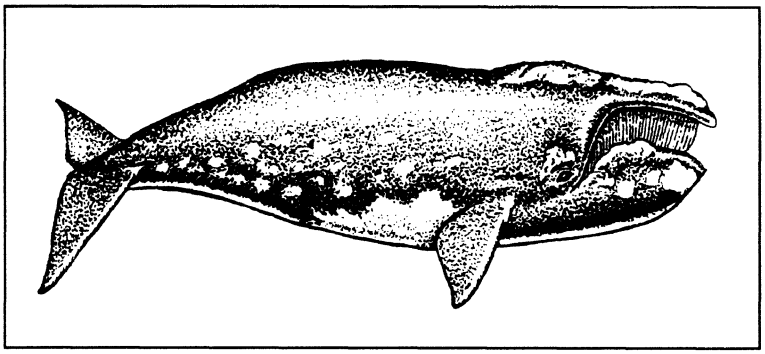
Habitat loss, degradation, and fragmentation is an increasingly overwhelming obstacle in Georgia. This state has several rapidly growing urban areas that are spreading into the surrounding countryside. These, along with particular areas of heavy industrial activity, exert a growing burden on terrestrial and aquatic ecosystems. Extensive areas of intensive agriculture and forest management, especially in the southern half of the state, are also significant factors contributing to the loss of habitat.

The Nongame and Endangered Wildlife Program and the Natural Heritage Program are involved in the site evaluation process for the Preservation 2000 land acquisition program. The goal of Preservation 2000 is to purchase for state ownership "the best of the rest." One of the governor's priorities is to acquire 100,000 acres of land to be managed as state parks, natural areas, and wildlife management areas. To date, $42 million has been raised through an increase in the cost of hunting and fishing licenses, general obligation bonds, federal funds, and cash donations.

The northern spotted owl (*Strix occidentalis caurina*) vs. old growth forest logging controversy in the Pacific Northwest might have a negative impact on endangered species habitat in Georgia. As wood production demands are shifted from that area to the Southeast, additional habitat for red-cockaded woodpeckers (RCW) (*Picoides borealis*) may be jeopardized. Though by far most RCW clusters in Georgia are on public land, working with the few private landowners who have woodpeckers on their property is a top Program priority. Efficient resolution of RCW-

Protecting the Northern Right Whale

The waters off Georgia's southern coast, extending into the coastal waters of northern Florida, provide the only known calving grounds for the remaining 300-350 northern (also known as North Atlantic) right whales (*Eubalaena glacialis*). Surveys are used to gather population data and identify individual whales. During the 1992 season, 13 cow/calf pairs were positively identified. However, during the 1993 season, only 5 calves were confirmed in Georgia and Florida waters. Of the five, only three survived. One fatality was most likely the result of natural causes, while the second fatality occured in a collision with a Coast Guard craft.



Georgia's southern and Florida's northern coastal waters are the only known calving ground of the endangered northern right whale (*Eubalaena glacialis*). Only 300-350 of these giant mammals are left in the world. (Illustration by David Lanier/Georgia DNR.)

Georgia recently implemented an Early Warning System to reduce the risk of collisions between whales and vessels (collisions with ships is a major source of mortality for the northern right whale). Georgia helped develop the system with other agencies, including the New England Aquarium, Woods Hole, the National Marine Fisheries Service, the U.S. Navy, and the Army Corps of Engineers.

The Early Warning System provides whale location information to dredge operators, harbor pilots, tug operators, and others who regularly use the calving grounds. The system requires daily aerial surveys of the most heavily used calving grounds to locate whales. This information is then provided to pilots and others through an established network of communications. Vessel operators use the information on whale distribution to take increased precautions to avoid collisions. These precautions include proceeding at the slowest possible safe speeds at night or in fog if whales are sighted within ten nautical miles of the channel by the previous aerial survey. This system also requires vessels traversing calving grounds to post shipboard watches to look for northern right whales. Through training sessions, Georgia has worked to educate and increase the awareness of mariners who use the calving area.

priority. Efficient resolution of RCW-timber harvest conflicts on private land is important in stemming the tide of anti-endangered species sentiment that seems to prevail in some circles.

Conclusion

During the next few decades, the circle in which Georgia's Nongame and Endangered Wildlife Program exists is expected to continue to grow and expand. A constant promotional and public awareness campaign will help ensure more public support, which in turn should yield the financial foundation this Program so critically needs. As public support grows, so will the autonomy to do more of the endangered species work Georgia's wildlife requires.

Demographically, the constituency of traditional state wildlife agencies is changing. People are demanding all types of outdoor recreational opportunities in addition to traditional hunting and fishing. Nongame/endangered wildlife programs, with new, innovative projects for all types, are bridging the gap between sports enthusiasts and the non-hunting/fishing public. For instance, more people are beginning to watch birds, and those who always have enjoyed birding are beginning to be more outspoken. People are becoming more aware of the dangers of unchecked development, and are now more interested in seeing dollars spent on preserving wildlife habitats, wildlife management areas, and parks. And with more than 80 percent of Georgians interested in nongame wildlife, more than 82 percent willing to support the use of tax revenues for endangered species conservation, more than 5,000 individuals voluntarily participating in a single survey, and more than 12,000 school children learning about endangered wildlife through a poster contest, Georgia's Nongame and Endangered Wildlife Program is optimistic and ready to soar into

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Report From the Field

Reauthorization of the Marine Mammal Protection Act: The Impact on Fisheries and Endangered Marine Mammals

by Sharon Young

This year, Congress is undertaking a reauthorization of the 1972 Marine Mammal Protection Act (MMPA). MMPA was among the first important environmental laws enacted in the 1970s, and predates the Endangered Species Act (ESA). One of the concerns that led to MMPA was the considerable mortality of marine mammals in commercial fisheries. The 1993 reauthorization is expected to provide a plan for meeting the zero mortality rate mandated in the original legislation. The history of the National Marine Fisheries Service's (NMFS) efforts at meeting this goal has been checkered, especially in regard to marine mammals whose populations are depleted.

In 1988, Kokechik Fisherman's Association v. Secretary of Commerce (839 F.2d. 795) reaffirmed that the government could not issue permits for incidental fishery takes of non-depleted stocks of marine mammals if the permitted fishing activity was likely to result in the killing of marine mammals from depleted populations. This led to the inclusion of an interim exemption program for fisheries in the 1988 reauthorization of MMPA. Under the interim exemption, fisheries were allowed to kill marine mammals incidental to their operations, as long as these kills were reported. In addition, data were to be gathered for five years under the interim exemption program in order to develop an effective plan to manage lethal takes of marine mammals. Although this five-year period of data gathering was due to end in September 1993, it has been extended until April 1, 1994, and Congress is currently considering options for a management plan.

Current Proposals

A number of management plans have been submitted to Congress. In November 1992, the NMFS submitted a proposal that was criticized by both fisheries groups and conservation interests. Fishing groups argued that the proposal could unfairly penalize fisheries with low levels of interactions with abundant stocks. Conservation and animal protection groups were concerned that the proposal did not include any incentive to reduce mortality rates. The involved parties participated in mediation, but consensus could not be reached on all issues. A subset of this group presented recommendations to Congress, while dissenting conservation and animal protection groups seeking better monitoring and tighter controls presented alternative recommendations.

On August 4, 1993, the House Subcommittee on Environmental and Natural Resources heard testimony on H.R. 2760 (Marine Mammal Protection Act Amendments of 1993), filed by Representatives Studds (D-MA), Young (R-AK), Fields (R-TX), Manton (D-NY), and Saxton (R-NJ). This bill addresses the reduction of fisheries related mortality in marine mammals. The Senate Commerce Committee has just passed a bill (also called the Marine Mammal Protection Act Amendments of 1993) sponsored by Senators Kerry (D-MA) and Stevens (R-AK).

Options for Reducing Mortality

The primary challenge to enacting a management plan to reduce fishery related mortality in marine mammals is to determine which marine mammal stocks are depleted. Six species of marine mammals that interact with fisheries are currently listed as endangered under the ESA: the humpback whale (*Megaptera novaeangliae*), finback whale (*Balaenoptera physalus*), North Atlantic right whale (*Eubalaena glacialis*), sperm whale (*Physeter catodon*), manatee (*Trichechus manatus*), and Hawaiian monk seal (*Monachus schauinslandi*). Two species are listed as threatened: Steller's sea lion (*Eumetopias jubatus*) and southern sea otter (*Enhydra lutris nereis*). One additional species, the Gulf of Maine harbor porpoise (*Phocena phocena*), has been proposed by the NMFS for listing as threatened. MMPA also lists four additional stocks of marine mammals as "depleted"—the northern fur seal (*Callorhinus ursinus*), the coastal mid-Atlantic stock of bottlenose dolphins (*Tursiops truncatus*), the eastern Pacific stock of spinner dolphins (*Stenella longirostris*), and the northeastern Pacific offshore stock of spotted dolphins (*Stenella attenuata*). However, the depletion status of most stocks of marine mammals has not been determined. This is because census information is difficult to collect, historic and/or current carrying capacities are difficult to calculate, and research monies are limited. This presents a management challenge if takes of depleted stocks are to be avoided, and if permitted takes are to avoid harming any marine mammal stocks.

Each of the proposals Congress is currently considering differs slightly in its approach to this problem. However, all the proposals rely on the Potential Biological Removal (PBR) formula, which determines the maximum number of animals from each stock of marine mammals that can be killed without jeopardizing recovery of depleted or potentially depleted populations. PBR is obtained by multiplying the best minimum population estimate by a known, or a default, reproductive rate. This product is then multiplied by a "recovery factor" to arrive at the PBR. The purpose of the recovery factor is to ensure a conservative removal of animals in order to aid species recovery. The difference in each of the proposals has to do with (1) their determination of the recovery factor, and (2) how the PBR formula applies to ESA listed stocks.

The NMFS proposal uses a recovery factor of 0.1 for endangered stocks,

0.5 for threatened stocks or stocks of unknown status, and 1.0 for stocks already at optimal sustainable populations.

The compromise proposal written by 33 fishing organizations and seven conservation groups differs from the NMFS proposal in that specific recovery factors are not set. Rather, this proposal allows recovery factors to be recommended to the NMFS by species-specific advisory groups comprised of fishing interests, conservation interests, managers, and scientists. Takes of ESA listed stocks would not be controlled by the NMFS, but would be referred to ESA recovery teams for management. The Senate bill reiterates this proposal.

The House proposal (H.R. 2760) provides specific recovery factors. For stocks below maximum net productivity level (MNPL), the PBR is that part of the net increment that can be taken without significantly delaying the time necessary for the population to rebuild to MNPL. For stocks of uncertain status, the product of the best minimum population estimate and one-half the best available estimate of growth rate at MNPL is multiplied by a recovery factor of 0.1 for populations below 10,000, or 0.5 for populations greater than 10,000. Kill levels of all marine mammals would have to be within this PBR. This bill would allow issuance of small take permits for incidental kills of endangered marine mammals, but also proposes that application for such permits would trigger a consultation under Section 7 of the ESA in order to determine jeopardy.

While the differences in these proposals may seem small, they are substantial in terms of numbers of marine mammals that can be killed and, consequently, how seriously animal populations and specific fisheries are affected.

At the August 4, 1993 hearing for H.R. 2760, fisheries groups criticized the rigid recovery factors in the House bill. Conversely, some conservation and animal protection groups criticized the bill for permitting any incidental takes of endangered species, and further criticized its reliance on the Section 7 process, which they argue does not adequately protect marine mammals. Furthermore, the NMFS and others have expressed concern that the House bill and the compromise proposal from fisheries and some conservation groups has reversed the burden of proof in MMPA. Currently, there is a moratorium on marine mammal takes unless evidence shows that stocks are not likely to be harmed. Under these two proposals, takes are permitted unless evidence is produced showing that marine mammal stocks *are* likely to be harmed.

The Final Plan—Who Will Be Affected?

The impact of Congress' final decision may reach beyond fisheries interactions. As fisheries are mandated to reduce their kills to the zero mortality rate goal, questions are raised about how other user groups will be affected. Native peoples, oil and gas explorers, the captive display industry, foreign countries, and other segments of society historically have killed ESA listed marine mammals. Will the management regime applied to fisheries' kills extend to these other groups? The answer to this question is critical. For example, if the captive display industry is allowed to remove marine mammals from the wild, will their takes be deducted off the top of the PBR as they have requested, thereby reducing the number that can be killed by fisheries?

Another issue that has been raised is that of inequities in permitting. Scientists must fill out extensive applications for permits to "harass" marine mammals during non-lethal research, while fisheries are allowed general authorization to fish and take marine mammals (within the PBR). The issue of PBR has important international implications as well. Altering our protection of ESA listed and depleted populations of marine mammals influences other nations to seek and find reason to omit or reduce their protection.

Managing kills of marine mammals by fisheries may be only the first step in reducing their mortality. Non-commercial users and habitat degradation have yet to be considered, even though both are likely to have significant impacts on the recovery of marine mammal stocks. Recreational boaters for example, not commercial fisheries, pose the greatest threat to endangered manatees.

Conclusion

Due to the large number of conflicting proposals and the fact that many of the differences are difficult to settle, the House has passed a bill which will extend the expiration date of the current interim exemption program to April 1, 1994. In addition to differences in the approach to management of endangered species, a number of issues are still being discussed. These include the following: the scope of a registration program for vessels, the nature of a monitoring and reporting system to verify incidental takes, and whether advisory groups to oversee reductions in mortality should be species-specific or regional. Further, issues of resource competition remain unresolved. Fisheries take large numbers of fish that are important dietary components of ESA listed marine mammals. Over-fishing and the resulting depletion of prey has been implicated in the lack of recovery of Steller's sea lion populations. However, voices have been raised calling for management, even culls, of abundant stocks of seals and sea lions that eat commercially valuable or declining stocks of fish.

These issues will be addressed in a variety of forums ranging from court rooms, to Congress, to international bodies. Because the issue of fisheries interactions is somewhat arcane, relatively few conservation groups have participated in the discussions and lobbying. Fishing interests, on the other hand, are well represented. Throughout the reauthorization process, the voices of non-governmental scientists have remained conspicuously silent, and the American public remains largely unaware of the magnitude of these issues and their potential impact on all marine mammals. It is vital that those interested in the recovery of endangered species become vocal, or risk the loss of critical protection at both the national and international level.

Sharon Young is a wildlife specialist with the International Wildlife Coalition. Ms. Young can be contacted at the International Wildlife Coalition, 70 East Falmouth Highway, East Falmouth, MA 02536-5954.

Bulletin Board

Sophie Danforth Conservation Biology Fund

The Sophie Danforth Conservation Biology Fund was established by the Roger Williams Park Zoo and the Rhode Island Zoological Society to help protect the world's threatened wildlife. Each year, grants up to $1,000 are awarded to individuals working in conservation biology.

Projects and programs that enhance biodiversity and maintain ecosystems receive the highest funding priority. Field studies, environmental education programs, development of techniques that can be used in a natural environment, and captive propagation programs that stress an integrative and/or multidisciplinary approach to conservation are also appropriate. Proposals for single species preservation, initial surveys, or seed money for technique development are not appropriate.

Recipients are required to acknowledge the Roger Williams Park Zoo and the Rhode Island Zoological Society in any publications that result from the project. Recipients must also submit a progress report that includes an update on the status of the project. This report is due one year after funding is awarded. All proposals must be submitted by May 1, 1994. Applications will be reviewed by a committee of zoo, zoo society, and outside advisors. Grants will be awarded in July 1994. For application guidelines and further information, please contact: Dr. Anne Savage, Director of Research, Roger Williams Park Zoo, Elmwood Ave., Providence, RI 02905, (401) 785-3510 telephone, (401) 941-398 fax, or BI599132@BROWNVM.BROWN.EDU electronic mail.

Eastern Cougar Conference

The Eastern Cougar Conference, 1994 will be held at Gannon University in Erie, Pennsylvania from June 3-5, 1994. The conference is sponsored by the American Ecological Research Institute (AERIE), Gannon University's Department of Biology, Friends of the Eastern Panther, Eastern Puma Research Network, and the International Society of Cryptozoology. This conference will bring together leading experts, state, provincial, and federal resource managers, and private citizens interested in the subject of cougars in the East. Three years in the making, this is the first conference of its kind, and space is limited to the first 300 registrants. Attendees will exchange ideas, discuss recent research, developments, and current needs, and make recommendations to streamline and unify future efforts relating to this fascinating topic. To obtain a registration form and receive further information, please contact: The Eastern Cougar Conference, 1994, Attn. Jay Tischendorf, American Ecological Research Institute-AERIE, P.O. Box 380, Fort Collins, CO 80522, (303) 224-5307. For individuals interested in presenting a paper, an outline or abstract must be included with the registration form. Final decisions on program content will be made March 1, 1994. Proceedings of the conference will not be published. However, abstracts of papers are required, and will be collated and issued to registrants in an exclusive, limited edition volume.

Erratum

The cover of the June 1993 issue of the Endangered Species UPDATE (featuring a red wolf, *Canis rufus*) should read Vol. 10 No. 8, not Vol. 10 No. 7.

Announcements for the Bulletin Board are welcomed.

Endangered Species UPDATE

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