

Changing Attitudes, Troubled Times: Lessons Learned from Protected Species Management in Urban Environments

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ABSTRACT The United States is becoming increasingly urbanized, with nearly 80% of the American population currently residing in urban centers. This trend in human settlement patterns away from rural areas has coincided with a shift in human values and perceptions regarding the natural environment. Urban wildlife managers are therefore presented with unique challenges not experienced by managers of times past and are left having to blend principles of wildlife ecology within a changed ethical and sociological context. Standard wildlife management practices may not be appropriate for this shifting paradigm and there is an ever-increasing need for innovative and collaborative efforts that produce goal-oriented management agendas intended to resolve conflicts by means that can be measured and quantified to gauge success or failure. Predator control programs designed to protect endangered and threatened species in developed areas are no exception. This paper includes a discussion of symptomatic versus systemic control methods, the human dimensions of predator control in high public-use areas, the role of ecological ethics associated with predator removal, and the little discussed potential for cascading effects following mesocarnivore removal. Two case studies are offered to examine these complexities and highlight lessons learned from protected species management in urbanized environments. Both scenarios exemplify the need to include diverse stakeholders in urban management decisions and to enact well-designed management programs that have achievable goals and measurable levels of success.

KEY WORDS urban wildlife management, ecological ethics, human dimensions

Urbanization has greatly impacted the American landscape. For much of its history the United States has been defined as a predominantly rural and agricultural nation, as exemplified in the late 18th century when >95% of the human population resided outside of metropolitan areas (Adams et al. 2006). But nearly two centuries later times have changed—drastically. Circa 1945, people began to flock away from family-operated farms in search of work in cities (Adams et al. 2006). By 1990, urban development dominated roughly 20% of the countryside and urban living characterized nearly 80% of the American populace (Heimlich and Anderson 2001). The tides had shifted away from a life in the country toward a society living, playing, and working in and around urban centers.

Intuitively, urban areas are those localities where the human hand is most prominent. Technically speaking, “urban”

may be defined as “all territory, population, and housing units located within boundaries that encompass densely settled territory, consisting of core census block groups or blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks that have an overall density of at least 500 people per square mile” (U.S. Census Bureau 2006). Of course urban centers are characterized by more than just numbers, and there are distinct physical modifications made to the environment that allow for such large congregations of a single species. Impervious surfaces, manicured parks and other green spaces, waste transportation systems and human dwellings dominate the landscape (McDonnell and Pickett 1990, Adams et al. 2006).

Understandably, urbanization has not come without ecological consequence. The ramifications of an increasingly urbanized

world are perhaps one of the greatest environmental conservation challenges of our times (Marzluff 2001). The process of development results in direct habitat loss, land degradation, an influx of non-native species, hydrological alterations and decline in overall environmental quality (Adams et al. 2006). Also apparent are imperiled species struggling to hold on in dwindling habitat (Marzluff 2002). Those species hit hardest include those with low reproductive output and poor dispersal ability (Knight 2001).

Likewise, the conversion of habitat also creates new niches for wildlife not previously available. Within metropolitan areas can be found abundant wildlife species living and breeding in astonishingly high numbers (Johnston 2001, DeStefano and DeGraaf 2003, Luniak 2004), a subset of which are classified as non-native, and in select cases invasive, while others may be tagged as a nuisance. Whatever the title, those species proven to be the most prolific in the urban wilds are demonstrating a great degree of behavioral plasticity allowing for successful colonization and exploitation of the urban environment. Researchers are documenting pronounced alterations in activity pattern, reproductive strategy, population density, foraging behavior, and antipredator response in urbanized animals relative to their rural or wilderness counterparts (see Adams et al. 2006 for an overview of urban wildlife ecology). Those same species may also show a tendency of increased habituation to the human presence (Harrison 1998). Despite the reasons for their success or failure, it is apparent that urban wildlife live in close association with people and are thereby heavily impacted by human actions.

PEOPLE AND NATURE: LOVE OR HATE?

With such a pronounced demographic shift

over the past two centuries has come a change in American philosophy, values, and attitudes toward the natural world (Adams et al. 2006). Some have argued that there is a marked disconnect between urban residents and nature (Adams et al. 2006), resulting in an uninformed public blindly altering the natural environment to suit their own needs. Others have suggested that urban dwellers have retained a reverence for those things natural (Adams et al. 2006), albeit from a distance and in well-groomed city parks and yards. Nonetheless, it is clear from the national increase in human-wildlife interactions and the dramatic surge in wildlife-watching activities (U.S. Census Bureau 2006) that “the wild” cannot, nor should not, be taken out of the urban matrix.

Human perceptions, attitudes and behaviors are playing an increasingly important role in wildlife management decisions (Gigliotti and Decker 1992, Messmer et al. 1999). This is especially true in areas of high human population density, where managers must blend ecological and social considerations to increase public acceptability of wildlife control plans (Lischka et al. 2008). To allow for this, some have suggested that managers shift attention away from goals relating to population numbers toward achieving specific desired impacts (Riley et al. 2002), such as decreasing negative human-wildlife interactions. It may be argued, for example, that the public doesn't care nearly as much about how many beavers (*Castor canadensis*) there are in a state, as much as when and how their subsequent property flooding can be resolved.

Nonetheless, the relationship that urban residents develop with wild animals in their backyards and parks establishes, at least in part, the framework from which they perceive the natural world. For avid gardeners, the woodchuck (*Marmota monax*) eating vegetable gardens may result

in utter frustration and anger toward all such critters. The backyard birder, however, may develop deep-seated appreciation and reverence for all birds, native or otherwise. Of course those same gardeners may hail the neighborhood red fox (*Vulpes vulpes*) after evicting a visiting rodent from her burrow, while the amateur birder curses gray squirrels (*Sciurus* spp.) for taking the bird's food. Specifics aside, the negative or positive connotations that develop around these experiences set the stage for their future interactions with wildlife, and expectations of nature in general.

The experiences of urban residents are often far removed from those of their rural counterparts. Nature interactions in the countryside are defined by predominantly consumptive use patterns (e.g., hunting, fishing), while urbanites typically show preferences toward non-consumptive practices (e.g., wildlife-watching) and may view wildlife in the same light as domestic animals and people (Mankin et al. 1999). These different perspectives on what it means to experience nature seem to accurately reflect opinions toward acceptable forms of wildlife damage control (Hadidian et al. 2006). Urban inhabitants may claim moral objections to lethal control for certain species, and may instead prefer nonlethal mitigation measures or relocation of problem wildlife in the name of being more humane. Interestingly, those same residents may paradoxically express full support of lethal control in their own backyards for predatory animals, such as coyotes (*Canis latrans*), or rabies vector species, such as raccoons (*Procyon lotor*), based on largely unfounded concerns of being attacked or potentially contracting a zoonotic disease. Rural residents, however, may be more accepting of lethal control measures in general given the prevalence of hunting, trapping, and fishing traditions in their lives. Likewise, in the absence of

livestock losses, rural inhabitants may be more tolerant of predatory species than urban citizens, given a greater direct dependence on the land and thus an increased understanding of the role of predators in an ecosystem. Nonetheless, the fact remains that a person's perception of nature and wildlife results at least in part from personal experience and past conditioning.

URBAN MANAGEMENT: TO (LET) LIVE OR NOT TO (LET) LIVE?

As a consequence of shifting human demographics and attributes exclusive to city-dwelling animals, urban wildlife managers are subsequently presented with unique challenges not experienced by managers of times past and are left having to blend principles of wildlife ecology within a changed ethical and sociological context. Traditional wildlife management tools, or those relying heavily upon consumptive use strategies, may be perceived by urbanites as largely inappropriate or incompatible for resolution of human-wildlife conflicts in urban and suburban areas (Hadidian et al. 2006). As such, there is an ever-increasing need for innovative and collaborative efforts that produce goal-oriented management agendas intended to resolve conflicts by means that can be measured and quantified to gauge success or failure.

Of course, several factors play into the level of acceptability of any form of wildlife damage control, and much depends on the extent of damage, species involved, monetary loss incurred and perceived threat to human safety (Reiter et al. 1999). Despite this, whichever form of damage control is employed, lethal or nonlethal alike, it should be a program that has well thought out and achievable goals. In order to accomplish this, managers must first clearly articulate the problem, then investigate all possible management options, next define what

success is and lastly, develop a means by which to adequately measure whether success has been attained. In those instances lacking a clear definition of the problem, all subsequent mitigation efforts will be inadequately focused. Acting without all management options being evaluated is like being a carpenter who carries only a hammer, while managing wildlife without a clear picture of what success looks like will only lead to failure. Not having a means by which to measure success will result in management actions that drag on for far too long, end prematurely, receive no evaluation or merely accomplish nothing at all. In the end, a management plan drafted and implemented in the absence of the aforementioned criteria will prove to be both costly and ineffective.

For those situations involving multiple and diverse stakeholders, partnerships should be forged in an attempt to bring the best minds to the table in a productive and concerted effort to reach the desired outcome. The dangers of acting in opposition to, or in absence of public consensus are many. Numerous media reports document the public backlash, public relations nightmares, court filings, and intense frustration that abound when wildlife resources are seemingly mismanaged. When handling wildlife matters in urban centers, wildlife professionals are often under even greater public scrutiny, as their action plans are mobilized with many eyes watching.

URBAN PREDATORS: UNEXPECTED NEIGHBORS

Predator control programs have created some of the most contentious environmental and public debates revolving around wildlife damage management (Messmer et al. 2001). In a country where most large predators now exist at substantially reduced population densities and within greatly retracted ranges, many U.S. residents either romanticize or

fear native or non-native carnivores. Some people believe that predator populations should be tightly controlled by regulated hunting or trapping, while others feel that predators should be afforded the utmost protection. Entire non-governmental organizations (NGOs), such as the Predator Defense League and Defenders of Wildlife, and federal agencies, such as U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS), have been created to tackle the issue of predator control from varying and sometimes conflicting stances.

When predators take up residence in urban areas they may begin to experience artificially high population densities and intense site fidelity (Prange et al. 2003, 2004), allowing for a greater probably of increased interactions with humans or human resources. When predatory animals in developed areas begin to negatively impact threatened or endangered species either via direct predation or indirect competition, wildlife managers may begin to consider population control as a means of protecting imperiled wildlife. Because these conservation programs are normally time-sensitive and highly visible to the public, there are often quick attempts made that involve little more than removing predators from the area. Unfortunately, given the propensity of many mammals to exhibit compensatory reproduction and increased immigration following removal campaigns (Voigt 1987, Cavallini and Santini 1996, Baker and Harris 2006, Barton and Roth 2007) and questions concerning humaneness of standard lethal control technology (e.g., trapping, shooting, and poisoning) (Littin and Mellor 2005), these removal efforts may be viewed as short-term, cost-prohibitive, ethically questionable, and of little conservation value (see case examples below).

SYSTEMIC VS. SYMPTOMATIC CONTROL

Perhaps one of the greatest obstacles to overcome for urban wildlife damage management is the recognition of those measures that are systemic, rather than symptomatic (Lessard et al. 2005). Systemic measures are those aimed at providing comprehensive and long-term resolutions to human-wildlife conflicts that satisfy stated management objectives by attempting to address the root cause(s) of a wildlife dilemma. Meanwhile, symptomatic approaches merely work to treat the symptoms of a wildlife damage situation by narrowly focusing efforts on the indicator, rather than the causative agents, of a human-wildlife conflict. Systemic efforts are intended to impact the entire system by rippling outward from the causative source of conflict, while symptomatic control methods are a stop-gap measure intended to temporarily treat an acute problem. To illustrate this distinction, we can look at two different approaches for handling a raccoon residing in a homeowner's attic. The symptomatic approach is to simply trap and remove the offending animal with no further action, as that seems to address the "symptom" at hand. Unfortunately, in all likelihood, the problem will repeat itself when a neighboring raccoon filters in to fill the void left by the removal effort. Meanwhile, the systemic-minded alternative may entail evicting the animal, or using a one-way door to allow the animal to remain alive and establish a new den site elsewhere, and then follow-up by fastening hardware cloth over the exterior entry point to prevent the problem from re-occurring. In essence, the entire system is altered as this action limits the den sites available in the area, which appears to be a limiting factor for raccoon populations (Gehrt 2003), while providing a more long-term fix for the homeowner.

With regard to predator control intended to protect imperiled species, symptomatic control measures normally involve the direct culling of the predator species and seek to reduce the level of predation risk experienced by the prey animal (Lessard et al. 2005). The trouble with this approach is three-fold, in that the predator population normally rebounds quickly due to compensatory reproduction and immigration, thus resulting in costly and cyclical culling programs; there may be unforeseen ecological consequences that result from predator removal; and that intense opposition may arise from conservation and animal welfare organizations following symptomatic control efforts (Lessard et al. 2005). Meanwhile, systemic methods may likewise be costly, but are generally more publicly acceptable and are aimed at limiting those factors that allowed for elevated predator numbers (Lessard et al. 2005). A conundrum arises when managers are faced with the decision of which means to implement when juggling the needs of vulnerable and sensitive prey species.

ECOLOGICAL ETHICS IN WILDLIFE DAMAGE MANAGEMENT

Unlike those in other biological sectors (i.e., biomedical scientists and clinicians), some field biologists and wildlife managers have never codified a comprehensive set of practical guidelines or established a professional forum to address the multitude of ethical questions encountered in the work environment; despite there being an ever-increasing need for such constructs in the wildlife management arena (Farnsworth and Rosovsky 1993, Minter and Collins 2005). Now, more than ever, wildlife managers are confronted with unique and challenging scenarios demanding multi-disciplinary approaches grounded in moral reasoning and deliberation. Many urban wildlife specialists

appreciate the need to blend the fields of wildlife ecology, human psychology, epidemiology, and sociology, to name a few, but the incorporation of a code of practical ethics continues to lag far behind (Hadidian et al. 2006). Wildlife professionals are left having to forge their own set of moral guidelines with little, if any, guidance or oversight.

The lack of ethical emphasis within the wildlife profession has created significant inconsistency among conservation practitioners with regard to appropriate means of managing wildlife (Muth et al. 2006). As such, there is considerable variation in wildlife conflict mitigation measures employed to resolve comparable wildlife problems, as embodied by recent management efforts of urban predators in central Colorado. Here, neighboring communities have drafted differing and somewhat conflicting management plans for dealing with similar human-coyote conflicts. Several municipalities have opted for coyote co-existence plans entailing public education and outreach, hazing, ongoing monitoring and incident report tracking, domestic animal ordinance enforcement and limited lethal control in select cases. Meanwhile, some neighboring communities have selected education alone, while still others have chosen to simply track coyote incident reports to better gauge acceptable methods of action. Simultaneously, other municipalities have taken a zero-tolerance approach to coyotes and have elected to trap and shoot coyotes on sight in an attempt to reduce their population size. The disparities between these programs as reported by the media leave the public with conflicting messages of how to best manage urban wildlife and often create mistrust in agency personnel. Differing actions also have resulted in public outrage, especially when lethal control programs of predators are highly publicized. Beginning to discuss,

debate and incorporate ethical guidelines applicable to the field of urban wildlife damage control, and wildlife management in general, will allow wildlife professionals and the public alike to regain trust in one another, will ease future discourse between parties and will promote consistency within the profession.

CASCADING EFFECTS FOLLOWING WILDLIFE REMOVAL

Ecological systems are highly complex and the ramifications of arbitrarily removing wild animals from an environment are just now beginning to be explored and discussed (Goodrich and Buskirk 1995, Ratnaswamy and Warren 1998, Barton 2005, Lessard et al. 2005, Barton and Roth 2007, Meshaka et al. 2007). For example, a recent study by Barton and Roth (2008) examined the impact of lethal removal of raccoons to protect nesting loggerhead sea turtles (*Caretta caretta*) in Florida. The authors highlighted the intricacies of food web dynamics in finding that their removal efforts resulted in a substantial increase in ghost crab (*Ocypode quadrata*) numbers. Because ghost crabs serve as a secondary predator of sea turtle eggs, their resultant population increase in the absence of raccoon predation resulted in a net increase in sea turtle egg mortality. In effect, the attempts to remove one predator of an endangered species worked to further jeopardize sea turtle conservation efforts. This case exemplifies the need to fully evaluate the potential cascading impacts following mesocarnivore removal in predator control programs.

Although the focus on threatened and endangered (T&E) species is an admirable one, managers cannot allow their vision to narrow to the point where the protection of T&E species results in environmental harm, unnecessary or cruel harm to wild animals, public discontent or mismanagement of

natural resources. The case studies below illustrate the need to carefully weigh all options available, establish clearly defined objectives and actively elicit public involvement in working to reduce predation upon protected species in urban environments.

CASE STUDY: PLAYBOY BUNNY SPARKS CONTROVERSY IN THE KEYS

The endangered Lower Keys marsh rabbit (*Sylvilagus palustris hefneri* [hereafter marsh rabbit or LKMR]), whose scientific name honors the donations received from Playboy mogul Hugh Hefner to aid in the species recovery, inhabits highly fragmented habitat throughout the lower keys of Florida. Over the past 30 years, encroaching human development has resulted in significant habitat loss and land conversion throughout the Florida keys, and is largely responsible for the species' original decline. In fact, during the 1980s and 1990s more than half of the suitable habitat for the LKMR was lost to urban development (USFWS 1999). Much of the remaining habitat had been tainted by impacts of exotic plant species, off-road vehicle usage, illegal dumping, landscaping practices, vehicle-wildlife accidents, and water quality degradation, which even further compromised the imperiled rabbit (USFWS 1999). Historically, the LKMR occupied all of the lower keys extending from Big Pine Key to Key West. At present, the endangered lagomorph is found on only a handful of the lower keys, including Boca Chica, Saddlebunch, Sugarloaf and Big Pine Keys. The entire LKMR population is now estimated to include a mere 100–300 individuals, and the most prominent threat to the species' continued survival is believed to result from feral and free-roaming cat predation (USFWS 1999). Some projections predict that without a significant decrease in

cat predation, the marsh rabbit will be extinct by the year 2050 (Forys and Humphrey 1999).

In response to the urgent need to reduce predation upon the marsh rabbit, the Florida Keys National Wildlife Refuges Complex, of the United States Fish & Wildlife Service (USFWS), initiated a cat trapping program on public lands, including the National Key Deer Refuge on Big Pine Key (BPK). The refuge subsequently signed a \$50,000 year-long contract with WS to remove all feral and free-roaming cats from federal and state lands (C. Shulz, USFWS, unpublished report). All trapped cats were either to be transferred to Monroe County Animal Services or euthanized in the field (C. Shulz, USFWS, unpublished report). Beginning in May 2007, live trapping efforts began on BPK, and shortly thereafter public outrage ensued. The trapping effort had several unintended consequences. Nearly 5 months after the on-set of trapping, only 13 cats had been removed from BPK (B. U. Constantin, USDA, APHIS, WS, unpublished report), out of an estimated population of several hundred. Taxpayers were outraged at having to pay more than \$4,000 per cat removed with very little protection, if any, afforded to the marsh rabbit from the removal efforts. Furthermore, over 85% of the animals caught in traps were nontarget, wildlife species (B. U. Constantin, USDA, APHIS, WS, unpublished report). The vast majority of these were raccoons, which are not documented as being predators of significance upon the LKMR. Nevertheless, many were euthanized after being trapped (B. U. Constantin, USDA, APHIS, WS, unpublished report). Also, as may be expected, feral cat activists and cat owners were dismayed by the notion of cats being killed even under the auspices of endangered species protection. Further allegations arose suggesting that both domestic and wild animals were being handled inhumanely by

WS personnel (e.g., insufficient trap check times, improper euthanasia procedures, etc.), while others questioned whether the program was in violation of National Environmental Policy Act (NEPA) compliance given the lack of a program-specific Environmental Assessment (EA). Not surprisingly, the highly visible traps began to be tampered with and hostile residents began threatening refuge staff and WS trappers. As would be expected, the local media picked up on the story and ran several television and paper stories highlighting the controversy between the National Key Deer Refuge and area residents.

Several months into the program, it was clear that public opposition had to be squelched if any management plan were to succeed. The refuge opted to terminate trapping efforts and began to solicit public involvement via the stakeholder process. Several public workshops were held during 2008 to allow the refuge staff, residents, NGOs, and other interested parties to openly brainstorm best management practices for reducing predation pressure upon the LKMR. The Integrated Predator Management Plan Stakeholder Workshop, as it came to be known, worked with a public facilitator hired by the USFWS to mediate and provide structure to the process and strived toward better understanding the level of public acceptance for differing control methods.

Much of the varying interests of the parties involved were bridged by consensus and mistrust between the groups became less apparent. The diverse stakeholders eventually recognized the common goal to eliminate homeless cats on Big Pine Key, which adequately addressed the needs of both wildlife conservationists and animal welfare advocates. A partnership was forged between the USFWS, cat advocacy groups, wildlife rescue organizations, environmental

non-profits, and animal welfare organizations. At the end of the public scoping process a comprehensive management plan developed which entailed extensive public education and outreach regarding responsible pet ownership and wildlife stewardship; initiation of wildlife monitoring efforts; increased enforcement of existing domestic animal regulations; and trapping, neutering or spaying, and relocating of feral and free-roaming domestic cats to either adoptive homes or placement in sanctuary. The National Key Deer Refuge agreed to work in concert with several local cat rescue groups to increase the successfulness of trapping efforts and to aid in the transport of unadoptable cats to a Georgia cat sanctuary.

Following the stakeholder process, a subgroup of community organizations formed with the purpose of finding a means to fund the effort. To date, several grants have been submitted jointly under the title, "Rabbit Rescue Alliance – Protecting the Lower Keys Marsh Rabbit through a Proactive Conservation Partnership", and funding has not yet been awarded. If funds are allocated, the management plan will be working toward providing more sustained protection for the LKMR by addressing the root causes of cat abandonment. The revised management plan now has clearly defined goals, a monitoring system in place to establish whether success is achieved and far greater public acceptance. In all, the new management direction will offer the LKMR a far greater chance of evading extinction than previous efforts.

CASE STUDY: SEA TURTLES OR FOXES: IS IT REALLY EITHER/OR?

Caswell Beach, North Carolina is a popular vacation and residential community along the Atlantic coast. Its population of full-time residents has doubled since the early 1990s (U.S. Census Bureau 2008) and during

summer months the town is inundated by a large transient population. The barrier island is characterized by suburban-style beachfront neighborhoods intermingling with golf courses and luxurious rental homes. But Caswell Beach also lends itself to being prime nesting habitat for threatened loggerhead sea turtles (*Caretta caretta*). During nesting season, which spans from mid-May to mid-August, the females move up to the beach at night to deposit somewhere between 75–150 eggs per clutch, and may visit the same beach three to five times per season. Given the lack of parental care following nesting, both loggerhead eggs and hatchlings come under intense predation from mammalian predators.

On Caswell Beach, red foxes were introduced to the island during the late 19th century by recreational hunters. Since that time, populations of the introduced predator have increased substantially and they have adapted well to life in the sand dunes. Some members of the population have become highly skilled at depredating sea turtle nests, and during the 2007 nesting season nearly 50% of the nests were dug up and destroyed by foxes even with the use of standard wire mesh protective screening (Turtle Watch, personal communication). In response to this, the all-volunteer turtle nest monitoring group, Turtle Watch, approached the city council to demand that lethal action be taken to remove red foxes from Caswell Beach in an attempt to reduce predation pressure upon sea turtles. They contacted numerous personnel at town, state and federal agencies in an attempt to persuade them to allow the removal program to move forward. Finally, Turtle Watch contacted WS who advised to remove foxes on Caswell by means of a sharpshooter.

The residents of Caswell Beach and some city council members were alarmed by the thought of a hired shooter on public beach access trails. They were likewise

concerned about the mention of leghold traps being used to line the beach in a possible attempt to reduce the fox population. Animal welfare organizations then weighed in and outlined the science-based flaws (Voigt 1987, Cavallini and Santini 1996, Baker and Harris 2006) and inhumane considerations (Kregger et al. 1990, Lossa et al. 2007) of cyclical fox culling programs, and outlined other non-lethal alternatives (Yerli et al. 1997). Meanwhile, several heated public forums were held to openly discuss the issue and the full range of options available, which only resulted in bitter arguments and utter discontentment among attendants. The controversy erupted when the Associated Press gave the issue national coverage, and the mayor and city council members who were being pressured by Turtle Watch to allow lethal control on town property, were inundated by phone calls and emails expressing concern for how the foxes would be handled. Of course, as in many communities with substantial transient visitors, people were intentionally and unintentionally feeding the foxes, which only served to further exacerbate the problem and subsequently inflated the size of the resident fox population. In response to this, the city council implemented a wild animal ordinance that prohibited the feeding of all Caswell Beach wildlife.

As a means of calming the tension, the mayor and town council decided to take no action on the decision until more information was gathered. Interestingly, the town ordinance passed earlier that year also prohibited the “harming” of any wildlife, which in effect disallowed the use of lethal control on town property. As such, city officials sought an alternate approach for protecting sea turtles that didn’t involve the killing of foxes, and they found themselves heeding the advice of the Gumbo Limbo Nature Center of Boca Raton, Florida.

Gumbo Limbo records nearly 1,000 sea turtle nests each year, which is roughly 10-fold that of Caswell Beach. As at Caswell, mammalian predators, namely foxes and raccoons, are responsible for depredating some portion of sea turtle nests. From the research conducted at Gumbo Limbo it became clear that the typical wire mesh screening placed around nests not only wasn't working to prevent successful predation attempts, but it was in fact acting as a visual cue to predators signaling nest location (Mroziak et al. 2000). Also, given the heavily urbanized area surrounding the beach, lethal control was deemed to be publicly unacceptable (Kirt Rusenko, personal communication). Following years of trial and error, in 2002, Gumbo Limbo personnel began applying habanero pepper powder to the surface of sea turtle nests. The next year they recorded a marked decrease in successful predatory attacks, despite an increased number of predation attempts, in the absence of a lethal predator control program (Rusenko et al. 2004). Gumbo Limbo also has an active public outreach campaign to educate residents about the need to reduce artificial food sources for wildlife and to modify human behavior to make beaches safer for sea turtles.

The Caswell Beach mayor and town council subsequently chose to defer the use of lethal control in light of a reasonable, and much more affordable alternative. Beginning in the 2009 nesting season, Caswell will be implementing the Gumbo Limbo model to protect sea turtle nests. They have also begun an intensive public education and outreach effort with a focus on highlighting the dangers of feeding wildlife, and foxes in particular, and the importance of protecting sea turtles. Their now less controversial efforts are intended to effectively reduce predation on sea turtle nests, while simultaneously eliminating supplemental feeding of foxes in an attempt

to decrease the predator population size. This move away from a purely symptomatic approach toward a systemic model, in conjunction with ongoing nest monitoring and a well-defined level of success set at achieving <10% nest predation, represents a more ecologically sound, cost effective and goal-oriented management plan.

LESSONS LEARNED

In Aldo Leopold's seminal work, *A Sand County Almanac*, he eloquently and simply stated, "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." (1949). But how does this adage apply to present-day conservationists, wildlife managers, urban ecologists, private wildlife control operators, and animal protectionists alike? The notion of what is "right" and what is "wrong" are clearly based on value-laden judgments and lends itself more to questions than to straightforward answers.

For example, what factors of a human-dominated ecosystem define its integrity? Does removing non-native red foxes from an island environment they were intentionally introduced to 150 years prior result in a system with greater integrity? And what actions or management decisions will destabilize an already compromised environment? As a case in point, what impact does the widespread removal of native raccoons have on the dynamic coastal ecosystem they inhabit? Meanwhile, as is often said, beauty truly is in the eye of the beholder. Whose aesthetic interpretation warrants the greatest clout – the feral cat feeder or the backyard birder? The trophy hunter or the animal rights activist? The inner-city dweller or the rural farm laborer?

No situation facing urban wildlife damage managers today can be rectified by a "one answer fits all" approach. We must begin to closely examine not only our

actions, but our motives. In the end, we must clearly define objectives and establish goals based on sound science, moral reasoning, and public involvement. Furthermore, management plans must be contrived in ways that allow managers to accurately measure levels of success or failure. We can no longer assume that the standard *modus operandi* is sufficiently addressing the needs of the burgeoning and diverse field of urban wildlife management. It appears that the times really are changing and with it so should our understanding of and relationship to urban wildlife.

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