IMPACTS of FERAL and FREE-RANGING CATS on BIRD SPECIES OF CONSERVATION CONCERN

A five-state review of
New York, New Jersey, Florida,
California, and Hawaii

AMERICAN BIRD CONSERVANCY

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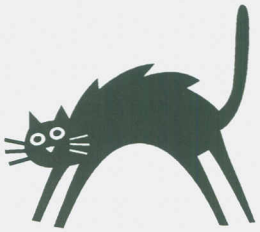

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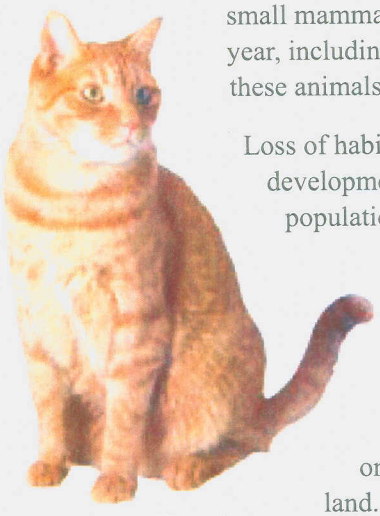
IMPACTS of FERAL and FREE-RANGING CATS

on Bird Species of Conservation Concern

This report reviews cat predation impacts on rare birds in the states of New York, New Jersey, Florida, California, and Hawaii, reviews government-authorized programs and ordinances affecting feral and free-ranging cats and their management, and makes recommendations on better ways to manage cat overpopulation problems. Sites marked * are State Important Bird Areas (IBAs) and sites marked ** are Global IBAs as identified by American Bird Conservancy (ABC) in *The American Bird Conservancy Guide to the 500 Most Important Bird Areas in The United States*. These areas are considered high priorities for cat control to protect threatened bird species.



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Alien Predators

The domestic cat is now so common in the United States that many people do not realize they are an alien species. Domesticated in Egypt more than 4,000 years ago, *Felis catus* is a descendant of the European and African wild cats. Thanks to explorers who took cats with them on their travels, the domestic cat may be the most widespread alien predator in the world—with devastating consequences. Domestic cats are considered primarily responsible for the extinction of 33 bird species since the 1600s. In New Zealand alone, cats were primarily responsible for the extinction of eight bird species and the eradication of 41 others from islands. There are at least 90 million pet cats in the United States, and perhaps an equal number of stray and feral cats. Scientists estimate that our nation's free-roaming cats kill hundreds of millions of birds, small mammals, reptiles, and amphibians each year, including endangered species. Cats prey on these animals whether or not they are hungry.

Loss of habitat and fragmentation due to human development are the primary causes of bird population declines worldwide. However, invasive species, including cats, are the second most serious threat. Habitat fragmentation results in cats and other predators having easier access to wildlife that is forced to live on progressively smaller tracts of land. Many rare birds, such as the Piping Plover, California Clapper Rail, Florida Scrub-Jay, and Hawaiian Petrel nest and/or feed on the ground. These species evolved in the absence of cats and other alien predators and do not have effective defenses against them. Keeping in mind these factors and their small populations, it is easy to understand why these birds are so vulnerable to predators, including cats.

Cat Management Controversies—Trap/Neuter/Release vs. Euthanasia

Cats are prolific breeders, especially in warm climates where they can breed year-round and produce two to three litters per year, each of three to six kittens. The problem of cat fecundity is exacerbated by cat owners who let their cats roam free, fail to spay or neuter their pets, and abandon unwanted cats. Historically, stray and feral cat populations have been managed by live-trapping for either adoption or euthanasia. However, most local governments do not have adequate funding or staff to effectively control stray and feral cat

populations. Many thousands of cats are euthanized by humane societies and animal shelters each year because there are not enough homes for pet cats, and the offspring of stray cats are not socialized enough to make good pets. As the most popular pet in America, however, domestic cats enjoy the support of some of the most ardent animal rights activists who strongly oppose euthanasia of homeless cats.

Photo/Morguefile.com.

In an attempt to avoid euthanasia and reduce breeding, in the early 1990s cat advocate groups introduced a new method to reduce populations of stray cats called Trap/Neuter/Release (TNR). With TNR, volunteers attempt to manage groups or colonies of cats that depend on a reliable food source by preventing their breeding. The cats are live-trapped, spayed or neutered by a veterinarian, and the tip of one ear is cut off so the cats are easily recognized as having been altered. The cats are then released, usually at the trap site, and fed daily for as long as they stay in the colony, which may be a day, a month, or many years. Socialized cats and kittens are usually removed for adoption, and cats with serious injuries or evidence of disease may be euthanized. The theory behind TNR is that cat populations in managed colonies will stabilize and eventually diminish.

TNR has been promoted by national and local groups as the only humane way to manage stray and feral cats.

Domestic cats are considered primarily responsible for the extinction of 33 bird species since the 1600s.

Unfortunately, managed cat colonies are known to persist for 15 or more years, and well-fed cats still prey on birds and other wildlife. The ability of TNR programs to reduce a local population of stray and feral cats, i.e. in a neighborhood, depends on a number of variables, including original size of the colony, the location, the commitment and skill of the volunteers, their financial resources, whether there are local cat control ordinances in place and enforced, and whether there are low-cost spay/neuter services readily available. It is also important to note that spayed or neutered cats that have a regular food source are likely to live longer than feral cats without human assistance.

Managed cat colonies may fail to disappear for many reasons, among them that often not all of the cats can be trapped for spay/neuter because the volunteers do not have adequate funds to pay for veterinary services, or because the cats evade capture. The cat food left out by volunteers often attracts more cats and other predators, such as rats, raccoons, and skunks, and colonies can become dumping grounds for unwanted pets. An analysis of the effect of neutering in two large-scale, long-running TNR programs in San Diego County, CA (14,452 cats) and Alachua County, FL (11,822 cats) failed to show a statistically detectable impact on the free-roaming cat population at the larger county-wide level.

TNR does not save cats from the many hazards of being outdoors, including injury, disease, parasites, getting hit by cars, being attacked by other cats, dogs or wildlife, and human cruelty. Many managed cat colonies occur in public parks and beaches where they pose a significant threat to wildlife and human health. Free-roaming cats are capable of spreading zoonotic diseases and parasites to other cats, wildlife and people, and concentrating cats in colonies aids in the spread of disease and parasites. Risk of disease transmission to humans from cats in colonies, as well as free-roaming pet cats, will become more of a concern if the deadly avian flu H5N1 hits the United States. As already seen in Europe, cats are capable of spreading the virus to other cats through nasal secretions and feces. Scientists fear that the virus may mutate and cats could transmit it to humans. The number of counties and municipalities that have passed ordinances legalizing TNR is growing, including areas with endangered birds and other species vulnerable to cat predation.

Federal Wildlife Protection Laws and TNR

TNR may violate federal and state wildlife protection laws. In 2002, the U.S. Fish and Wildlife Service (USFWS) commissioned the Conservation Clinic of the Levin College of Law at the University of Florida to analyze and compare federal, state, and local laws as they pertain to managed cat colonies. The report, *Feral Cat Colonies in Florida: The Fur and Feathers are Flying* (http://www.law.ufl.edu/conservation/pdf/feralcat.pdf), concluded that federal and state wildlife laws designed to protect endangered and threatened species conflict with the practice of releasing non-indigenous predators into the wild. Specifically, TNR practices likely violate the Endangered Species Act (ESA) and the Migratory Bird Treaty Act (MBTA), because they may result in the direct take of protected species. In addition, the review found that local governments that enact ordinances to legalize TNR may be found in violation of these laws if cats in legalized colonies kill or harass protected species.

Managed cat colonies, a result of trap/neuter/release programs, do not save cats from the many hazards of living outdoors. Free-roaming cats are constantly at risk from injury, disease, and predation. Photo/Morguefile.com.

Many managed cat colonies occur in public parks and beaches, where they pose a significant threat to wildlife and human health.

NEW YORK

Laws and Policies Affecting Feral and Free-Ranging Cats and TNR in New York

From Jones Beach State Park to Westhampton Dunes, Long Island, there are thousands of unwanted cats and few places to put them. Animal shelters in Nassau and Suffolk counties already overflow with pet cats and kittens. A number of volunteers try to manage the stray and feral cat crisis by TNR. In 2002, biologists with the New York State Department of Environmental Conservation contended that a feral cat colony at Cedar Beach near Mount Sinai frightened off a formerly thriving population of nesting Piping Plovers. A 2002 survey by the New York State Department of Parks found that Long Island has more parks reporting feral cats than other regions in the state.

Piping Plovers are at risk from free-ranging and feral cats in New York. Photo/Michael Stubblefield.

Given the problems with stray and feral cats in state parks, the New York State Department of Parks, Recreation, and Historic Preservation drafted, "Guidelines for Feral Cat Control in State Parks," which states that the overall goal is for zero feral cats within state parkland. Guidelines for park staff include: establishing working relationships with groups such as humane societies that can assist in cat removal; including individuals who are feeding cats in the process to address the issue; educating park patrons and staff on the problems associated with feral cats on parkland; and once a colony has been removed from a park, not allowing feeding of feral cats. The Parks department is currently working with cat advocates to reduce cat colonies at 15 Long Island state parks comprising more than 100 cats.

Sites in New York where Feral and Free-Ranging Cats Have Documented Impacts

Long Island Piping Plover Nesting Beaches:** The Piping Plover is New York state-listed as Endangered and federally listed as Threatened. All of the Piping Plovers within the New York portion of the Atlantic Coast population occur on Long Island on the North and South shores. In 2005, approximately 390 plover pairs were counted at 80 sites. Wildlife biologists report that on the North Shore, plover nests are surrounded by cat tracks, and there are hundreds of cat colonies on the South Shore. The following are specific site accounts of cat predation on Long Island beaches.

Fire Island National Seashore*: Biologists report that feral cats are an increasing threat to the Piping Plover and other nesting birds such as the Common and Least Terns. While it is difficult to determine the causes for fluctuations in the number of breeding Piping Plovers, or find direct correlation to nesting success or failure, plover nest abandonment and chick loss due to cats have been recorded here. Fire Island is mostly owned by the U.S. National Park Service (NPS), but there are significant private landholdings. This area is also well-known as a migrant songbird stopover location, with large numbers and diversity, especially in the fall.

Gateway National Recreation Area*: At Breezy Point, cats have been trapped and removed every year since 1995. Nonetheless, in 1999, an estimated 1,850 breeding Common Terns was the lowest number since 1991. The terns had arrived on their breeding territory and were observed displaying mating behaviors. However, within 2 weeks, approximately 800 terns were gone. Cat tracks were found going to and from the dunefront section of the tern colony. The tracks were

followed to a group of bushes where 5 kittens and the adult female cat were found with the remains of 17 adult common terns. The cats were removed. Three of the terns had leg bands—one bird was 15 years old and the other was 22. The third bird had been banded in Brazil and its age was not known.

Westhampton Island/Westhampton Beach*: According to the Long Island Chapter of The Nature Conservancy, cat depredation of Piping Plovers has been recorded annually since 2000. Four lost nests were attributed to cats in 2005. One abandoned four-egg nest was surrounded by cat tracks. One nest that was depredated had cat tracks inside the exclosure fencing. At two locations, each two-egg nest had one egg that had been depredated and a second egg that had rolled out of the nest scrape, with cat tracks leading directly to the nest. In 2004, a Piping Plover biologist at Westhampton Dunes observed a cat playing with a plover egg on the beach. He also observed the head and wings of an adult female piping plover sitting on the nest, the eggs were crushed and there were cat tracks surrounding the nest. In 2003, a four-egg plover nest was abandoned in a high-traffic cat area. Two four-egg nests disappeared, three out of four eggs from another nest were lost, and a fourth four-egg nest surrounded by exclosure fencing was abandoned. At all of these sites, evidence that cats were to blame was found in the form of cat tracks in the sand. In 2002, a partially eaten plover chick was discovered in an area where cats and cat tracks were frequently observed. Cat tracks were also observed circling exclosures, resulting in the abandonment of at least two four-egg nests. Another pair lost four chicks in an area of high cat activity, and abandoned their second nesting attempt due to cat harassment. Another four-egg nest disappeared among numerous cat tracks. In 2001, cats were responsible for the failure of at least seven nesting attempts by Piping Plovers. Cat tracks around exclosures resulted in the abandonment of two four-egg nests. Another pair lost two four-egg nest attempts in an area covered with cat tracks. A plover pair lost its four-egg nest just four houses away, with evidence of cat activity. A four-egg nest was lost, with one egg found approximately 15 feet from the nest scrape. Cat tracks were visible around the location.

Shelter Island*: In 2000, the loss of a breeding adult Piping Plover at Lower Beach, with feathers and wings discovered outside the predator exclosure, was consistent with cat predation. A free-ranging domestic cat from a nearby home was regularly seen patrolling the site. The loss of the adult plover also resulted in the abandonment of a four-egg nest. There were at least three four-egg nests lost with evidence of cat activity near the nests.

Additional Sites Where Cat Predation is Considered a Threat to High-Priority Bird Species

The following are sites that state biologists and others have identified as having cats among the threats to native bird species. All species listed are on ABC's Green List (http://www.abcbirds.org/greenlist.htm) and are vulnerable to cat predation. In addition, the Piping Plover is federally listed.

West Hempstead Bay/Jones Beach West, Nassau County* (mix of private, state, and municipal ownership): Piping Plover, American Oystercatcher, Least Tern, and Black Skimmer. Although TNR advocates had 36 kittens and 11 cats adopted from Jones Beach, drop-offs continue to be a big problem. Approximately a dozen pairs of Piping Plovers nest at Jones Beach.

Captree Island Vicinity, Suffolk County* (mix of private, state and municipal ownership): Piping Plover, Roseate Tern, Least Tern, Black Skimmer, Black Rail. Captree has a colony of at least eight cats.

Nissequogne River Watershed, Suffolk County* (mix of private, municipal, county and state-owned lands): Piping Plover, Least Tern.

NEW JERSEY

Laws and Policies Affecting Feral and Free-Ranging Cats and TNR in New Jersey

Although abandoning cats is cruel and illegal according to state law, many cats are left behind each summer by visiting tourists along New Jersey's coastal resort communities. These cats are also a serious threat to beach nesting birds and put a financial burden on municipalities, which need to trap the cats and take them to shelters where cats that are not adopted will be euthanized.

Since 1995, the City of Cape May has sponsored a TNR program for people who register their cat colonies with the City's Animal Control Department. There are currently 12 registered feral cat caretakers in Cape May. This program has been widely cited as a model for other New Jersey coastal communities to use to control their stray and feral cat populations. Foundations have given over $200,000 in grants to animal welfare groups in the state to promote TNR and gave a $40,000 grant in 2005 to the City of Cape May to promote TNR throughout Cape May County.

In 2005, "Nature's Refuge" received a $20,000 grant to implement a large-scale TNR program called the Burlington County Feral Cat Initiative (BCCI, http://www.njferals.org). Burlington County is located in the New Jersey Pinelands, a sensitive ecosystem with a number of endemic plant and animal species. Woodland and Beverly Townships passed TNR ordinances, and in December 2005, Tabernacle Township was also poised to adopt a TNR ordinance. With the intervention of New Jersey Audubon Society (NJAS) and agreement from BCCI, it was amended to become the first TNR ordinance to include the goal of reducing feral cat predation on wildlife and the requirement to, "use due consideration to avoid the taking of rare, threatened or endangered species under the state's Endangered and Nongame Species Conservation Act., N.J.S.A. 23:2A-1, et seq." Since then, NJAS, BCCI, the New Jersey Division of Fish and Wildlife Endangered & Nongame Species Program (NJDFW), ABC, and cat advocate groups have joined in a collaborative effort to determine the best ways to reach the shared goals of reducing feral cat populations and protecting wildlife through a model ordinance for Burlington County. In the meantime, however, Shamong and Southampton townships have passed ordinances similar to that of Tabernacle Township.

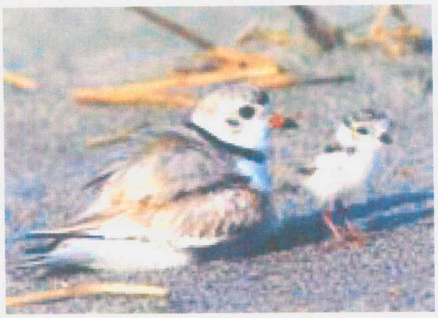
Avalon and Stone Harbor, located in Cape May County, have breeding Piping Plovers present and problems with cat predation. Avalon and Stone Harbor recently adopted TNR ordinances, citing the City of Cape May's program as a model. Strong opposition from the NJDFW and the USFWS resulted in designation of buffer zones around the most sensitive areas (beach nesting bird and colonial waterbird breeding areas) where TNR colonies are not permitted and agreements with animal welfare groups to actively trap and remove cats in those sensitive areas.

New Jersey *Cats Indoors!* Campaign: In 2003, and again in 2005, ABC has promoted a statewide *Cats Indoors!* education and outreach campaign led by NJAS. NJAS is attempting to familiarize groups promoting TNR with the use of internet-based mapping to identify critical habitat so that maintenance of stray and feral cat colonies can be avoided in those areas.

Sites in New Jersey where Feral and Free-Ranging Cats Have Documented Impacts

New Jersey Piping Plover Nesting Beaches: In New Jersey, the Piping Plover population has ranged from a low of 93 pairs in 1998 to a high of 144 pairs in 2003. In 2004, of the failed nests at sites monitored by the NJDFW, predation was the leading cause of failures (43%), followed by abandonment (26%) and flooding

(25%). Abandonment rose notably in 2004, largely as a result of predator harassment of exclosed nests. Due to the higher rate of nest abandonment associated with exclosures, and the elevated risk of human vandalism and predator harassment at such nests, NJDFW uses exclosures on a selective basis. Approximately half the nests that failed due to abandonment were likely caused by predator activity. Predators are undoubtedly the main factor in brood reduction, although direct evidence is nearly impossible to obtain.



Piping Plover and chick. Photo/Chris Davidson.

In 2005, only 111 pairs of Piping Plover nested in the state, an 18% decrease from 2004 and one of the largest single drops since federal listing in 1986.

However, in 2005, only 111 pairs nested in the state, an 18% decrease from 2004 and one of the largest single drops since federal listing in 1986. There are 30 active nesting sites in the state. Of the failed nests monitored by the NJDFW in 2005, flooding was the leading cause (44% of failures) followed by abandonment (22%) and predation (20%). The drop in nests lost to predation may be the result, in part, of predator control efforts as well as an increase in the percentage of nests protected with predator exclosures.

Monmouth Beach North: In 2005, after the trapping and removal of 6 red fox and one cat, productivity for Piping Plover was 1.67 fledges per pair (based on three pairs), one of the few sites in the state above the recovery goal of 1.50 fledges/pair.

Monmouth Beach South: In 2002, cats were suspected to be the cause of site abandonment by a small Least Tern colony.

Stone Harbor Point: Stone Harbor Point hosts one of the largest concentrations of beach nesting birds in the state. Feral cats, raccoons, and Laughing Gulls were identified as causes of extremely low reproduction at this site in 2004 for Piping Plover, Black Skimmer, Least Tern, Common Tern, and American Oystercatcher. In addition, people were feeding a feral cat colony at the parking lot. A total of eight feral cats, five skunks, and two raccoon were removed. Piping Plovers had a fledging rate of 0.60 fledges per pair based on ten pairs as compared with 0.26 fledges/pair from 1999-2004. Flooding prevented reproductive success from being even higher. In 2005, a large colony of Black Skimmers produced 600-700 fledglings after almost entirely failing in 2004 due to a variety of factors, including predation. American Oystercatchers had a fledgling rate of 0.70 fledges per pair based on ten pairs, up from 0.29 fledges/pair in 2004. Productivity of tern species was low, caused primarily by flooding and gull predation. Least Tern and Black Skimmer are on the state's list of endangered and threatened species.

In 2004, nine plover pairs produced three eggs and only one fledged chick. Low productivity was due in part to high levels of predator activity by cats that resulted in loss of young, as well as harassment of breeding adults. Of 40 Least Tern pairs, none fledged. Four hundred pairs of Black Skimmers produced only 33 fledglings.

In 2002, prior to the nesting season, the Borough contracted to have feral cats removed from the site. Approximately 16 cats were trapped and taken to a local shelter. Six pairs of plovers nested at the site for a total of 12 nesting attempts. Only five nests hatched, for a total of 14 chicks, of which only one fledged.

Piping Plover chick. Photo/Michael Stubblefield.

NEW JERSEY

In addition to plovers, a medium-sized Least Tern colony, a medium-sized Common Tern colony, and a large Black Skimmer colony were present at the site. Productivity for the Least Terns was low (0.5 fledges/pair), while productivity for Black Skimmer and Common Terns was high. In spite of predator removal, all three species suffered nest and chick losses due to flooding.

Avalon Dunes: In 2004, eight plover pairs produced 15-22 chicks, but only six fledged because of high levels of nest abandonment and nest predation, caused primarily by cats. Sixty-five pairs of Least Terns nested, but only two fledged. In 2002, seven pairs of plovers made a total of eight nesting attempts. One pair re-nested after losing its entire brood. A total of 23 chicks hatched, of which only nine fledged. Five of the plover nests were protected with predator exclosures. In addition to plovers, a large Least Tern colony of 293 adults was present in the area, but productivity was low. Predation by several animals was suspected, including cats.

Townsend's Inlet: In 2002, cats were a concern at this location where only one pair of plovers nested at the site and hatched three chicks, two of which fledged. A medium-sized Least Tern colony was present and productivity was moderate. Predation by cats was suspected because cat tracks were observed in the nesting area.

Feral and free-roaming cats prey on adult Least Terns, as well as their eggs and chicks. Constant predation may force terns to abandon nest sites and entire colonies. Photo/Gary Smyle.

Island Beach State Park*: Feral cats are a threat throughout the park for land birds and beach nesting birds including Piping Plovers.

U.S. Coast Guard Training Center, Cape May: Predation by cats and other animals was responsible for nest failures and chick loss at the site in previous years. The Coast Guard conducted a predator removal program in 2001 and 2002, and three predator exclosures were erected for the three pairs of plovers that nested at the site. Three nests hatched and one failed due to an unknown predator. A total of nine chicks hatched, of which only three fledged.

Cape May NWR and Cape May Migratory Bird Refuge:** Cape May is one of North America's greatest birding hotspots. Fall-outs of migrating birds occur here, with counts of a single species sometimes numbering in the hundreds of thousands. It is also one of the premier hawk-watching sites during fall migration. Cape May also has a high population of abandoned and feral cats.

In 2002, only one pair of plovers nested at the site, resulting in two nesting attempts. Both nests failed to hatch. The first nest was predated, and the second nest was abandoned. Cats are a serious concern in this area, but it is not known whether pet or feral cats are the problem.

FLORIDA

Laws and Policies Affecting Feral and Free-Ranging Cats and TNR in Florida

According to Florida state law 372.265 F.S., it is unlawful to release within the state any species of the animal kingdom not indigenous to Florida without having obtained a permit from the Florida Fish and Wildlife Conservation Commission (FWC). Under Code 68A-4.005 F.A.C., it is unlawful to release or introduce any wildlife, fish or organism that might reasonably be expected to transmit any disease to wildlife. According to Florida state law 828.13 F.S., it is also illegal to abandon cats. The University of Florida law review, previously mentioned, concluded that TNR is a likely violation of these state laws and codes.

Florida Scrub-Jay. Photo/Laura Erickson.

Florida Scrub-Jay populations in Florida have declined by 90% due to predation and habitat loss.

Florida's Feral Cat Policy: On May 30, 2003, the Florida Fish and Wildlife Conservation Commission (FWC) unanimously passed a landmark policy to, "protect native wildlife from predation, disease, and other impacts presented by feral and free-ranging cats." Under the policy, TNR is not allowed on lands managed by the FWC, and they strongly oppose programs and policies that allow release, feeding, or protection of cats on public lands that support wildlife habitat. This policy received broad support from ABC and other conservation groups, federal and state agencies, and wildlife rehabilitators, and serves as a model for other wildlife agencies to follow. (See Florida Fish and Wildlife Conservation Commission Policy on Free-roaming Cats at http://www.abcbirds.org/cats/florida_policy.htm.

TNR in Florida: Some counties, such as Palm Beach and Brevard, have amended their ordinances to allow cat colonies if the colony is registered with a designated agency. In Brevard County, that "agency" was Space Coast Feline Network, which received $119,000 of government funds to spay/neuter over 6,000 feral cats in over 700 colonies. In March 2004, an attorney for a private citizen asked the USFWS to seek an injunction to prohibit the county from authorizing feral cat colonies because the TNR ordinance authorizes activity that intensifies the negative impacts cats have on species listed under the ESA. For example, a resident of Cocoa, Florida witnessed a free-roaming cat enter his yard and attack and kill a Florida Scrub-Jay which is listed as threatened under the ESA. The resident later placed a trap in his yard and caught an ear-tipped cat. The resident took the cat to the Central Brevard Shelter, but the cat was returned to its colony pursuant to the TNR ordinance provisions. A 2002 letter from the USFWS to the county noted that at least one cat colony was located on a site that was occupied by Florida Scrub-Jay and stated that these birds are, "particularly susceptible to being taken by cats because they inhabit low-growing vegetation, are highly territorial, and are relatively weak flyers." The letter also states that, "the survival of scrub-jays in Brevard County is very important to the status of the species as a whole, and the continuing loss of scrub-jays to predation by feral cats could have dire consequences." As of this writing, Brevard County's TNR ordinance is still in place, unamended, but new managed cat colonies must be registered with Animal Control, and county funding has been eliminated.

"Operation Catnip" at the University of Florida, College of Veterinary Medicine, in Alachua County claims to have spayed or neutered 11,822 stray cats from 1998 to 2004. This group refused to agree to keep cat

FLORIDA

colonies at least one mile from the Paynes Prairie Preserve State Park* boundaries where cats are a threat to birds in this state IBA. Orange County Animal Control has a cooperative program with TNR advocates who agree to follow specific guidelines. From December 1995 to 2001, the County neutered 7,903 stray and feral cats for release through this program.

The largest remaining hardwood hammock forest is found at Key Largo Hammocks State Botanical Site**—home of the federally endangered Key Largo woodrat and Key Largo cotton mouse. This park is also an important stopover site for migratory birds. Directly adjacent to the park is the Ocean Reef Club, an upscale residential community employing a full-time paid veterinarian heading a TNR program for approximately 500 stray and feral cats, with 40 cat feeding stations, some of which are directly adjacent to the park. Raccoons commonly feed at the cat feeding stations as well. From December 2003 to March 2004, 23 cats were live-trapped in the state park and taken to local shelters. Woodrats can once again be found in the park.

In a Florida International University study, two managed cat colonies in Miami-Dade County (Crandon Marina and A.D. Barnes Park) were observed for 13 months. The number of cats in each colony remained relatively stable (with 91 cats at Crandon and 37 cats at Barnes), but the population dynamics changed. Almost every month, some cats disappeared and new cats joined the colonies. Adult cats and kittens were abandoned at each park during the study, despite state and county laws prohibiting pet abandonment. Cats that had not been spayed or neutered were observed at both sites, and some were not trapped for several months. Other cats were never captured. At Crandon, several females became pregnant and two of them gave birth in the park. Aggressive interactions among colony cats were few and mostly limited to the commencement of feeding. After the majority of cats fed, cats on the outskirts would eat, contrasting with the notion that

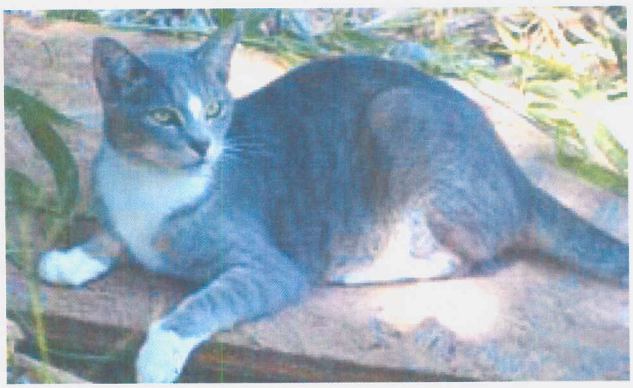
The Painted Bunting is an ABC Green List species at risk from feral and free-ranging cats in Florida. Photo/Barth Schorre.

cats limit access to food or the number of cats in a colony. Despite being well fed, cats at both locations were observed stalking and killing birds, including a Common Yellowthroat and Blue Jay. A variety of other animals were also seen eating the cat food, including raccoons, dogs, spotted skunks, gray fox, Black Vultures, Muscovy Ducks, Eurasian Collared-Doves, European Starlings, and Common Grackles.

Florida *Cats Indoors!*: In 2004, the FWC commissioned ABC to produce stewardship materials on the impacts of cat predation on Florida's unique wildlife. Educational materials include a poster, PowerPoint slide presentation, and print, radio and TV public service announcements. These materials can be downloaded at http://www.MyFWC.com.

Efforts to Manage Feral and Free-ranging Cats in Florida: Neotropical migrants that rely on small, forest remnants for migration stopover sites are also

vulnerable to the high densities of cats in some south Florida parks, such as Greynolds Park in Miami-Dade County. A survey conducted by the Everglades Research Group, Inc. concluded that the decline of upland bird populations during the period 1988–1998 was due to a managed cat colony in the park. It was not uncommon to observe 30-50 cats there. Fortunately, in 2001, the park commissioners strengthened laws making it illegal to abandon animals and feed them in county parks. The cats have since been trapped and removed from Greynolds.



Feral and free-ranging cats will kill birds, even if the cats are well-fed. Photo/Ricardo Zambrano.

Sites in Florida where Feral and Free-Ranging Cats Have Documented Impacts

Florida Keys, Monroe County:** Migratory birds rest in the Florida Keys during spring and fall migration. Unfortunately, the Keys are overrun with cats, and migrants, exhausted from their journey over the Gulf of Mexico, are easy prey. Due to severe weather in the spring of 2001, a massive fallout of migrant warblers descended on the Keys. Thousands were killed outright by flying into windows, cars, and other reflective objects, and many of the injured and exhausted birds were observed killed by free-roaming pet, stray, and feral cats.

Archbold Biological Station, Highlands County: The Florida Scrub-Jay is the only bird species found exclusively in Florida, and its population has declined by at least 25% since 1983 to approximately 8,000–10,000 individuals. The Florida Scrub-Jay was federally listed as Threatened in 1987 primarily because of habitat fragmentation, degradation and loss. It is also state-listed as Threatened. The Florida Scrub-Jay has been extirpated from Alachua, Broward, Dade, Duval, Pinellas, and St. Johns counties. Currently many populations of scrub-jays are small and isolated. More than half of the remaining birds occur on or around two large tracts of land: Ocala National Forest** and Merritt Island National Wildlife Refuge**. The USFWS South Florida Multi-Species Recovery Plan states that house cats have been documented to prey on Florida Scrub-Jays. Jay survival after leaving the nest is much lower in nearby residential areas than in undeveloped habitat at Archbold Biological Station, due in part to predation by cats. Predation also accounts for 80% of all scrub-jay nestling losses. In the past ten years, a suburban population of scrub-jays decreased from 135 families to only 32 families. More research is needed to determine the role cat predation plays in scrub-jay survival. However, scientists suspect that a population of domestic cats supported by human feeding could eliminate a small, local population of Florida Scrub-Jays.

Bay County, Okaloosa County, Franklin County, and Leon County: In a study comparing hatching success in four roof-nesting and four ground-nesting colonies of Least Terns in Florida, the proportion of eggs that hatched in roof colonies was three times greater than in ground colonies. Tracks of domestic cats and other predators were seen in the ground colonies and could often be followed from one empty tern nest to the next. No evidence was found of mammalian predators on the roofs. In addition, all of the roof colonies studied were active the following year, whereas two of the ground colonies were abandoned and a third had 70% fewer nests.

FLORIDA

Additional Sites Where Cat Predation is Considered a Threat to High-Priority Bird Species

Shell Island, St. Andrews State Recreation Area and Tyndall Air Force Base, Bay County*: The site holds approximately 3% of the state's wintering Piping Plover and 11% of the state-listed, Threatened Snowy Plover.

T.H. Stone Memorial St. Joseph Peninsula State Park, Gulf County*: The site holds a few wintering Piping Plover (<1% of the state population) and 3% of the state's breeding Snowy Plovers. Feral cats are removed when encountered.

Fort George Island, part of Big Talbot Island State Park, Duval County*: The site has supported as many as 78 singing male Painted Buntings, an ABC Green List species.

Paynes Prairie Preserve State Park, Alachua County*: This is considered a site of high bird diversity with as many as 267 species recorded annually. Among species vulnerable to cat predation are many resident and migrant songbirds, including as many as 34 species of wood warbler. There are managed cat colonies near this park.

Wekiwa Basin GEOpark*, Lake, Orange, and Seminole counties: The site can been exceptionally rich during migration seasons and annually has as many as 220 species. Among species vulnerable to cats, there have been single-day counts for warblers and vireos in the thousands. Prescribed fire is being used to restore habitat for the Florida Scrub-Jay.

Hugh Taylor Birch State Park*, Broward County: This site is a small coastal park in a massively urbanized region of Florida and offers one of the few significant coastal stopover habitats for Neotropical migrants in Broward County. It has supported as many as 37 species of wood warbler in a single season. Feral cats are removed.

Neotropical migrants that rely on small forest remnants for migration stopover sites are also vulnerable to the high densities of cats in some south Florida parks.

Photo/Morguefile.com.

CALIFORNIA

Laws and Policies Affecting Feral and Free-Ranging Cats and TNR in California

TNR in California: Managed cat colonies occur throughout California, including public parks and beaches, and areas adjacent to sensitive wildlife habitat. TNR in California is so widespread that Maddie's Fund (http://www.maddiesfund.org) gave a $9.5 million grant to the California Veterinary Medical Association (http://www.cvma.org) to reimburse more than 1,000 veterinarians responsible for spaying or neutering 170,334 stray and feral cats for release over three years. Only half of these cats received a rabies vaccine, and far fewer received immunizations for other fatal feline diseases.

Some counties have amended their ordinances to legalize cat colonies. In 1994, San Mateo County exempted from its "ownership" definition those people who register as caretakers of feral cat colonies and who trap or make, "a reasonable effort to trap all feral cats over the age of eight weeks in his/her care, and has them spayed or neutered." Santa Cruz and Santa Clara counties also approved ordinances legalizing domestic cat colonies. Environmental reviews were not conducted before these ordinances were passed.

Efforts to Manage Feral and Free-ranging Cats in California:

Golden Gate Park, San Francisco: Twenty years ago, cats in San Francisco's Golden Gate Park were routinely removed, and California Quail were numerous. However, in the early 1990s, animal rights activists objected to the euthanasia of stray and feral cats trapped in the park. At the same time, underbrush was cleared from some areas of the park to discourage homeless people. As a result, the once abundant California Quail has all but disappeared from Golden Gate and other city parks. The city's Commission on the Environment passed a resolution in July 2000 to designate the California Quail as the official city bird. However, the resolution also specifies that quail restoration must be accomplished, "without killing other animals." Cats are still fed in Golden Gate Park.

The federally-listed California Clapper Rail is a ground-nesting species that is especially vulnerable to cat predation. Photo/Ashok Khousla.

Alameda Naval Air Station*: In 1997, a group of stray cats abandoned by Alameda Naval Air Station personnel were being fed near a colony of federally-listed California Least Terns. Cats are known to prey on Least Terns and it was illegal to feed cats on the base. Animal rights groups protested the Navy's effort to trap and remove the cats and insisted that feeding cats on the base should be legalized. However, the Navy continued to trap and remove cats and other predators as required under the ESA, and this effort has paid off. In 1983, there were only three nesting tern pairs left. In the summer of 2001, there were approximately 275 nests which fledged an estimated 320 chicks. Control of the station is proposed to be transferred to the USFWS and designated the Alameda National Wildlife Refuge.

East Bay Regional Parks: The East Bay Regional Park District (EBRPD) manages over 91,000 acres

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with 14 state or federally-listed threatened or endangered species and at least 27 state species of special concern. Rare ground-nesting birds found in EBRPD such as the federally-listed California Clapper Rail, California Least Tern, and Western Snowy Plover, as well as Burrowing Owl and Black Rail, are particularly vulnerable to cat predation. Abandoning cats and feeding them and their offspring has been a significant problem in some of the district's parks, despite laws prohibiting these activities. Huge controversies erupted in the media whenever the district removed cats from the parks by humane trap and removal or by lethal control. In an effort to resolve this issue, in 1999 the district proposed the "Feral and Abandoned Volunteer Program," which would allow cat colony advocates who signed a liability waiver and volunteer guidelines to trap and remove cats on EBRPD lands. Although ten volunteers signed the waiver, only one actually removed cats. The volunteer program has since been disbanded, and park staff are trapping and removing cats from the parks.

Bidwell Park, Chico: In 1997, the stray and feral cat population in Bidwell Park (http://www.bidwellpark.org) had reached an estimated 200-300 cats, and the park's California Quail population had been decimated as a result. The city's Park and Playground Commission began to enforce the state law prohibiting pet abandonment and the city's anti-litter law. Although cat advocates demanded to start a TNR program in the park, the Commissioners refused. In response, the Chico Cat Coalition (http://www.ChicoCatCoalition.org) was formed to rescue the cats. Since 1998, the Coalition has trapped and removed 804 cats and found homes or foster homes for 633 of them. Seventy cats, unsuitable for adoption, are living out their lives in the comfort of a fully enclosed barn on private property. The City of Chico pays for spay and neuter services. California Quail are once again seen in the park, and it is unusual to see a stray cat. The Chico Cat Coalition and the Park Commissioners found a humane solution for the cats and the native wildlife that allows park visitors to once again enjoy this unique riverine park.

Studies of Feral and Free-ranging Cats in California: Most of California's threatened or endangered birds are vulnerable to domestic cat predation. The California Fish & Game Department has an extensive bibliography and complete articles on its Web site at http://www.dfg.ca.gov/hcpb/species/nuis_exo/dom_cat/cats_wildlife.shtml. The following studies show effects of cat predation on some of California's native birds and wildlife.

East Bay Regional Park Study: A two-year study was conducted in two grassland parks in the East Bay Regional Park District. One park had no cats, but over 20 cats were fed daily in the other park. Almost twice as many birds were seen in the park with no cats as in the park with cats. California Thrasher and California Quail were seen in the no-cat area, but were never seen in the cat area. In addition, over 85% of the native deer mice and harvest mice trapped were in the no-cat area, whereas 79% of the house mice, an exotic pest species, were found in the cat area. Most likely, the cat food was supporting the house mice in that park. Native deer and harvest mice are important in maintaining the native grassland habitat. According to Dr. Cole Hawkins who conducted the study, "Cats at artificially high densities, sustained by supplemental feeding, reduced the abundance of native rodent and bird populations, changed the rodent species composition, and may have facilitated the expansion of the house mouse into new areas. Thus…the feeding of cats in parks should be strictly prohibited."

San Diego Study: In studying the relationships between coyote, mid-sized predators such as cats, and scrub-dwelling birds, a survey was conducted of cat owners living along the rims of steep-sided canyons to determine the amount and type of prey their free-roaming cats brought home. These canyons are isolated fragments of habitat with many endemic species.

Survey respondents reported that on average, each outdoor cat that hunted returned 24 rodents, 15 birds, and 17 lizards to the residence each year. Researcher Dr. Kevin Crooks estimates, "…that all the cats living along the rim of a moderately-sized canyon…return about 840 rodents, 525 birds, and 595 lizards to residences each year." He further states that, "This level of bird predation appears to be unsustainable." The study also found that in small canyons where the coyote was absent, there was an increase in mid-sized predators such as cats, raccoons, and opossum, and a drastic decline in diversity, and in some cases elimination of scrub breeding birds such as Cactus Wren, California Gnatcatcher and Greater Roadrunner. However, in larger canyons where coyotes were still present, scrub-breeding birds were also seen.

Sites in California where Feral and Free-Ranging Cats Have Documented Impacts

Don Edwards San Francisco Bay NWR:** The federally-listed California Clapper Rail is one of California's most endangered birds. Historically, thousands of Clapper Rails could be found in the marshes of San Francisco Bay. However, excessive commercial and sport hunting significantly depleted the population, and increased urbanization led to the diking of most of the Bay's productive tidal marshes for salt ponds, industry, agriculture, and airports. These dikes allow feral cats easy access to Clapper Rails and other rare marsh species such as Black Rail, Burrowing Owl, California Least Tern, Western Snowy Plover, and salt marsh harvest mouse. By 1991, only 200-300 Clapper Rails were left in South Bay. The Refuge conducts intensive non-native predator control every year. As a result of these efforts, the California Clapper Rail population in San Francisco Bay has grown to approximately 1,200–1,500 birds at present, and the population is currently stable. There are an estimated 600 Clapper Rails in South Bay. There are four landfills directly adjacent to the Refuge: Sunnyvale, Palo Alto, Newby Island, and Tri City. The USFWS has identified these landfills as a major source of feral cats on the Refuge, and steps are currently being taken to limit the numbers of cats entering the refuge from these sites.

Elkhorn Slough, Monterey:** The Western Snowy Plover is a small shorebird associated with coastal wetlands and coastal dune habitat. The decline and loss of Western Snowy Plover populations along the Pacific coast is due to habitat loss and disturbance caused by urbanization. Causes of low reproductive success include loss and degradation of breeding habitat, inclement weather, human disturbance, and increase in numbers of predators associated with urban areas, including feral cats. Feral cats threaten federally listed Western Snowy Plover at Elkhorn Slough, taking both adults, chicks, and eggs. PRBO Conservation Science removes alien predators, including cats, which has greatly enhanced reproductive success of nesting Snowy Plovers at the salt ponds.

San Clemente Island:** This island has two federally-listed subspecies of birds found only on the island: the San Clemente Loggerhead Shrike, one of the rarest birds in North America, and the San Clemente Sage

Feral and free-ranging cats account for millions of bird deaths each year, including threatened and endangered species. Photo/Dawn Grafe, FWS.

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Sparrow, both federally listed as threatened. The Western Snowy Plover also nests on its beaches. Navy personnel have long fed a large feral cat population. Control of rats and cats is ongoing, along with a captive breeding program conducted by the San Diego Zoo for the shrike. In 2002, 71 shrikes were detected on the island, up from a low of 14 in 1999, due in part to cat control.

Lake Hodges:** Free-roaming cats from neighboring residential areas surrounding Lake Hodges threaten the California Gnatcatcher, which was federally listed as Threatened in 1993.

San Diego NWR Complex:** California Gnatcatcher also breeds in the San Diego NWR along with Least Bell's Vireo, Southwestern Willow Flycatcher (both listed under the ESA), and several other endemic subspecies. Given the dense human population surrounding the refuge, cat predation is also probably a problem for these species.

Sweetwater Marsh NWR:** California Least Tern nest at Sweetwater Marsh NWR along with a few Endangered Light-footed Clapper Rails and Belding's Savannah Sparrow. Feral cats are a problem, and several Clapper Rails have been brought to the Refuge office with fatal injuries consistent with a cat attack. The Refuge has an outreach program aimed at local residents, which stresses the importance of keeping cats indoors. Pet cats trapped on the refuge are turned over to the local animal shelter where their owners can claim them.

Tijuana River National Estuarine Research Reserve and Tijuana Slough NWR**:** Breeding birds in these locations include the federally endangered Light-footed Clapper Rail, California Least Tern, Least Bell's Vireo, Belding's Savannah Sparrow, and Western Snowy Plover. Predation by domestic cats and dogs is a problem.

Additional Sites Where Cat Predation is Considered a Threat to High-Priority Bird Species

Benicia State Recreational Area,* Solon County: California Clapper Rail, Black Rail.

Camp Pendleton, San Diego and Riverside Counties:** California Least Tern, California Gnatcatcher, Light-footed Clapper Rail, Western Snowy Plover.

Del Norte Coast,* Del Norte County: Western Snowy Plover.

Eastshore Wetlands,* Alameda County: Black Rail, California Clapper Rail.

Goleta Coast,* Santa Barbara County: Western Snowy Plover.

Orange Coast Wetlands,* Orange and Los Angeles Counties: California Least Tern, Light-footed Clapper Rail, Black Skimmer, Western Snowy Plover, California Gnatcatcher.

Sacramento Valley Wetlands,* Glenn/Butte/Sutter/Colusa Counties: Sensitive species include Long-billed Curlew, Burrowing Owl, Tricolored Blackbird.

San Pablo Bay Wetlands,* Marin/Sonoma/Napa/Solano Counties: California Black Rail, California Clapper Rail, Western Snowy Plover.

The Western Snowy Plover is only one of many threatened bird species in California at risk from cat predation. Photo/Laura Erickson.

HAWAII

Laws and Policies Affecting Feral and Free-Ranging Cats and TNR in Hawaii

Hawaii is considered the endangered species capital of the world, with more endangered plant and animal species per square mile than any other place on Earth. Beginning with Polynesian settlement over 1,600 years ago, Hawaii's bird extinction crisis continued through the period of European settlement to today. By the late 18th Century, at least 45 species of endemic birds had become extinct, including flightless geese and ibis, over a dozen honeycreepers, an eagle, a hawk, and several species of owls and crows. Destruction of habitat for farming and human development, invasion of alien plant species, over-hunting, disease spread by introduced mosquitoes, predation by introduced rats, mongoose, and domestic cats, and habitat degradation by feral pigs, goats, sheep, and cattle have all played a role in bringing many of Hawaii's unique native birds to the brink of extinction.

Given the mild climate, cats can breed year-round on the Main Hawaiian Islands, with up to three litters per year of four to six kittens per litter. There are no wild predators of cats, such as coyote to help keep the free-roaming cat population in check. Cats range from sea level to at least 9,500 feet on the "Big Island", and 10,000 feet on Maui. According to Hawaii's Comprehensive Wildlife Conservation Strategy (CWCS), cats are widely distributed and are found throughout bird habitat on all of the Main Hawaiian Islands from sea level to high elevation. While a single cat can have a devastating effect on a breeding seabird colony, "cat colonies" pose an even greater threat to bird populations because of their concentrated sheer numbers. High densities of feral cats, rodents, and mongooses are a major cause of mortality among endemic Hawaiian birds. Removal of introduced mammals from important habitats to establish ungulate and predator free areas on each island is a high priority of the CWCS.

Laws Affecting Feral and Free-Ranging Cats and TNR in Hawaii

TNR in Hawaii: The TNR program in Hawaii was begun in 1993, and is supported by the Hawaiian Humane Society (HHS–http://www.hawaiianhumane.org) and the Hawaii Cat Foundation (HCF–http://www.hicat.org). As of 2002, 19,786 cats were sterilized for release on Oahu. Approximately 21% of Oahu's households have cats, totaling approximately 150,000 pet cats. In 1995, Oahu passed a Cat Protection Law, which mandates that all outdoor cats six months or older must be sterilized and wear identification. It is also illegal to abandon any animal. Despite these laws, a low-cost spay/neuter program, and the TNR program, the Hawaiian Humane Society (HHS) must euthanize over 11,000 cats per year on Oahu alone.

Managed cat colonies in Hawaii occur wherever stray and feral cats have congregated, including public parks, beaches, and sites adjacent to sensitive wildlife habitat, such as seabird nesting colonies. For example, in 1999, researchers found that a Wedge-tailed Shearwater colony at Waiehu on Maui lost 23 adult birds to cats in a colony. A shearwater colony at Hookipa lost 59 adults to cats and only 27 burrows fledged chicks. At a small shearwater colony east of Kuau, six adult birds were killed by cats, which caused the total loss of all chicks at five burrows.

At Pauwalu, remains of Bulwer's Petrel chicks were found near a cat colony during each of three years, and there was no evidence that any chicks had successfully fledged from the colony during this time. According to researcher Dr. Fern Duvall, II, "Small colonies (of seabirds) were vulnerable to total failure and larger colonies to losses of returning adults and late-stage chicks and adults. Comparison of cat free Molokini islet illustrated that cat predation has a sustained negative impact on established Maui native seabird colonies, expansion of colonies, and colonization of new areas by native seabirds."

Palila, a Hawaiian finch found only on the upper slopes of Mauna Kea volcano on the island of Hawai'i. Photo/Jack Jeffrey.

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Even common native bird populations are impacted by cats in Hawaii. A scientific study investigated the effects of domestic cat predation on three small nesting colonies of Wedge-tailed Shearwater at Malaekahana State Recreation Area on Oahu, where stray cats were fed by the public. These colonies were compared with a large Shearwater colony at nearby Moku`auia Island State Seabird Sanctuary, where cats were absent. During the study, feral cats were fed daily at Malaekahana at a site that was located only 100 feet from the closest shearwater nesting colony. Many more burrows produced chicks at Moku`auia (62%) than at Malaekahana (20%). At Malaekahana, reproductive success was zero at the colony closest to the cat-feeding site, and almost all breeding adult shearwaters in that colony were killed. Populations of long-lived seabirds such as shearwaters, which produce only one egg per year and often do not breed until they are five or more years old, are sensitive to the loss of breeding adults.

In 2000, the State Health Department of Vector Control proposed a ban on feeding animals in public areas because of concern that the abundant cat food at colonies was also supporting large numbers of rats. Cat advocates were outraged and succeeded in getting a bill introduced in both the state House and Senate that would have created, "a temporary managed cat colony task force to address health concerns related to the feral cat population." The bills would have delayed the adoption of any rules relating to feral animals, and any rules already in effect could not be enforced until the managed cat colony task force had made its recommendations. The bill was not passed by the legislature, but little has been done to prohibit cat colonies on state-owned public land.

Hawaii *Cats Indoors!*: The Hawaii Division of Forestry and Wildlife commissioned ABC to produce educational materials on cat predation and Hawaii's endangered birds. Materials include a poster, fact sheet, and PowerPoint slide presentation, and can be downloaded from http://www.state.hi.us/dlnr/dofaw/cats/index.htm.

Sites in Hawaii where Feral and Free-Ranging Cats Have Documented Impacts

Hawaiian Forest Birds

The 2003 Draft Revised Recovery Plan for Hawaiian Forest Birds states that the introduction of alien mammals, such as rats, feral cats, and the small Indian mongoose, has severely impacted populations of native forest birds. Control of these alien predators is required for forest bird recovery. However, predator control efforts thus far generally have not been conducted over areas large enough to result in significant improvement in the status of a species, subspecies, or distinct local population. Research priorities for most Hawaiian forest birds include developing improved methods for controlling rats and feral cats in native forests.

The 'I'iwi, or Hawaiian Honeycreeper. Photo/Jack Jeffrey.

Sites with detailed information:

Alaka'i Wilderness Preserve, Kaua'i: Eradication of rats and feral cats from this preserve would benefit species such as federally endangered Puaiohi (Small Kaua'i Thrush), Kama'o (Large Kaua'i Thrush), Kaua'i 'Elepaio, Kaua'i Amakihi, Kaua'i 'Akepa, and 'Akikiki (Kaua'i Creeper). The `Akikiki is a candidate for listing under the ESA.

Mauna Kea Forest Reserve, Hawaii: The federally endangered Palila, a Hawaiian honeycreeper, is threatened by feral cats in their protected, but limited habitat of mamane and mamane-naio forest on Mauna

Kea from 6,500 to 9,250 feet in elevation. Biologists have been monitoring the Palila population and found that in some areas, black rats and feral cats may be responsible for up to 40 % of nest failures. Predation has also likely contributed to the high rate of nest abandonment observed by researchers. Feral cats have been documented to prey on nestlings and adults. To learn more about the movements, ranges, and habits of feral cats in high elevation dry forests, biologists from the U.S. Geological Survey captured and attached radio collars to five male and three female feral cats, and tracked them for 18 months. Given the cats' large home ranges, and immigration of new cats from lower elevations, the scientists concluded that controlling feral cats in Palila habitat will be very difficult. Another study found that despite the great abundance of mice in this environment, the largest diet component of 118 feral cats was birds (78.8%), of which > 44.1% were passerines. A high proportion of these feral cats, of all age and sex classes, tested positive for toxoplasmosis (37.3%) and feline leukemia virus (FeLV; 15.9%). Feline immunodeficiency virus (FIV) occurred only in adult males comprising 8.7% of the overall population. Feral cats must be trapped and removed annually in Palila habitat.

Kona Forest Unit, Hakalau Forest National Wildlife Refuge, Hawaii: The 'Alala, or Hawaiian Crow, is the world's most endangered corvid. Endemic to the island of Hawaii, this crow was once abundant in lower and middle elevation mesic forests on the western and southern sides of the island. However, by the early 1990's, 'Alala could only be found in a small area of central Kona on the west slope of Mauna Loa Volcano. The 'Alala has suffered from loss and degradation of habitat, predation by cats, rats, and mongoose, and avian malaria and pox carried by introduced mosquitoes. In addition, captive released birds have contracted toxoplasmosis, a disease caused by a protozoan carried by domestic cats and rats, which now exist throughout historical 'Alala habitat. Between 1993 and 1998, 27 captive-raised juveniles were released at McCandless Ranch. Of these, 21 died in the wild and six were recaptured and returned to the captive flock. Currently, no individuals are known to exist in the wild. There are currently 51 'Alala in captivity. Continued captive propagation of the 'Alala is required for its recovery. After the election of an appropriate release site, feral ungulates, rats and cats will have to be removed before re-introduction of 'Alala.

The 'Alala, or Hawaiian Crow, is the world's most endangered corvid. Populations of 'Alala have been decimated by introduced cats, rats, and other non-native predators. Photo/Jack Jeffrey.

In addition, the following parcels in recovery habitat have been identified as priorities for predator control to protect rare Hawaiian forest birds on the main island of Hawaii. All sites are managed by the State of Hawaii except where noted:

Northeastern slopes of Mauna Kea: Palila

Kanakaleonui Corridor: Palila

Hilo Forest Reserve, Laupahoehoe and Piha Sections

Hakalau Forest National Wildlife Refuge, USFWS

Pu'u 'o'o Ranch

Kipuka `Ainahou Nene Sanctuary

Ka`ohe: Palila

Mauna Kea Forest Reserve: Palila

Waiakea Forest Reserve, Upper and Lower Portions

Palila, a Hawaiian finch found only on the upper slopes of Mauna Kea volcano on the island of Hawai'i. Photo/Jack Jeffrey.

HAWAII

'Ola'a/Kilauea Partnership, managed by Kamehameha Schools, Keauhou Ranch, Kulani Correctional Facility, Pu'u Maka'ala managed by Hawaii Volcanoes National Park.

Hawaiian Seabirds

Many seabird species, including Hawaiian species, did not evolve with mammalian predators and have no effective defenses against them. On their nesting grounds, all adult and juvenile seabirds are susceptible to mammalian predators, including dogs, pigs, rats, feral cats and the small Indian mongoose.

Haleakala Crater, Maui; Mauna Loa, Hawaii: The federally endangered Hawaiian Petrel or `Ua`u, which nests in burrows, was once abundant on all main Hawaiian Islands except Ni'ihau. Today the world's largest known breeding colony of an estimated 1,000 pairs is found at Haleakala Crater on Maui. The primary threat to this colony is predation by introduced rats, small Indian mongooses and feral cats. Since 1981, an ongoing and aggressive predator control program has halted most losses, and this important colony appears stable. In a study comparing reproductive success before and after trapping, and in areas protected and unprotected from predators, protected sites showed significantly higher nesting activity and success in six of eight years. In a study of Hawaiian Petrels on Mauna Loa, Hawaii, monitored burrows in the eastern group of nests suffered limited cat predation. A single cat was trapped, and the researchers did not find evidence of predation following the capture. Success for all nests that year (1995) was 61.5%. In 1996, trapping was not conducted, and nest success dropped to 41.7%, mainly due to cat predation in one of the central nest groups. A population viability analysis suggested that at this rate of predation, the southeast Mauna Loa population of approximately 50 nests might not persist.

Kaua'i, Hawaii, Moloka'i, and Lehua: Approximately 75% of the federally threatened 'A'o, or Newell's Shearwater, nest on Kauai, and indications are that

The Hawaiian Petrel, or 'Ua'u, has no effective defenses against cats and other non-native predators. Photo/Jack Jeffrey.

this population is in decline. Between 1993 and 2001, radar detections of Newell's Shearwater have declined by 62%. This species was abundant prior to the arrival of Polynesians, but hunting and predation by introduced predators resulted in a decline in the population such that they were thought to be extinct by 1908. Like all seabirds, adults and nests are susceptible to mammalian predators. Despite the remoteness of colonies, predation by feral cats has been documented.

Hawaii Volcanoes National Park, Hawaii; Haleakala National Park, Maui; Kaua'i, and Moloka'i: The federally endangered Nene, or Hawaiian Goose, used to live on all the main Hawaiian Islands, but nearly became extinct in the 1950s due to over-hunting. In 1951, the wild Nene population was estimated at 30 individuals. The current population is estimated at 1,300–1,500 individuals. The "Big Island" is the only place where they are found naturally in the wild. Thanks to propagation efforts, Nene were re-introduced on Maui, Moloka'i and Kaua'i. Nene nest on the ground. When flightless during molt, adults and goslings are extremely vulnerable to predation by introduced predators such as dogs, cats, and mongooses. Predation is believed to be the greatest factor limiting Nene populations at this time. The Hawaii CWCS and the Nene Recovery Plan consider control of predators

in Nene habitat, especially during the breeding season, as essential. Their recommendations include: develop feral cat control programs in prime Nene breeding areas; develop effective predator-proof fencing; evaluate current trapping efforts in all locations; increase public awareness of feral cat impacts on Nene recovery; and build support for feral cat control actions.

Kilauea Point National Wildlife Refuge, Kaua'i: According to the USFWS, cats and rats are major predators of federally endangered Nene, federally and state-threatened Newell's Shearwaters, and Red-tailed Tropicbirds attempting to nest in this location.

The Nene, or Hawaiian Goose, is federally listed as Endangered. Nenes are threatened by feral cats and other predators, which prey upon their eggs and young. Photo/Jack Jeffrey.

Hawaiian Waterbirds

The introduction of alien predators, including cats, has had a documented negative impact on populations of four endangered waterbirds: Hawaiian Coot, Hawaiian Duck, Hawaiian Moorhen, and Hawaiian Stilt. The proliferation of feral cat feeding stations near parks and other areas that support waterbirds may have a significant effect on waterbird recovery in these areas. The extirpation of Laysan Ducks from the main Hawaiian Islands probably occurred 1,500 years ago due to harmful predators, human exploitation, and habitat loss. The disappearance of the Laysan Duck is coincidental with the appearance of rats in the chronological subfossil record. Although not currently a problem on Laysan Island, mammalian predators pose the greatest direct threat to the recovery of the species. Laysan Duck will require reestablishment of the species on at least some of the Main Hawaiian Islands, nearly all of which are inhabited by rats, cats, dogs, mice, pigs, and mongoose. Laysan Ducks are incapable of flight during their annual molt, and they also tend to run or freeze in place rather than fly as an escape response, which makes them highly susceptible to predators. Cats are now the only mammalian predator on Kaho'olawe. If cats were removed, Kaho'olawe would be an excellent release site for Laysan Duck. Additional possible translocation sites include:

Ni'ihau: Ni'ihau Playas

Kaua'i: Wainiha Valley, Lumaha'i Valley, Hanalei NWR, Wailua/'Opaeka'a Valley, Hule'ia NWR, National Tropical Botanical Garden, Lawa'i Valley

Oahu: Lualualei, 'Uko'a Marsh, Kahuku Point, La'ie Wetlands, Waihe'e Marsh, He'eia Marsh, Nu'upia Ponds, Kawai Nui Marsh

Moloka'i: Moloka'i Playas, Kaunakakai Wetlands, Kakahai'a NWR, Paialoa Pond

Lana'i: Whole island

Maui: Kanaha Pond Sanctuary, Kealia Pond NWR, Koanae Point, Nu'u Pond

Hawaii: Pololu Valley, Waimanu Valley, Waipi'o Valley, Loko Waka Ponds, Ke'anae Pond, Koloko Pond, 'Opae'ula Pond, 'Aimakapa Pond, Kona Refuge

Removal of cats and other predators from these areas would also benefit Hawaiian Coot, Hawaiian Duck, Hawaiian Moorhen, and Hawaiian Stilt.

RECOMMENDATIONS FOR RESOURCE MANAGERS

Federal and state wildlife biologists provide the first line of defense in protecting rare birds from predators, including cats. However, their ability to protect rare birds is often hampered by inadequate funding and unwillingness by some staff to deal with potentially controversial issues such as predator control. The following recommendations may be helpful to resource managers.

- Identify predator threats at specific sites, including the use of nighttime monitoring.
- Increase efforts to trap and remove predators or undertake additional predator management where warranted.
- Increase predator removal measures where exclosures and/or electric fence are not effective or feasible.
- Conduct public outreach efforts to reduce detrimental human activities near nesting birds, including the distribution of informational brochures, such as ABC's "Keeping Cats Indoors Isn't Just For The Birds," placement of interpretive signs at nesting sites, informal on-site contact with the public, formal group presentations, and staffing of informational booths at local events and festivals.
- Coordinate management efforts, such as predator removal, with municipalities and other landowners.
- Encourage municipalities to adopt ordinances or other measures to help reduce predator activity, including bans on feeding of domestic or wild animals, and a prohibition of TNR programs.
- If managed cat colonies are threatening local wildlife populations, work with cat advocates to develop a plan and a timetable for permanent removal of those cats.
- Conduct research on developing more effective predator control measures.
- Increase state and federal funding requests for predator management.

RECOMMENDATIONS FOR CONSERVATIONISTS

Conservation groups and individuals have an important role to play in helping to educate the public on responsible pet ownership and in generating support for predator management projects. Here are some tips that can help protect birds from free-roaming cats in your community.

- Keep your own cats indoors, and walk it outside on a harness and leash, or in an outdoor enclosure. Encourage others to keep their cats indoors.
- Spay or neuter your cat at an early age before it can reproduce.
- Do not feed stray cats and never abandon a cat you can no longer care for. Instead, find a good home for your cat or take it to an animal shelter or humane society. For a shelter nearest you, see the National Shelter Directory at http://www. aspca.org.
- Work for passage of local cat ordinances that prohibit cats from roaming off their owner's property.
- Conduct a *Cats Indoors!* campaign in your community. For free downloadable materials and more information, see http://www.abcbirds.org/cats.
- Support efforts of public land managers to humanely trap and remove cats from habitat managed for wildlife.
- Conduct a media campaign in your community using print and radio Public Service Announcements (PSAs) found at http://www.abcbirds.org/cats.
- Sponsor a children's poster competition for National Keep Your Cat Indoors Day, held on the second Saturday in May. For more information see http://www.abcbirds.org/cats/NKYCID.htm.
- Print an article or PSA in your organization's newsletter.
- Ask your state wildlife agency to print an article in their magazine and/or produce a Web page on the issue for their Web site.
- Ask your state wildlife agency to adopt the *Cats Indoors!* campaign and distribute brochures and other materials to the public through their visitor centers, educational programs, and displays.

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