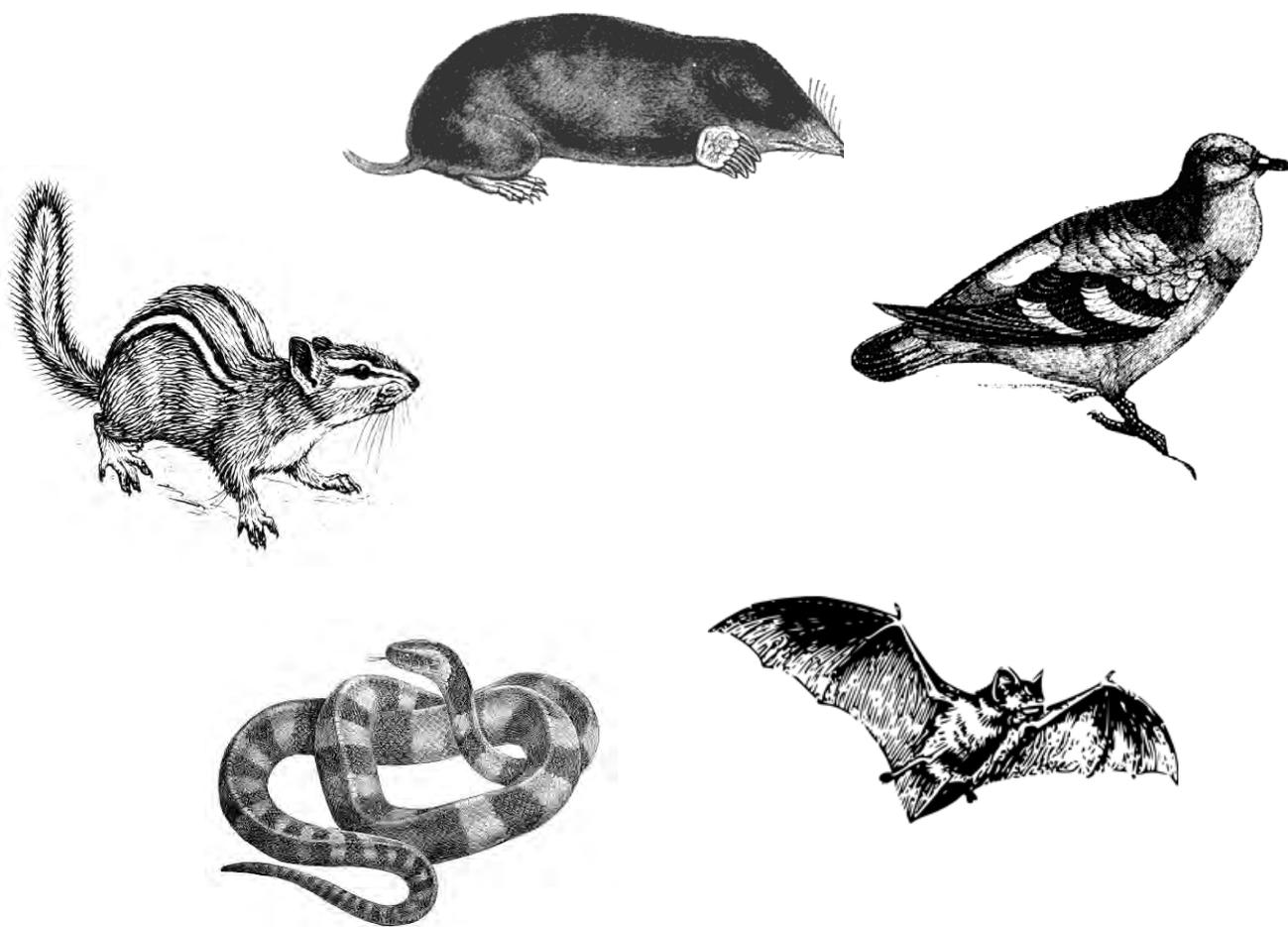


**MARYLAND PESTICIDE APPLICATOR TRAINING  
MANUAL  
WILDLIFE CONTROL  
Category 7 C**



# **MARYLAND PESTICIDE APPLICATOR TRAINING MANUAL**

## **WILDLIFE CONTROL**

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## INTRODUCTION

This training manual is designed to provide information for commercial pesticide applicators who wish to become certified in the wildlife control category. Persons engaged in wildlife control must be certified or work under the supervision of a certified applicator. This manual provides information on the impact of wildlife on humans; identification, biology, and habits of the major pest species; integrated pest management approaches to wildlife control; regulations and product resources. Practical exercises to provide insight on dealing with pest bird problems, and an examination to assess comprehension and understanding of the material are also included.

Increasing urban development of agricultural and wooded areas has forced many species of animal wildlife from their native habitats. My wife and I have lived in the suburbs for the last 25 years, but not until we moved to suburban Maryland 18 years ago, did I realize the impact that humans have on native animals which often are considered to be pests. From their perspective, humans are the true pests encroaching on their natural environments.

Over the years in our own backyard, we have observed deer, field mice, grey and red fox, raccoons, woodchucks, chipmunks, squirrels, rabbits, opossum, skunk, turkey vultures, bats, pheasants, geese and various other birds. Many of these animals have exploited areas near or in our house as nesting sites, such as in the garage, basement, under the flagstone patio, between the rock-lined steps, under the front porch, and in the woodpile.

Our housing development is typical of those in our area and in many locations throughout Maryland where developers are building on agricultural lands and the wooded areas abutting them, thus depriving native wildlife of their natural harborage sites and food resources. As animals seek out harborage and food in their newly modified habitats, they discover that creeks and streams have been converted to culverts and underground drainage systems; that most, if not all, trees have been replaced by man-made structures, e.g. houses, light poles, etc. and that their food supplies are greatly diminished.

It is easy to see how raccoons may perceive a chimney to be a hollow tree, how bats and squirrels may see an attic as a warm place in which to nest and over-winter, and how chipmunks and field mice find rock walls and woodpiles to be attractive nesting sites.

Regardless of where we live, wildlife is an integral part of our environment and daily life. They have become the major component of non-consumptive wildlife recreational activities in the United States and are the most important element of state and federal fish and wildlife programs, U.S. Fish and Wildlife Service programs, and other non-game conservation activities. The National Audubon Society has played a major role in promoting bird-watching throughout the world. This group, along with a number of other environmental organizations, has been instrumental in influencing environmental legislation and efforts to protect various bird species.

What is an animal pest? According to *Webster's Dictionary*, a pest is a person or thing that causes trouble, annoyance, and/or discomfort. Thus, wildlife pests are individuals or populations which affect humans in this way. However, from the animal's perspective, humans fit this definition as well because humans have encroached into their native habitats, leaving animals no opportunity but to adapt to this incursion. Construction techniques have created ideal roosting and nesting sites that offer birds year-round protection from the elements and provide harborage for other animals. Cultural practices, including waste disposal, recreation, and gardening, have enticed wildlife to take advantage of artificial environments, such as, landfills, ponds, etc.

Wildlife cause significant damage to crops with subsequent loss of food and animal feed. Estimates for this type of depredation range into the hundreds of millions of dollars annually. Damaged crops include grains, corn, vegetables, berries, fruits, etc.

Damage to structures by wildlife can be extensive and expensive to repair. Most damage is related to the process by which animals gain entrance to the structure, the creation of nesting sites, and to the filth generated by their droppings. Significant damage can also occur when animals are trapped or harassed by humans. Birds damage structures through their nest building activities, accumulation of droppings, diseases, ectoparasites, and contamination of food and water causing it to be unpalatable or unsuitable for human consumption.

A recent incident occurred in a nearby suburban area in which children came upon several deer in their backyard and began to

chase them through the neighborhood. The terrified deer, in their attempt to escape the children, jumped through plate-glass windows in neighboring houses, resulting in thousands of dollars in damage to furniture, walls and other property within the homes as well as to themselves as they became injured. At least one deer had to be destroyed. Fortunately, no humans were physically injured, although they easily might have been.

Several years ago, a pest control company was called in order to trap squirrels that were nesting within the attic of a house, and to prevent them from re-entering the house. The job took place during the homeowner's vacation. Unfortunately, the company failed to ensure that all the squirrels were out of the attic before the exterior entryways were sealed. The squirrels wreaked havoc in their attempts to exit the attic, eventually chewing their way through the ceiling into the living spaces of the house and tearing up upholstered furniture and other property in their search for food and escape.

Consumers most often complain about wildlife damage to ornamental plants, shrubs and trees. Damage can result from wildlife animals' eating buds and foliage and rubbing bark off of young trees. Both of these situations may result, at worst, in the death of the vegetation, and at best, in disfigurement of the plants as well as in ticked-off homeowners who may, in turn, seek revenge on the wildlife in question.

Bird strikes to commercial and military aircraft around airports are financial concerns, but more importantly, jeopardize human life. Gulls are the most important species involved in this type of damage.

Birds, such as starlings, can create a severe annoyance by the obnoxious noises they create when roosting near dwellings or buildings. The early morning drumming of a woodpecker on the gutter of a roof to mark its territory can be a severe irritant, as can probing the outside of a log home looking for an insect.

The presence of pest bird species displace more preferred species. Some pest birds take over other birds' nests, destroy eggs of non-pest species, and kill fledglings.

Sparrows, pigeons and, increasingly, gulls persistently beg for food, loafing around outdoor eating areas, parks, and similar locations. Gulls are more of a problem around port areas. Unfortunately, these behaviors are often encouraged by park visitors and customers. When they leave, however, the permanent human residents of the area are left to contend with the by-products of the birds. Occasionally, this feeding activity can be aggressive, especially with gulls, to the point that humans are intimidated by the birds' approach.

Some birds, particularly crows, have come to recognize a free meal even when it is carefully bagged. These birds recognize the potential of a large dark garbage bag placed by the curb for pick-up and quickly rip it apart in search of a gourmet meal.

The most important result of human encroachment into wildlife habitat is the increased risk of exposure to diseases (diseases that are transmissible from animals to humans) such as histoplasmosis, Lyme disease, hantavirus, and rabies. More than 50 diseases are associated with birds, their nests, and droppings. Diseases, such as chlamydia, encephalitis, and

salmonellosis can affect human and domestic animal health, and, in some cases, even cause death. A variety of ectoparasites, such as mites and ticks, are associated with wildlife and often bite humans or infest domestic animals resulting in extreme discomfort. Other arthropods, such as dermestid beetles, flies, etc., can invade structures from the nests and droppings left by animals.

There are many negative ways in which wildlife pests affect us, our dwellings, and domestic animals. However, it is important to remember that their benefit unquestionably outweighs the damage they cause. Nevertheless, there are occasions when wildlife control is necessary and pest management strategies must be utilized. Wildlife problems are unique pest management situations.

The best approach to such problems is the use of an integrated pest management (IPM) program, i.e., a systems approach which uses a decision-making process in order to anticipate and prevent pest activity and infestation by combining several strategies to achieve long-term solutions. Components of an IPM program might include education, proper waste management, structural repair, maintenance, biological, and mechanical control techniques, and pesticide application. The order and degree to which these techniques are used depends on the situation. Most wildlife management programs require much planning and time to implement. Therefore, only those companies willing to make these investments should undertake this type of work.

# **CHAPTER 1**

## **DISEASES, ECTOPARASITES AND DAMAGE ASSOCIATED WITH WILDLIFE**

Animals serve as reservoirs of numerous disease-causing organisms and ectoparasites. This section discusses the role of animals in the transmission of diseases, such as encephalitis, histoplasmosis, salmonellosis, cryptococcosis, chlamydiosis, tularemia, plague, Lyme disease, rabies, etc. Animals are also hosts for numerous ectoparasites, e.g., mites, ticks, fleas, etc., which are carried on their bodies or found in their nests. This section discusses those ectoparasites that attack humans and domestic animals. Insects associated with animals and their nests, such as fly maggots and dermestid beetles, are mentioned. Finally, this section covers the effects of wildlife on food production, storage, and distribution as well as the damage to structures that can result because of them.

### **DISEASES**

Krzysik (1989) describes 5 major and 15 minor diseases that are associated with birds and which may be human health hazards. Most of the disease organisms associated with birds only affect their health and, therefore, are not a major threat to human health. Many bird species are territorial and very independent, pairing only to mate, or forming very small groups. Thus, they do not congregate in large flocks which minimizes the likelihood of diseases being transmitted within the species and reduces the risk of disease transmission to humans and domestic animals. However, there are

three pest bird species-- pigeons, European starlings and house sparrows--that do form large flocks and frequent areas in close proximity to humans and domestic birds. This significantly increases the risk of disease organism transmission between members of the flock as well as the likelihood of human and domestic animal exposure.

### **VIRUSES**

The most noteworthy viral diseases associated with pest birds include Eastern Equine Encephalitis (EEE), St. Louis Encephalitis (SLE), West Nile Virus and Western Equine Encephalitis (WEE). Other viral diseases include meningitis, Newcastle's disease, avian pox and gastroenteritis. These diseases are called arboviruses because they are transmitted from a reservoir animal, e.g., birds, to an incidental host, e.g., humans, by an arthropod vector, e.g., mosquitoes. These diseases can be transmitted among the bird population by other arthropods, such as ticks and mites, or through infected blood ingested while pecking other birds with no notable effects on the bird population.

The spread of the disease is dependent upon the virus multiplying to large numbers within the blood stream of the reservoir birds or other small vertebrates as well as the presence of mosquitoes. Humans are not effective reservoirs for these viruses because the viruses do not increase to high enough

numbers in the blood stream, therefore the mosquitoes do not ingest them when they are taking a blood meal. Transmission of the disease is very species-specific with regards to the reservoir animal(s) and the mosquito vector(s).

Only a small percentage of people who are bitten by an infected mosquito exhibit symptoms of the disease. Symptoms can include headache, nausea, dizziness, fever, neck pain, and, in severe cases, coma and death. EEE and WEE cause severe cases of encephalitis in horses.

**Eastern Equine Encephalitis.** EEE occurs almost exclusively in the Eastern part of the United States. Although it does not affect large numbers of humans, the population at greatest risk is young children. The death rate of infected individuals reported in two studies was between 60-75%. EEE is a more serious disease in horses since they are more frequently affected than humans with mortality rates around 90%.

*Culisetta melanura* is the mosquito species responsible for the transmitting of the virus between birds. However, this fresh water breeder rarely bites humans. The mosquito species most often involved in transmitting the disease to humans are *Aedes vexans* and *Aedes sollicitans*. Pigeons and starlings are the reservoir birds most often associated with disease outbreaks in humans and horses.

**Western Equine Encephalitis.** WEE rarely occurs in the Northeastern part of the United States and is the least problematic of the three types of encephalitis. *Culisetta melanura* is the principal species involved in bird-to-bird transmission. Brown-headed cowbirds, pigeons, house sparrows and

blackbirds have- been implicated in the transmission of this disease.

**Saint Louis Encephalitis.** Until 1999 when West Nile virus was found in the United States, SLE was the most prevalent viral disease associated with birds and impacting human health. It occurs throughout the United States, although epidemics are more common in western and central states, particularly around the Mississippi river. SLE mortality rates are lower (10-30%) than EEE; however, the number of cases is significantly higher, and the over-60 year old age group is the one most significantly affected.

The species of mosquito most often associated with the disease in the Northeast is *Culex pipiens pipiens*. The most important reservoir birds include house sparrows, pigeons, and blackbirds.

**West Nile Virus.** WNV was identified for the first time in the Western Hemisphere in New York in 1999. By the end of the year, the virus had caused encephalitis in 62 people and numerous horses in and around New York City, resulting in 7 human and 10 equine deaths. The virus has continued to spread south and westward through 2004. Evidence of WNV has now been found in virtually all of the United States.

As far as severity of the disease, WNV is no more dangerous than SLE (one of our "native" encephalitis viruses) and similarly is more dangerous to older patients. WNV causes a bird disease and is transmitted by mosquitoes such as, *Culex restuans*, *Cx. salinarius*, *Cx. pipiens*, *Cx. quinquefasciatus* and possibly *Oclherotatus japonicus*. It is a mosquito-borne virus that is transmitted through the bite of a mosquito, which becomes infected with the virus by feeding

on an infected bird, such as crows and other members of the Corvidae family.

West Nile encephalitis is a viral infection of the brain that can cause serious illness or even death, particularly in the elderly and those with weakened immune systems. West Nile is not transmitted from person to person or from birds to persons. Symptoms occur five to 15 days following the bite of an infected mosquito. An infected person may have no symptoms at all or may experience a fever and headache before fully recovering. Severe infections may include high fever, headache, confusion, muscle aches, weakness, seizures or paralysis. At its most serious stage, the infection can result in coma, permanent neurological damage or death.

The other viral diseases commonly associated with pest birds have various effects on domestic and non-domestic birds and mammals, such as, cattle, pigs, dogs, cats, chickens, turkeys, and ducks. In some cases, these epizootics (i.e., disease epidemics in animals) can be disastrous. For example, on several occasions, Newcastle disease epidemics in poultry have resulted in approximately a 90% mortality rate and the destruction of millions of birds. Humans infected with Newcastle disease rarely experience more than 3 to 4 days of conjunctivitis (inflammation of the eye) that may rarely persist for up to 21 days). Most human exposure results from contact with diseased poultry or their by-products.

**Hantavirus.** Hantavirus is a virus capable of causing hantavirus pulmonary syndrome (HPS) in the western hemisphere. The most prevalent type of hantavirus causing HPS in the US is Sin Nombre virus or “Four Corners virus”. Three other types, New

York-1, Black Creek Canal, and the Bayou, have been identified in the US.

The Centers for Disease Control (CDC) reported a total of 289 HPS cases through January 2002. Of these reported cases 38% of the individuals died. Males accounted for 60% of the reported cases. The average age for all cases is 37 years with a range of 10 to 75 years of age. Caucasians represented 78% of the cases followed by native Americans with 19% of the cases. Cases have been reported from 31 states, with the most being west of the Mississippi River. Nearly 75% of the cases were reported from rural residents.

The hosts of the hantavirus are rodents, with the primary host species in the US being the deer mouse, *Peromyscus maniculatus*. To lesser extents, the cotton rat, *Sigmodon hispidus*, the marsh rat *Oryzomys palustris*, and the white-footed deer mouse, *Peromyscus leucopus*, also serve as hosts.

Recent studies have found that infected rodents are present in all habitats, but the prevalence of infection is higher in deer mice and within specific geographic areas. The fact that deer mice are the primary species involved in the transmission of the disease is of concern, because of their propensity to live in close association with humans when compared to other rodent species. Two additional factors which enhance this mouse’s ability to transmit the disease are its larger population densities and wider range of habitats.

Typically HPS infections are acquired by inhaling virus-laden dust contaminated with urine and/or feces. This usually occurs when people work in areas which have been heavily infested with one of the above rodent species and where there are

significant accumulations of urine and droppings. In addition, the disease can be contracted by exposure to contaminated materials, fresh or dry, which are introduced into broken skin, the eyes, or by ingestion. Person bitten by rodents have also been infected. Transmission of this disease does not occur through contact with infected humans or arthropod bites.

## **Rabies**

Rabies is a preventable viral disease of mammals most often transmitted through the bite of a rabid animal. Wild animals are much more likely to carry rabies, especially raccoons, skunks, bats, foxes, and coyotes. However, dogs, cats, cattle (cows), or any other warm-blooded animal can transmit rabies to humans. Domestic animals account for less than 10% of the reported rabies cases, with cats, cattle, and dogs most often being reported.

The rabies virus infects the central nervous system, causes damage to the brain, and ultimately death. Early symptoms of rabies in humans are nonspecific, consisting of fever, headache, and general malaise. As the disease progresses, neurological symptoms appear and may include insomnia, anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, excessive salivation, difficulty swallowing, and hydrophobia (fear of water). Death usually occurs within days of the onset of symptoms. The number of rabies-related human deaths in the United States has declined from more than 100 annually at the turn of the 20<sup>th</sup> century to one or two per year in the 1990's. In the United States, human fatalities associated with rabies occur in people who fail to seek medical

assistance, usually because they were unaware of their exposure.

## **BACTERIA**

There are more bacterial organisms associated with birds that affect human health than all other disease-causing organisms. Krzysik (1989) lists chlamydiosis, erysipeloid, Q fever, salmonellosis, vibriosis and yersiniosis as bird-associated diseases which potentially result in death.

**Chlamydiosis.** The bacterial disease most often associated with birds is chlamydiosis. However, it more frequently is referred to as parrot fever, psittacosis, or ornithosis. While this disease affects over 140 bird species, the two pest bird species most often infected are pigeons and gulls. The feral pigeon infection rate in several studies within the United States and Canada ranged from 15 to 73%. Feral pigeon populations in Baltimore had a 15% infection rate, and in Washington, D.C. the infection rate was 35%.

The causal organism is *Chlamydia psittaci* which has numerous strains. The effects of the disease range from mild infection to death depending on the species and age of the infected bird with younger birds being more susceptible to the disease.

While many birds do not exhibit symptoms of the disease, they are capable of transmitting it. The bacterium is a contaminant of feathers and droppings. It is very stable even when the droppings are very dry. Humans contract the disease by inhaling bacteria-laden dust, being bitten by a bird, accidentally ingesting infected material, or possibly through arthropod

vectors, such as mites, ticks and fleas. It is thought that these arthropods move the bacteria from one site to another on the surface of their bodies instead of transmitting the disease through a bite. The persons that are most likely to contract the disease are those individuals who have frequent contact with birds.

Human infections are rare, with only about 150 cases reported annually. Mortality rates are low and most often involve the elderly or individuals incapacitated with other infections. The symptoms are flu-like, and may include headaches, nausea, muscle aches, diarrhea, fever and chills. When properly diagnosed, this disease is easily treated with antibiotics.

**Salmonellosis.** Salmonellosis is the other major bacterial disease associated with birds. There are more than 2,000 different blood types in the genus *Salmonella*. The most common bacterial form found in birds is *Salmonella typhimurium*. This bacteria is not unique to birds and is very common in dogs and turtles.

Most *Salmonella* outbreaks are associated with some type of food poisoning, with contaminated poultry being one of the main sources. Individuals affected by the disease usually exhibit symptoms, such as nausea, vomiting, fever, chills, stomach cramps and diarrhea between 8-48 hours after eating. The disease usually is not fatal. However, young children and the elderly are more severely affected.

While many wild bird species are infected with the bacteria, the two pest birds likely to be involved in the transmission of *Salmonella* are pigeons and house sparrows. The bacteria often are found in bird

droppings and can become airborne when the droppings dry out. When dried, the bacteria are highly tolerant of environmental conditions and may persist for long periods of time. It is important to inspect for and remove bird droppings that have accumulated near air intake vents.

A variety of other bacterial diseases tend to affect other birds and domestic animals more significantly than humans. Avian tuberculosis is caused by the bacterium, *Mycobacterium avium*, which occurs frequently in sparrows, starlings and gulls. This disease can cause significant mortality in domestic poultry but has little effect on most domestic animals and rarely occurs in humans.

**Erysipeloid.** This disease is caused by the bacterium, *Erysipelothrix rhusiopathiae*. The organism is found in many animals and causes serious infections in birds. However, most humans who contact the organism develop no more than a skin lesion at the site of infection. The bacterium, *Listeria monocytogenes*, which is easily found in the environment and on many animals, causes severe mortality in birds. Listeriosis can cause meningitis and other infections or inflammations in human tissues.

*Borrelia burgdorferi*, the bacterium which causes Lyme disease, has been isolated from a few birds, causing speculation that birds may serve as hosts and dispersal agents for the disease. This hypothesis is also supported by the fact that the black-legged tick, *Ixodes scapularis*, is the principal vector of the disease in the Eastern United States and readily feeds on birds.

A disease that often causes severe mortality in bird populations, particularly crows, gulls and chickens, is pastuerellosis. It is caused by the bacterium *Pasteurella multocida*, which is rare in humans and usually, causes no more than an upper or lower respiratory infection or infection of other internal organs.

Other bacterial infections commonly associated with birds and usually having limited effects on other animals and humans are Q fever (*Rickettsia burneti*), tularemia (*Francisella tularensis*), vibriosis (*Vibrio fetus*), and yersiniosis (*Yersinia pseudotuberculosis* or *Y. enterocolitica*).

**Plague.** This is an acute disease of the circulatory and respiratory systems, caused by the pathogenic bacterium, *Yersinia pestis*. This bacterium is transmitted to rats and several other rodents by fleas. There are at least 125 species of fleas capable of transmitting plague, including the widespread human flea (*Pulex irritans*) and the northern rat flea (*Nosopsyllus fasciatus*). The northern rat flea is a common flea of domestic rats especially in the temperate and northern regions of the world. Nevertheless, relative to a human transmission threat, it is the Oriental rat flea (*Xenopsylla cheopis*) that is the principle vector of the plague organism.

People contract plague when fleas containing the bacterium bite them. Fleas obtain the plague bacteria after taking a blood meal from an infected host such as, rats, ground squirrels, prairie dogs, wood rats, chipmunks, etc. Plague kills the rodents it infects. When the rodent dies, the fleas leave the host and seek another suitable host. For the most part, humans are considered "accidental hosts."

From an epidemiological aspect, two types of plague occur: urban (cities and towns) and sylvatic (wild/wooded areas) plague. Urban plague is usually transmitted from commensal rodents (e.g., roof and Norway rats) by the bite of the Oriental rat flea and less often by other flea species. Urban plague cases are rare in the U.S., although isolated cases have occurred in Norway rats near urban areas in the West and Southwest. The rats in these cases likely became infected from the fleas of wild rodents, in areas where the plague bacteria are established among the wild mammal populations. Because of urban sprawl, new housing developments are now spreading into what were previously wild areas. Thus, there is increasing concern as to the potential for sylvatic plague to be transferred to domestic rodents and become urban plague.

Away from urban areas, sylvatic plague is transmitted to people from ground squirrels, chipmunks, prairie dogs, wood-rats, deer mice, California ground squirrels, rabbits and hares. The fleas of these mammals may attack humans, usually hunters, when the animals are handled and skinned. For the 284 human cases of sylvatic plague reported between 1970 and 1990, about 50 % of these cases were reported in New Mexico, with the remaining cases occurring in Arizona, California and Colorado.

In humans, plague manifests itself in three clinical forms: (1) bubonic, (2) septicemic and (3) pneumonic. Without treatment, mortality rates range upwards to 95 % depending on the type of plague and the severity.

**Tularemia.** This is a potentially serious illness that occurs naturally in the United States. It is caused by the bacterium

*Francisella tularensis* found in animals (especially rodents, rabbits, and hares). In the United States, most persons with tularemia acquire the infection from arthropod bites, particularly tick bites, or from contact with infected mammals, particularly rabbits. Historically, most cases of tularemia occurred in the summer and were related to arthropod bites. While in the winter they were related to hunters coming into contact with infected rabbit carcasses. In recent years, a seasonal increase in the incidence of contracting this disease has occurred in the late spring and summer months, when arthropod bites are most common. Outbreaks of tularemia in the United States have been associated with the handling of muskrats, tick bites, deer fly bites, lawn mowing or cutting brush.

Tularemia characteristically presents itself as an acute fever and in some cases an ulcer forms at the site on the skin, or mucous membrane, where the organism was injected. People who have been exposed to the tularemia bacteria should be treated as soon as possible. This disease can be fatal if it is not treated with the right antibiotics.

## FUNGI

**Histoplasmosis.** The most notable fungal disease associated with birds and bats is histoplasmosis which is caused by the spores of *Histoplasma capsilatum*, a very common soil organism in temperate and tropical climates. The fungal spores tend to proliferate in areas where bird and bat droppings accumulate in significant quantities, particularly on spore-laden soil.

There are three forms of histoplasmosis: acute pulmonary, chronic pulmonary, and disseminated. The acute pulmonary form is

the most common form, with symptoms similar to those of a cold or allergy, and they usually go away without treatment. Symptoms of the chronic form include respiratory problems, productive cough, weakness, and fatigue. Untreated, these conditions may continue for several weeks or years and ultimately result in death, usually from associated conditions. Disseminated histoplasmosis is the result of the organisms spreading throughout the body via the bloodstream. It affects the internal organs, particularly the liver and spleen, and can cause fevers, anemia, and mouth-sores. These symptoms usually become apparent 11 to 14 days after exposure and are more severe in young children and the elderly. It is usually fatal if left untreated and causes approximately 50 human deaths per year.

Transmission of histoplasmosis usually results from inhalation of airborne spores when soil in the roosting sites or accumulations of droppings is disturbed. With estimates of over 30 million Americans infected, only 10% ever exhibit symptoms. Individuals usually contact the spores when cleaning bird-roosting areas due to contaminated clothing, or the spores being sucked in through air-handling systems. Generally, it takes about three years of continuous roosting for the number of spores to reach infectious levels. However, spore growth is affected by temperature, humidity, and pH. While these conditions are essential for growth, the spores can survive for years under extremely dry conditions and grow at depths up to 15" (37 cm).

Roosting birds most often associated with histoplasmosis outbreaks include blackbirds and starlings, particularly in their winter roosts. Many domestic and wild animals,

including bats, are infected with the disease. However, they do not transmit it, nor do they serve as a means for dispersing the spores. They are dead-end hosts, as are humans, and for the most part are immune to the disease's effects. There is circumstantial evidence that bats might be involved in dispersal of the spores.

**Cryptococcosis.** Another fungal disease associated with birds is caused by *Cryptococcus neoformans*. While some birds serve as the carrier of the spores, they are not significantly affected by the organism. However, smaller animals and humans usually are the only animals significantly affected.

In many ways, this disease is similar to histoplasmosis, in that the early stage of the disease affects the respiratory system with symptoms similar to those encountered with the flu, a cold, or allergy. As the disease advances, it may cause muscle and joint pain, and affect various organs, the central nervous system, and mucosal linings. Ultimately, the disease may result in meningitis. Usually *Cryptococcus neoformans* affects individuals who are predisposed to infections due to a previous or ongoing illness.

Another similarity between cryptococcosis and histoplasmosis exists in how the disease is contracted. In most cases, it is through the inhalation of airborne spores which accumulate in the bird droppings, particularly those of pigeons. Pigeons are believed to harbor the organisms within their intestinal tract and pass them in their droppings. In several studies, more than 50% of the pigeons in a given population tested positive for *Cryptococcus neoformans*.

This fungus is very sensitive to basic solutions and as a result can be removed and inactivated using an ammonia solution.

**Aspergillosis.** This fungal disease is caused by several species of *Aspergillus* and has devastating effects on wild and domestic birds because they develop respiratory infections. Humans contract the disease, not directly from birds, but, indirectly through inhalation of spores from droppings or other contaminated materials.

Two other fungal diseases associated with birds include blastomycosis (*Blastomyces dermatitidis*) and candidiasis (*Candida albicans*). The former has been associated with starling roosts and pigeon manure, while the later disease with pigeons, turkeys and chickens. Both organisms can cause respiratory infections, skin lesions, and other infections.

## ENDOPARASITES

**Protozoans.** Birds play a role as reservoir animals in the transmission of protozoan parasites which live in the blood cells of their hosts. Three major protozoan diseases associated with birds are American trypanosomiasis, toxoplasmosis, and malaria. These diseases rarely have any effect on the reservoir bird population.

American trypanosomiasis (*Trypanosoma cruzi*) is vectored by kissing bugs, mainly *Triatoma* spp., which feed on human blood, thereby transmitting the disease. They also are known to take blood meals from birds. However, while the birds are unaffected by the organism, they can serve as a reservoir. A protozoan, *Toxoplasma gondii*, commonly found in pigeons, starlings, and house

sparrows, causes toxoplasmosis. It also is very common in domestic animals, particularly cats which likely contract the disease by eating wild birds. The disease is contracted when animals and humans eat materials contaminated with feces containing oocysts, the infective life stage of protozoans.

Four species of *Plasmodium* account for millions of human deaths worldwide as a result of malaria. Successful transmission of malaria requires two hosts, e.g., mammal, bird, amphibian, etc., and a blood-feeding arthropod, usually mosquitoes. The disease is transmitted to humans and most animals by mosquito bites but can be transmitted in animal populations by several other blood-feeding flies. Birds do not play a role in malaria transmission to humans because avian malaria is caused by different *Plasmodium* than the four species found in humans. Malaria in bird populations can be very localized or widespread. In some cases, infection rates as high as 100% have been reported. The disease does not appear to cause significant bird mortality.

**Baylisascaris.** This is an intestinal raccoon roundworm that can infect a variety of other animals, including humans. The worms develop to maturity in the raccoon intestine, where they produce millions of eggs that are passed in the feces. Released eggs take 2 to 4 weeks to become infective to other animals and humans. The eggs are resistant to most environmental conditions and with adequate moisture, can survive for years.

Young raccoons become infected by eating eggs during foraging, feeding, and grooming. Adult raccoons acquire the infection by eating rodents, rabbits, and birds infected with the larvae of *Baylisascaris*.

People become infected when they accidentally ingest infective eggs in soil, water, or on objects that have been contaminated with raccoon feces. When humans ingest these eggs, they hatch into larvae in the person's intestine and travel throughout the body, affecting the organs and muscles.

Anyone who is exposed to environments where raccoons live is potentially at risk. Hunters, trappers, taxidermists, and wildlife handlers may also be at increased risk if they have contact with raccoons or raccoon habitats.

**Giardiasis.** This is a diarrheal illness caused by a one-celled, microscopic parasite, *Giardia intestinalis* (also known as *Giardia lamblia*). Once an animal or person has been infected with *Giardia intestinalis*, the parasite lives in the intestine and is passed in the stool. Because the parasite is protected by an outer shell, it can survive outside the body and in the environment for long periods of time. *Giardia* is found in soil, food, water, or surfaces that have been contaminated with the feces from infected humans or animals. During the past 20 years, *Giardia* infection has become recognized as one of the most common causes of waterborne disease in humans for both drinking and recreational water within the United States. You can become infected after accidentally swallowing the parasite, but cannot become infected through contact with blood. Typically the disease is contracted by swallowing recreational water that is contaminated with *Giardia*. Recreational water includes water in swimming pools, hot tubs, jacuzzis, fountains, lakes, rivers, springs, ponds, or streams that can be contaminated with sewage or feces from humans or animals.

## ECTOPARASITES

Ectoparasites are organisms which live on the exterior of a host animal and are dependent on the host for survival. Many are host-specific and have adapted to living on a single type of organism, such as birds while others are opportunists and feed on a more diverse group of animals. Most birds have one or more species of ectoparasites living on their bodies or in close association with them. These parasites typically feed on body tissues or blood.

Several arthropods are considered to be occasional blood feeders on birds. For example, several species of true bugs in the family Cimicidae, which includes the bedbugs, are found in bird nests. They do not travel on the birds as do other blood feeders. Approximately 125 species of fleas have been found on birds, but is still considered a rare occurrence. Bird fleas pose a greater threat to young birds than to adult birds or humans.

Another group of blood feeders associated with birds is the louse flies (Diptera: Hippoboscidae). Most species of these unusual looking flies are wingless and have very specialized mouthparts. Another of their unusual features is that their larvae are never seen because they develop in the abdomen of the female and pupate immediately after she expels them. Louse flies tend to remain in the nest and are rarely dispersed by the birds. On the other hand, the flies are involved in the dispersal of various mites and lice that are associated with birds.

Ticks and mites are another group of common blood-feeding arthropods associated with birds and other wildlife.

## TICKS

**Hard Ticks.** Three hard ticks found in bird nests, particularly ground-nesting birds, are the rabbit tick (*Haemaphysalis leporispalustris*), *Ixodes brunneus* (the most common hard tick found on birds with it reportedly being found on over 64 species), and the lone star tick (*Amblyomma americanum*) which also feeds on skunks, rabbits, raccoons, fox, squirrel, rats, dogs, cats, cattle, and humans. Other hard ticks that feed on mammals include: American dog tick (*Dermacentor variabilis*) – found on deer mice, rabbits, squirrel, moles, sheep, cattle, dogs, and cats; black-legged tick (*Ixodes scapularis*) - found on deer mice, skunks, raccoon, opossum, deer, dogs, cats, and humans; Each life cycle stage (larva, nymph and adult) of most hard ticks parasitizes a successively larger host animal.



*Ixodes scapularis* (Deer Tick)

One of the major problems with hard ticks is their ability to survive for several years after consuming a single blood meal. This means that the animal may be long gone when the ticks begin searching for the next blood meal. These ticks occasionally are found indoors when they are carried in on a domestic animals or people, however they do not reproduce indoors and rarely require

interior treatment. Treatment for these ticks should focus on outdoor areas frequented by domestic animals and brushy areas that transition between woods and lawns and pastures.

**Soft Ticks.** This type of tick is more often associated with birds than hard ticks. In fact, *Argas* spp. are almost exclusively found associated with birds. The fowl tick, *Argas persicus*, feeds almost exclusively on birds including sparrows, geese and pigeons and rarely on humans. The pigeon tick, *Argas reflexus*, is more likely to bite humans, but it does not transmit disease. *Argas* larvae actively search for a blood meal at day or night, while the nymphs and adults are active only at night. The nymphs and adults hide in cracks and crevices or the nest during the day. The life cycle for this tick averages about two months with adults living approximately one year. *Ornithodoros* spp. shows no distinct preference for birds or mammals. In addition to birds this group of soft ticks feeds on humans, domestic animals, white-footed mice, and ground hogs. These ticks carry and transmit the disease organism that causes relapsing fever.



Soft tick Laying Eggs

## FLEAS

Fleas are best characterized as laterally flattened and wingless blood feeding insects that are capable of jumping. Various species of fleas feed on a wide range of wildlife and can be found associated with their nests, dens, and trails where they travel. It is not uncommon that once an animal is removed from a chimney, crawlspace, or area under a porch to receive a call from a customer about flea bites.



Flea

Flea larvae develop where the host animal spends a lot of time particularly the nest or den area. Adult fleas lay their eggs on the host animals. The eggs then fall off the animal and when the larvae hatch in a couple of days they feed on the undigested blood excreted by the adult fleas. After 7 to 10 days the larvae pupate and the pupae mature into adults within a few days to several months. This resting pupal stage can make flea control difficult and necessitate several treatments.

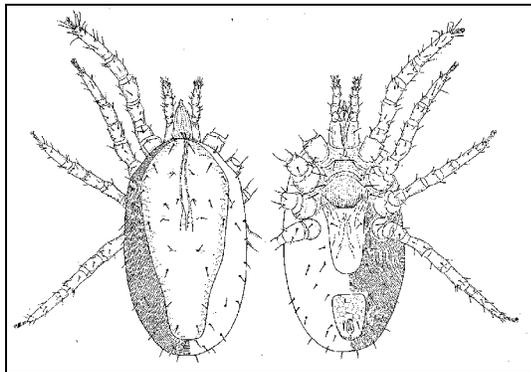
## MITES

The most difficult group of ectoparasites to control in pest management is mites because they are so small, can get through the

smallest opening, and can cause severe irritations to humans. The three most common species associated with birds are the chicken mite (*Dermanyssus gallinae*), the northern fowl mite (*Ornithonyssus sylviarum*), and the tropical fowl mite (*Ornithonyssus bursa*). Other mites, such as the tropical rat mite (*Ornithonyssus bacoti*), are associated with mammals.

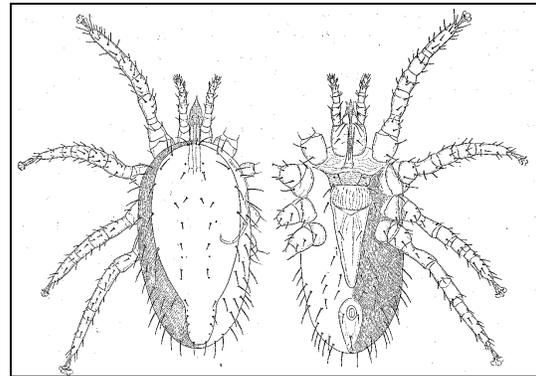
**Chicken Mite (*Dermanyssus gallinae*).**

This is the most common mite on sparrows, starlings, and pigeons and most often causes human dermatitis. They are intermittent nocturnal feeders and do not remain on the host bird. During the day, they are found in cracks, crevices, and/or the nest. They can survive up to eight months without a blood meal.



Chicken Mite (*Dermanyssus gallinae*).  
NPMA

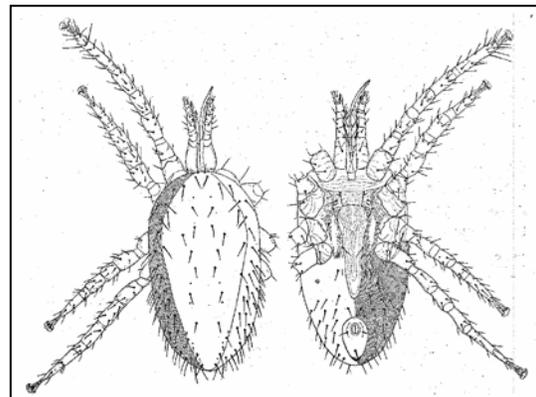
**Northern Fowl Mite (*Ornithonyssus sylviarum*).** Northern fowl mites bite humans and mainly are an annoyance. However, they also can cause dermatitis. They are a common parasite of sparrows, starlings, and pigeons. These mites spend most of their time on birds and can survive only three weeks off birds. Northern fowl mites overwinter in bird nests and readily migrate out of the nests when they are vacated.



Northern Fowl Mite (*Ornithonyssus sylviarum*). NPMA.

**Tropical Fowl Mite (*Ornithonyssus bursa*).**

The biology of this mite is very similar to that of the northern fowl mite. They typically are associated with sparrows but prefer to remain in the nests instead of on the birds. They survive less than ten days without the host bird and, therefore, pose a short-lived problem in human habitats. Tropical fowl mites bite humans and can cause dermatitis.



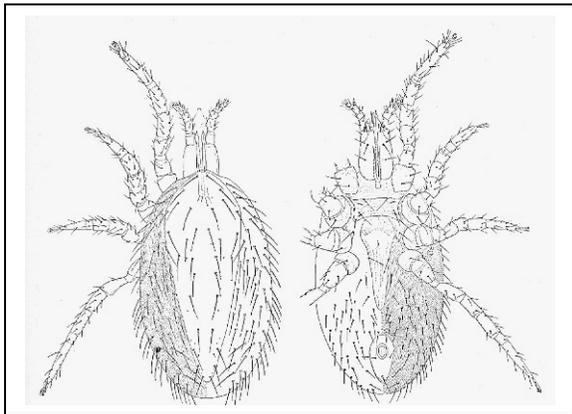
Tropical Fowl Mite (*Ornithonyssus bursa*).  
NPMA

**Feather Mites.** This is a group of mites which infest birds and cause dermatitis in humans and domestic animals. They use their chewing mouthparts to feed on bird

skin, scales, feather oils, gland secretions, and quill substances.

**Tropical Rat Mite (*Ornithonyssus bacoti*).**

Typically this mite is associated with Norway rats. However, they have been found on skunks, squirrels, field mice, opossums, raccoons and shrews. They feed at night and hide in the walls near sources of heat during the day. These mites readily feed on humans even when an animal host(s) are available and can survive a couple of months in the absence of a food source. They are considered minor vectors of tularemia and plague.



Tropical Rat Mite (*Ornithonyssus bacoti*).  
NPMA

**Mange Mite (*Demodex spp.*).** This mite is found in the hair follicles of humans, domestic animals, and wildlife. Animals that are heavily infested with the mite occasionally develop a secondary bacterial infection and the combined effect is referred to as mange. Mange is characterized by the fur falling out in patches, reddened skin, and in more severe cases open sores and scabs.

**MISCELLANEOUS**

Another group of insects which feed on similar substances is the chewing lice (Mallophaga) which usually are host-

specific, and though they do not represent a threat to human health, it is not unusual to find them associated with bird nests.

A variety of other insects, including dermestid beetles, hister beetles, rove beetles, tenebrionid beetles, clothes moths, earwigs, and bottle fly maggots, may be associated with birds and their nests. Most are classified as scavengers and are opportunistic feeders. When the birds leave the nest or the nests are removed, these insects move into other areas of the structure looking for food and water.

Because these actions often lead to the development of a secondary pest problem, the implications of animal and nest removal during any wildlife job should always be anticipated and included as a critical part of the pest management plan.

Most of these potential problems can be solved by removing accumulated droppings and the nests, making sure to dispose of them immediately. To control insects, mites, ticks, and other associated pests, a pesticide should be applied to the nest area, cracks, and crevices within the vicinity of the nest.

**SAFETY MEASURES WHEN WORKING WITH WILDLIFE INFESTATIONS**

As a pest management professional, you are probably at greater risk for exposure to these diseases than many of your customers. So, use proper personal protective measures and be careful when dealing with wildlife.

Personal protection is essential when working in and around bird nests and roosts, areas where there have been large deer and white-footed mice, and bat infestations. Most of the diseases associated with these

animals that impact human health are due to airborne exposures. The areas of greatest concern are vacant buildings, sheds, garages, crawlspaces, and attics. A respirator capable of filtering out particles as small as 0.3 microns (HEPA filter), protective gloves, hat, coveralls, and boots should be worn. The use of disposable clothing eliminates exposure of laundry personnel to these diseases. Following job completion, equipment and personal protective equipment should be cleaned, and individuals should shower.

To avoid risk of contracting several diseases from areas that contain accumulated animal droppings, the following precautions should be noted:

- Bird and bat droppings and animal feces should be sprayed with water to prevent dust and spores from becoming airborne, then scraped or shoveled into a plastic bag for disposal.
- The outside of the bag should be wet in order to remove any dust and the droppings. Rewet the bag if dry areas are exposed. This process should be continued until all droppings have been removed.
- The area can then be disinfected by spraying the surface with a bleach solution, mixing one part bleach to ten parts water).
- Trash bags should be deposited directly in the landfill rather than left by the curb or in a dumpster where they might be broken.
- Care should be taken to avoid contaminating hands and clothes.
- The use of gloves and facemask will help prevent cross contamination.
- Wash your hands often, using soap

and warm water, especially after handling animal carcasses.

Rabies exposure occurs through the introduction of contaminated saliva into an opening in the skin, or from the bite of an infected animal. Animals typically affected by rabies include: fox, skunk, raccoons, bats and woodchucks. Early treatment of the disease typically results in full recovery, except in extremely rare cases where failure to treat results in death. Severe bites are likely to occur when wild animals are approached, fed and handled. Personnel performing wildlife management with potentially rabid animals should be immunized against rabies. This provides limited protection, however, a bite or scratch from a potentially rabid animal may require additional rabies treatments. This is why it is very important to talk to your doctor, or health care provider, right away if you are bitten by any animal, especially a wild animal.

Protect yourself from arthropod bites that may transmit diseases by following these precautions:

- Outdoor activities during peak insect activity, typically dusk to dawn, should be avoided.
- Breeding sites and resting sites should be avoided.
- Long sleeved pants and shirts should be worn.
- Skin repellents, such as DEET, should be used when entering areas in which mosquitoes are active. Formulations containing more than 35% active ingredient are overkill.
- Clothing repellent, such as products containing 0.5% permethrin should be applied to all outer garments before putting on the clothing. Skin

applications of these products are not permitted.

Falls represent another hazard in wildlife control, especially bird work, and should be avoided at all costs. Bird work often requires technicians to work considerable distances off the ground. Ensure that the appropriate equipment such as, ladders,

scaffolds, cherry pickers, safety lines, etc., are selected for the job, serviceable, in good repair, and used properly. When climbing on equipment and buildings, proper safety procedures and equipment must be used. Ensure that sufficient personnel are available to perform the job safely in order to prevent falls, serious injury, or death.

## **CHAPTER 2**

# **IDENTIFICATION, BIOLOGY, HABITS, AND MANAGEMENT OF MAJOR PEST BIRD SPECIES**

The most important steps in performing bird control work include identifying the species involved, determining the extent of the problem, and differentiating pest bird species from other birds that are protected by State or Federal law. Some bird species are migratory and protected by the federal Migratory Bird Treaty Act. These include species such as, crows, geese, cowbirds, blackbirds, gulls and starlings. See Section VIII for more information on this Act.

See Appendix A for pictorial keys to birds and other wildlife of public health importance. In addition, individuals performing bird control work should use a

regional bird identification field guide to assist them in the identification of non-pest species. See Appendix B for a list of other resource books.

Identification of the pest bird species is essential to successful bird management programs. Knowing the bird provides information on the biology and habits of the pest bird population. It also helps to determine where, when, how, and what pest management strategies should be utilized.

This section describes the most common pest birds, their biology, habits, and the damage associated with their presence.

**Rock Dove or Pigeon**  
*Columba livia*



The rock dove, or pigeon, is one of 11 species of the family Columbidae which breed in North America. The species was introduced to North America in the early 1600s and is distributed throughout the United States, southern Canada, and Mexico. Pigeons have adapted to a variety of environments, from cities to agricultural settings and from buildings to cliffs. They have become the most serious bird pest associated with buildings.

**Identification**

Pigeons are distinguished by the following characteristics:

- approximately 13 inches (33 cm) long;
- vary in color from white to black;

- most have a dark grey head with an iridescent sheen, a light grey back, and wings with two dark bands;
- stocky body, short legs and neck, and small head;
- in flight, the tail-tip usually is square and black.

**Biology**

Pigeons nest in a variety of protected locations that include sites, such as, the underside of bridges, building ledges, rafters in barns and other open buildings, roofs, air conditioners, signs, etc. Their loosely-constructed nests usually consist of sticks, stems, leaves, and other debris. Nests that are reused often become solid with the accumulation of droppings and debris.

Their white eggs are laid 1 to 2 at a time and require approximately 18 days of incubation. The eggs are incubated by both parents. The male incubates them from mid-morning through the afternoon, and the female for the rest of the day and evening. They produce 2 to 5 broods, or up to 10 young per year.

After hatching, the almost featherless young birds are totally dependent on the parent birds for warmth and food. For the first five days, the newly hatched birds are fed a milky substance, called “pigeon milk” that is produced in the crop of the parent birds. During the next five days, more water and grain is incorporated into the “milk” and finally, they are fed only grain and water. The young pigeons leave the nest approximately one month after hatching.

Male pigeons are sexually mature at 3 to 5 months of age and females at 6 months. Pigeons nest during all seasons, conditions permitting, and they mate for life unless separated by death or accident. If one of the mated pair is lost, the survivor will mate again within several days. Adults can mate again while feeding the preceding fledglings. Pigeons typically live 4 to 12 years.

## **Habits**

In rural settings pigeons typically feed on seeds, grain and fruit. They find areas with spilled silage, such as., grain elevators, railroad yards and mills, all of which are very attractive feeding sites. In urban areas, pigeons feed on handouts, garbage, vegetable matter, and insects.

In contrast to many other bird species, pigeons prefer flat and smooth surfaces like roof tops, for resting and feeding. If threatened, this affords them a quick getaway. They gather in flocks which use the same roosting and feeding areas. Feeding usually occurs no more than a few miles from the roosting site.

## **Damage**

Pigeons produce very acidic droppings which can cause significant damage to equipment, painted building surfaces, marble, limestone, etc. Their fresh droppings which accumulate on sidewalks, ledges, and other flat surfaces, result in slippery and dangerous situations. Droppings also contaminate unprocessed grain and processed food and can contain a variety of disease-causing bacteria, fungi, nematodes, etc. Pigeons serve as reservoirs for several viral encephalitic diseases. Many of the parasitic mites associated with pigeons also bite humans.

## European Starling *Sturnus vulgaris*



The European starling is one of two species of the family Sturnidae that were introduced into North America from Europe in the late 1800s. They are distributed throughout the United States, including the southern tip of Alaska, most of Canada, and Mexico. They occur in a wide range of habitats, from farms to urbanized areas.

### Identification

Starlings are distinguished by the following characteristics:

- 7½ - 8½ inches (19-22 cm) long;
- color varies with the season:
  - in the summer: purplish-black with an iridescent sheen;
  - in the winter: the tips of their feathers are marked with white and gold, resulting in a speckled

- appearance;
  - the bill is bright yellow in the spring and summer but turns dark in the winter;
- stocky body with a very short tail that makes them appear tailless.

### Biology

Starlings usually select nesting sites in the shadows of brighter light. In urban areas, they tend to roost in building cavities often 20 to 70 feet (6-21 m) above average street light height. In suburban and rural settings, they often nest in tree holes, birdhouses with holes larger than 1.5 inches (4 cm) in diameter, and other protected areas 2 to 60 feet (1-18 m) above the ground. Nests are constructed of twigs, grass, and other debris and are lined with feathers and/or other soft materials. Both parents build the nest, incubate the eggs, and care for the young.

The eggs vary in color, from white to light blue, and some have dark spots. They are

laid 2 to 8 at a time and require 12 to 14 days to incubate. They average 2 broods each year and can produce up to 16 young per year. After hatching, the young are almost featherless and totally dependent on the parent birds for food and water.

Young starlings leave the nest approximately three weeks after they hatch. Unmated, males flock and move from roosts to feeding sites together. As the first brood matures, they join this flock. Thus, as late summer approaches, the flock increases significantly in size as the final brood and mating pairs join them.

### **Habits**

Some starlings migrate as cold weather approaches. Birds that do not migrate usually roost in protected areas, such as, buildings in urban areas.

At dawn, starlings travel as far as 70 miles (113 km) from the roosting site to a feeding site. When they return to the roosting area at dusk, they first perch on telephone wires, bridges, buildings, trees, etc., until after sunset at which time they fly around the roosting site, perhaps several times, before settling in for the evening.

Starlings feed on the ground and away from their roosting sites. During spring and early summer, insects and occasionally soft fruit is the principal diet of nesting birds. During late summer, fall and winter, their diet preference shifts to grains, seeds, and fruits. They can consume up to 1 oz (28 g) of grain per day.

### **Damage**

European starlings increasingly are found nesting in kitchens, bathrooms, ovens and dryer vents resulting in problems for the homeowner.

They consume large quantities of animal feed and also feed on small fruit crops and vegetables. They contaminate animal feed and foul buildings and sidewalks in the vicinity of their roosts. People often are bothered by the accumulation of their droppings and their irritating noise at their roosting sites. Others do not like the fact that, by competing for nesting sites and food, they displace other more desirable cavity-nesting birds such as woodpeckers. Starlings have been implicated in the transmission of several human viral and bacterial diseases.

**House Sparrow**  
*Passer domesticus*



The house, or English, sparrow is one of two species of the family Passeridae which occur in North America. It is not a true sparrow, but, a type of finch. This species was introduced into the United States in the mid-1800s, is distributed throughout the United States, most of Canada, and Mexico. It has become well-established in both rural and urban settings.

**Identification**

House sparrows are distinguished by the following characteristics:

- approximately 6 inches (15 cm) long;
- color varies with the sex:
  - males have a black patch under the beak, and the cheeks, rump, and the top of the head is grey-white and in the winter, the black area is hidden by the grey feather tips;
  - females and young sparrows are dull brown with a dirty white breast and brow.

**Biology**

Sparrows prefer to build their nests in protected man-made and natural areas, such as building ledges, openings within structures, gutters, signs, light fixtures, birdhouses, beneath the eaves of houses, bridges, electrical power lines, and transformers. They also displace other birds, such as wrens, robins, purple martins, etc., from their nests, destroy their eggs, and use their nests for their own broods. Occasionally, sparrow nests are constructed within trees. Both sexes construct rather large and flimsy nests from straw, grass, feathers, strips of paper, string and other debris.

The eggs range in color from white to light green to light blue and have numerous dark spots. They average 5 to 6 eggs per clutch and require 10 to 14 days to incubate. They produce 2 to 3 broods or up to 21 young per year. After hatching, the almost featherless young birds are totally dependent on the parent birds for food and warmth. Young sparrows leave the nest shortly after their first flight at approximately 15 days and

begin to form small flocks. They are joined by successive broods, and eventually the adult birds, often form a flock of several hundred sparrows.

### **Habits**

In rural settings, sparrows cause considerable damage to wheat, sorghum, and other crops as birds consume as much as 0.2 oz (6.0 g) per day. They also feed on insects, various seeds, tree and plant buds, sprouting plants and, occasionally on ripening fruit.

Sparrows tend to be very territorial, both as individuals and as flocks, and restrict their nesting and feeding to specific locations. They congregate in urban areas in the winter and disperse to rural areas in the spring. Flocks of juvenile birds and non-breeding adults sometimes travel 4 to 5 miles (6.4-8 km) from nest sites to feeding areas.

### **Damage**

House sparrows increasingly are found nesting in kitchens, bathrooms, ovens, and dryer vents, resulting in problems for the homeowner.

Sparrows destroy the eggs, confiscate the nests, and kill more desirable nesting song birds. They foul structures with their droppings, particularly those areas used for roosting and loafing sites. They enter food plants, warehouses, department stores, and malls where they often contaminate food products and other merchandise.

Their droppings can contain a variety of disease-causing bacteria, fungi, and nematodes, etc. Sparrows are considered one of the major reservoirs of St. Louis encephalitis. Numerous blood-feeding parasitic mites associated with sparrows also bite humans.

**Herring Gull**  
*Larus argentatus*  
and  
**Ring-billed Gull**  
*Larus delawarensis*



The herring and ring-billed gulls (Family: Laridae) are two of the more than 50 species of gulls which occur throughout the United States. They are the two most commonly encountered gulls in the Northeast. Their range extends from Maine, south along the Gulf Coast to New Orleans. Both species are found the length of the Mississippi river basin. The herring gull also occurs throughout most of Canada, and the ring-billed gull is found in the middle plain states. Two other species of gulls, laughing gull (*Larus atricilla*) and greater black-backed gull (*Larus marinus*), occur in Maryland. Earlier in the 20<sup>th</sup> century the distribution of gulls was limited to coastline areas. However several species have extended their ranges significantly inland due to the attraction of landfill areas and increased agricultural development. Because the latter two species are predators of rodents and insects, farmers have derived

significant benefit from their presence in agricultural areas

**Identification**

Gulls are distinguished from other birds based on their large size, long pointed wings, square tails, hooked bills, and webbed feet. It is often difficult to distinguish species because the color of the head plumage varies seasonally from a dirty white/brown to pure white/black. The young are often dirty white to brown. They are distinguished by the following characteristics:

**The Herring Gull:**

- 23 to 26 inches (58-66 cm) long;
- light gray back and wings with black tips and white spots;
- white head and breast, a red spot near the tip of the lower portion of
- its bill, and yellow eyes.

The Ring-billed gull:

- 18 to 20 inches (46-51 cm) long;
- slightly darker gray back and wings with black tips and white spots;
- white head and breast, a black ring near the tip of its bill, and yellow eyes.

The Laughing Gull is:

- 15 to 17 inches (38-43 cm) long;
- easily recognized by its black head.

The Greater Black-Backed Gull is:

- black on its back and the top of its wings;
- white wing tips, head, breast and tail.

## **Biology**

Both species tend to nest in colonies on the ground. The nest is constructed of seaweed, grass, sticks, and feathers. Herring gulls occasionally nest on ledges or cliffs while ring-billed gulls occasionally nest in low trees.

They lay 2 to 4 brown to olive green eggs which have several darker marks. The incubation period is approximately 3 to 4 weeks. Only one batch of eggs is produced each year. Adult sea gulls provide little care for their young. The young birds have feathers when they hatch and readily move and feed themselves.

## **Habits**

Gulls feed on a wide variety of materials, including fish, clams, mussels, garbage, dead animals, insects, earthworms, rodents,

fledgling gulls, etc. The ring-billed gull is the species most often found around fast food restaurants, whereas the herring gull prefers landfill areas. They often loaf in large open areas with a good field of view.

They are very gregarious birds, often roosting by the thousands during the breeding season and winter. It is not uncommon to find several species roosting together. Feeding sites can be located up to 40 miles (64 km) from the roosting area.

## **Damage**

Gulls in the urban environment often are major nuisances. They foul residential and commercial buildings and public areas with their extremely smelly droppings. They can be very noisy and aggressive when begging for food. Occasionally, they damage gardens, affect other nesting birds, and are responsible for more than fifty percent of documented aircraft-bird strikes. They also are a particular nuisance around harbors, landfills, and agricultural areas.

Ring-billed gulls have adapted their nesting habitat to roof tops of buildings in some locations. The feathers and litter the gulls bring into the nest site cause roof drains to clog and water to overflow into the buildings below. They peck holes in flat roofs covered with rubber type coatings, and the resulting leaks cause damage to the buildings, ceilings, and contents.

Sea gulls pose little threat to human health, and their ectoparasites are not a problem because they rarely, if ever, nest or loaf in populated areas.

**Canada Goose**  
*Branta canadensis*



The Canada goose is one of 40 species of swans, geese and ducks (Family: Anatidae) which breed in North America. In contrast to the aquatic members of this family, it is primarily a terrestrial species. There are at least 11 geographical races of geese which range in distribution throughout the United States, Canada, and the very northern areas of Mexico. The largest and most abundant race occurs in Maryland. At one time, this species was migratory, however, it now overwinters at sites where they are fed regularly.

**Identification**

This species is distinguished by the following characteristics:

- 22 to 45 inches (56-114 cm) long;
- brownish gray with a black head, neck, and tail feathers;
- distinctive white triangular patch on the underside of the neck.

**Biology**

Geese generally nest at the edges of lakes, ponds, swamps and other large bodies of water. The nests, which usually are located on rocks or clumps of grass within the body of water or in grass near its edge. They are constructed of sticks, mud, grass, etc., and lined with feathers. Some geese are adapting to reduced nesting habitats by utilizing building balconies and roofs.

They produce a single clutch of 4 to 8 white eggs each year. The eggs require approximately 4 weeks in which to incubate. Geese care for their young by showing them what to eat and protecting them from predators. Young birds have feathers upon hatching, readily move and feed themselves, and leave the nest within 2 days of hatching.

## **Habits**

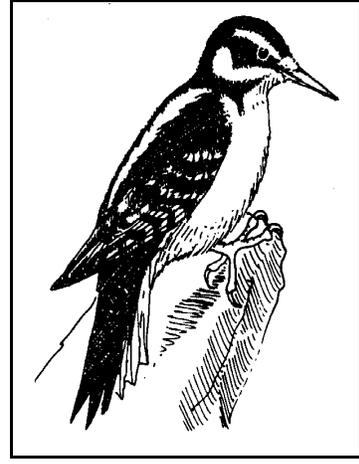
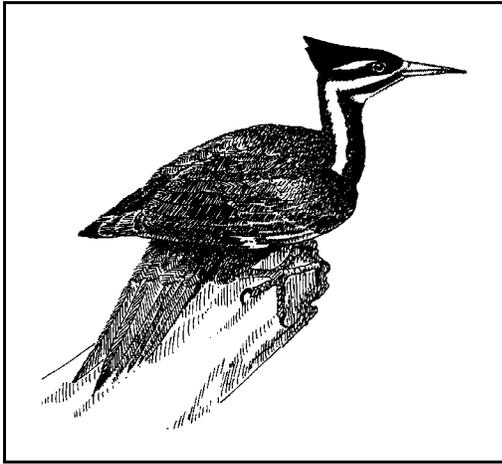
Canada geese feed in the water on submerged vegetation and on land in stubble cornfields, or on winter wheat, clover, and waste grain. They thrive in many suburban areas where they subsist on grass and handouts from humans. Feeding sites tend to be open with good visibility.

## **Damage**

These majestic birds are beautiful to watch in flight as they travel to various feeding sites, however, they can create major problems in their nesting areas. Golf courses, parks, residences with large ponds, and other locations can become overrun by large numbers of geese which foul the area with their large and numerous droppings. In addition, they often eat and wear the grass to the ground and can be aggressive with people.

Canada geese are a threat to aircraft when they are found on airports.

## Woodpeckers Family: Picidae



This family is represented by 22 species which breed in North America. They also include the sapsuckers, which characteristically band a tree horizontally with small holes. Various species are found throughout the United States, Canada, and Mexico.

### Identification

Woodpeckers generally are distinguished by the following characteristics:

- 6 to 18 inches (15-45 cm) long;
- vary greatly in color;
- most distinguishing feature is the sharp pointed beak used to dig and probe into trees in search for insects and to feed on sap.

The pileated woodpecker is:

- 18 inches (45 cm) long;
- mostly black with white markings on the side of the head and neck;
- has a bright red crest.

The downy woodpecker is:

- about 6 inches (15 cm) long;
- the bill is about half the length of the head.

The hairy woodpecker is:

- 9 inches (22 cm) long;
- the bill is about the length of the head;
- downy and hairy woodpeckers are similar in color with a white back and belly and predominately black wings with white spots;
- males have a patch of red on the back of their necks.

### Biology

The large pileated woodpecker nests within dead wood, 15 to 70 feet (5-21 m) up in the tree. It produces one clutch of 3 to 5 eggs each year and prefer to feed on carpenter ants. Feeding sites can be recognized by the 4 to 6 inch (10-15 cm) square excavations on the tree.

Downy woodpeckers excavate holes in dead trees for nests. They produce one clutch of 4 to 5 white eggs each year and feed on a variety of wood-boring insects.

Hairy woodpeckers excavate holes in live trees for nests. They produce one clutch of 4 to 6 white eggs each year and feed on a variety of wood-boring insects.

### **Habits**

The three woodpecker species discussed above share two habits, drumming and feeding on wood structures, that earn them occasional pest status. The male drums to mark territory, 150 to 200 acres for pileated woodpeckers, and to signal their availability to females during mating season. This behavior is also exhibited between males

and females as part of their courtship behavior. Unfortunately, they prefer to drum on materials that resonate loudly, such as gutters, vents, metal siding, dead tree stubs, etc., and occasionally, this activity results in structural damage.

### **Damage**

Damage to structural wood, telephone poles, signs, etc., is often cosmetic and localized. However, wood structures that remain seasonally vacant, such as cabins, or log homes can become heavily damaged. Parts of structures that are attacked include siding, eaves, decks, and shutters. Some of this damage is the result of the birds pecking in the wood in search of wood-boring insects, such as, carpenter bees.

**Crows, Ravens, Magpies and Jays**  
**Family: Corvidae**



This family is represented by 16 species which breed in North America. Various species are found throughout the United States, Canada, and Mexico.

**Identification**

Crows are distinguished by the following characteristics:

- 9 to 27 inches (23-69 cm) long;
- crows and ravens are coal black;
- most of the remaining species are brilliantly-colored;
- the sexes do not differ significantly in color;
- in contrast to the sounds of song birds, they tend to squawk gratingly.

The American crow is the species commonly found in Maryland. It is distinguished by the following characteristics:

- large, 17 to 21 inches (43-53 cm);
- black;
- large breasted;
- fan-shaped tail.

**Biology**

The American crow produces 1 to 2 clutches of 4 to 5 bluish green to dull green eggs with brown spots each year. The nest is constructed of twigs, grasses, and sticks and usually is located in a tree.

## **Habits**

The preferred habitat is deciduous trees along bodies of water, open pine forests, orchards, and parks. American crows form communal roosts which include younger birds from previous years. They assist in caring for the young and defending the territory.

## **Damage**

Most of their damage is to agricultural products, particularly seeds, nut crops, and corn seedlings. Crows and ravens have adapted well to the urban environment where they readily feed on road kills, garbage, and refuse.

In suburban areas, they pick through roadside garbage, garbage cans left uncovered, or in dark plastic bags. Crows and ravens are predaceous on other birds, fledglings, eggs, amphibians, reptiles, and small rodents. They use utility poles, lamp posts, and even the tops of buildings as perches to look for prey, roosts, and nesting sites.

Crows cause even more damage and problems for homeowners who live in the vicinity of a roost. For example, within Maryland the towns of Hagerstown, Frederick, Baltimore, and Rockville have roosts each year.

## Blackbirds, Grackles and Cowbirds Family: Emberizidae



This native American family of birds, represented by 95 species, also includes the Bobolink, meadowlarks, and orioles. Various species are found throughout the United States, Canada and Mexico.

### Identification

These birds are 6 to 17 inches (15-43 cm), and the colors are highly variable with the males more brightly colored than the females. They are distinguished by the following characteristics:

Red-winged blackbirds:

- black with a red shoulder patch and a splash of white;
- females lacking this distinctive coloration are brown with a streaked breast.

Grackles

- black with some iridescent areas;
- slightly larger than robins;
- long keel-shaped tail and yellow eyes;
- females are dull brown, some with pale markings on their breasts.

Brown-headed cowbirds:

- relatively small, i.e., slightly smaller than mockingbirds;
- males are glossy black with brown head;
- females are grayish brown with a white throat patch.

### Biology and Habits

Redwing blackbirds nest in hayfields, marshes and low brushy vegetation. They lay 3 to 5 eggs and produce 2 to 3 broods each year. During the nesting period, they feed almost exclusively on a variety of crop insect pests, and as a result, are very beneficial to farmers. They often fly as far as 40 to 50 miles (64-80 km) from their roosts to crops, grasslands, and woods. When they depart the roost they tend to disperse in smaller flocks.

Grackles are a more gregarious species, preferring to live in colonies. They produce one clutch of 4 to 7 eggs each year. The nest is made of grass, twigs, leaves and mud constructed in a tree or vines 3 to 30 feet (1-9 m) above the ground or water.

Cowbirds are considered parasites because of their habit of using the nests of other birds for their eggs. The female removes one of the host bird's eggs and deposits one of her own. The cowbird nestling hatches one day earlier and is larger than the host bird nestlings. As a result, it gets a disproportionate share of the food and care. This works well unless the host bird recognizes the egg or nestling as foreign and either destroys or abandons it. This is predominately a ground-feeding species, eating grain, insects, grasses, and seeds. Cowbirds do flock with other family species and can cause crop damage.

## **Damage**

In late August, at the end of the nesting season, blackbirds, cowbirds, and grackles flock together, often forming combined flocks numbering in the millions. The problems associated with flocks of this size moving through suburban areas and feeding at agricultural sites are obvious and can result in significant problems for homeowners living in or near roosts.

In August, redwing blackbirds become pests as they feed on grain crops, particularly mature corn. The husk is ripped open exposing the kernels to insects and disease. Grackle damage is similar to that caused by red-winged blackbirds.

## MANAGEMENT OF BIRDS

Bird management operations begin with a thorough survey to determine if there is a pest bird problem, the species involved, population size, identify any unique behavioral characteristics of the population, and evaluate the site. It provides the basis for a pest management plan that considers all available tools and options, including habitat modification, exclusion, frightening, trapping, shooting, and toxic baits.

### SURVEY

The most important step in solving a pest bird problem is conducting a survey. Initially the survey determines the species of bird(s) causing the problem and if a situation exists that requires action. In many cases, bird problems are transient and are resolved with no intervention. Most bird management plans fail or are complicated by public relations problems, because an inadequate survey was conducted.

At a minimum, the survey should address the following areas:

- location of the job site
- species observed (target/non-target; day/hour; number)
- habitat (food; water; structures)
- special equipment
- time requirements
- analysis of problem
- public relations issues
- recommended control procedures
- pricing considerations

The survey and proper identification of the pest and non-pest birds requires several tools:

- binoculars

- watch
- field manual - identification (see Appendix B)
- reference manual - biology, habits and control (see Appendix B)
- site plan or map
- survey form

A problem involving a single bird or a few birds usually does not require extensive planning. However, a few birds now may mean many more at a later time. Once a significant bird problem has been identified, the site should be revisited on several days and at least at three different times during each day. The site visit should be on a “typical day” rather than on a day when unusual activities such as, construction or building repairs, are taking place, or when normal activities are not occurring like a mill shut-down for fumigation. Adverse weather conditions, such as rain or high winds, should also be considered.

Observations should be made at sunrise, at midday, and finally in late afternoon. Each observation should note date and time. Binoculars and a field manual should be used to identify both target and non-target birds in the area. An estimate of the population(s) and notes on behavioral patterns should be made during each observation. This information should be recorded on the survey form and any notes or corrections made to the site plan. Site plans provided by the account management may be old, and structural changes may have occurred that may alter the approach to the bird problem.

This information forms the basis for developing an integrated pest management

(IPM) plan for the control of pest bird population(s). A written plan detailing the procedures to be used facilitates the development of a cost estimate for the project.

## **TOOLS AND TECHNIQUES**

Before instituting any pest management program for bird control, read the information contained in Section VIII, Public Relations and Regulations, of this manual. While the pest management plan targets only pest birds, consideration must also be given to migratory birds, and other non-target species in order to minimize the risk to these birds which may be affected by pest management operations. Questions regarding these laws and regulations and program implementation should be directed to Wildlife Administration of the Maryland Department of Natural Resources, Tawes State Office Building, Annapolis, MD 21401. *Lack of understanding is not an excuse for noncompliance.*

## **HABITAT MODIFICATION**

The best opportunity for habitat modification is the design and construction of a building or other structure. Unfortunately, in most cases, bird problems are an afterthought with little or no consideration given to potential problems during construction of the structure. Ledges, open beams, ventilation systems, cooling towers, structural ornamentation, etc., are sites which offer birds potential roosting and loafing areas. Many government buildings and monuments have structural details, such as establishments, like restaurants, and grocery stores, where a dumpster or a few refuse cans are involved.

as nooks, crannies, and ledges which appear to have been “designed” for birds and are ideal for perching and nesting. Attention to detail during construction can eliminate many of the nooks and crannies that birds can exploit for nesting. Constructing ledges on a 45° angle, making concrete as smooth as practical, and covering flat structural beams with sloped encasement are a few of the ways building design and construction can prevent bird problems.

Habitat modification involves changes to resources, such as food, water, nesting and roosting sites that are essential to bird survival. The site survey should identify which resources are being exploited by the birds and determine what measures can be taken to either remove the resource(s) or prevent access to them.

## **FOOD**

Birds are attracted to feeding sites primarily because a preferred food source is readily available. The following strategies are effective in established feeding sites, or as preventive measures. However, they are ineffective if the area is a resting, loafing or roosting site.

Mills, food processing plants, and similar facilities create an ideal feeding situation. This particularly is true in areas where spilled grains accumulate such as, rail sidings, silos, etc. Both procedural changes that eliminate the spillage and scheduled clean-up of these areas can reduce bird feeding in these areas. Similar procedures are easier to institute at commercial

In residential areas, crows have become a major problem because they dig through garbage bags placed by the curb. They

readily rip open plastic garbage bags in search of food. To remedy this problem plastic bags should be placed in metal cans, or reusable plastic collection containers, with tight fitting lids.

Gulls have become major pest birds around landfills. Proper operation of the landfill, including clean-up and regular covering of deposited waste, is essential to discourage or prevent bird activity. Gulls also have become major nuisances at harbor areas. For example, at the Inner Harbor of Baltimore, MD hundreds of gulls exhibit very aggressive behavior as they fight and beg for food. This feeding activity is facilitated by visitors who offer scraps of food to the birds. This type of human behavior can be corrected through education.

Urban areas, parks, and other public areas have become desirable feeding sites for sparrows and pigeons because the feeding of these birds provides entertainment for human visitors. This very sensitive situation is difficult to stop or prevent.

## **WATER**

Water sources are classified as either temporary or permanent. During the site survey, it is important to determine the water sources available to the bird population. In many cases, temporary water sources are easily eliminated or the birds are easily excluded from the site. However, permanent water sources may be too large to eliminate, or it may be too costly to exclude the birds from the area.

Temporary water sources, such as plugged gutters, drainage ditches, intermittent streams and creeks, etc., often can be eliminated by improving the drainage. Another water source often overlooked in site surveys, particularly of commercial structures, is flat roofs which can collect water in pools for a few days or as long as a month or more. A roofing company should be consulted to determine if drainage can be improved, or if the roof can be built up with gravel to reduce pooled water.

Lakes, ponds, and marshes are both attractive to large bird populations and difficult to manage in terms of bird activity. Though shallow water attracts more birds than deeper water, both support large bird populations. It is possible to exclude birds from permanent bodies of water by using netting (discussed in the section on exclusion).

## **ROOSTING, LOAFING, AND NESTING**

With the exception of sparrows, geese, and gulls, the major pest bird species discussed in this manual prefer to roost in trees with thick and protective canopies. Blackbirds and starlings usually select trees for their roosting sites. Sparrows usually use thick bushes around the foundations of structures. Starlings and grackles, as well as many other non-pest birds, prefer to feed in fruit trees. Therefore, it is important to note in the site survey the specific trees and bushes used for roosting and feeding sites.

Pruning and thinning trees and bushes are effective ways to discourage their use as roosting sites. Effective thinning may require that up to 30% of the canopy be removed. However, this could significantly weaken or damage the tree or bush. In addition, it is very expensive to replace an established tree or bush in the landscape, and as a result it may be more prudent to utilize a tree service or arborist. Trees and bushes should be trimmed when the birds are away feeding. Entire trees may require removal to discourage large starling and blackbird roosts.

Sparrows also use areas on structures that have become overgrown with ivy and other climbing vines as roosting sites. This situation can be managed by either thinning the thick growth to destroy the cover or by completely removing it from the structure.

Red winged black birds prefer to use sturdy tall grasses, such as reeds, for roosting. Areas supporting this activity can be mowed, or the tall portion of the grass can be cut. Gulls, pigeons, starlings, crows and geese prefer to loaf and graze in open areas where the grass is 2 to 4 inches (5-10 cm), and affords them a wide field of vision. Allowing grass to grow at least 6 to 10 inches (15-25 cm) high discourages grazing and loafing in the area.

Another technique often used to discourage nesting is nest and egg destruction (**WARNING: Nest and egg destruction for all migratory birds requires both federal and state depredation permits before the nests and/or eggs can be destroyed**). This works well for pigeons and sparrows, particularly when their numbers are not overwhelming. An easy way to accomplish this is to use a long pole or a broom. An alternative is to use a high

pressure sprayer, however, this can cause damage to the structure. Unless removal is supplemented with other techniques, such as exclusion, nests should be destroyed every two weeks during the spring and summer until the birds move to other nesting sites. Otherwise they will rebuild the nest within a couple weeks. When the nests are removed, the area should be treated with an appropriately-labeled insecticide/acaricide to kill bird ectoparasites.

## EXCLUSION

The number of exclusion products and techniques have increased dramatically in the past several years. In addition, product quality has significantly improved, e.g., netting materials are offered in different colors, plastic materials are more durable, and installation methods cause less damage. These factors, along with greater public acceptance of non-lethal strategies, have significantly increased the use of these techniques.

## STRUCTURAL REPAIRS

Most of the following information deals with various bird population sizes. However, some situations exist in which the customer has a problem with only one or two birds. This usually involves a sparrow or starling which enters the structure through an exterior opening, such as an open door or window, vent, chimney, hole, etc. This problem can usually be solved with very little effort by identifying the point of entry, then sealing it off. If birds are nesting in these areas, remove the birds, including any young and the nesting material from the opening prior to sealing it. A variety of materials are available for this type of work.

A properly designed chimney cap will keep birds and other animals out. Steel and copper wool can be used to fill smaller openings. The latter is the better choice if there is any water or condensation at the site of application. Screen and hardware cloth can be used to protect vents that require air flow. Aluminum or plastic screen and a heavy gauge hardware cloth should be used to avoid rust problems. Holes in walls, soffits, and eaves, etc. should be permanently repaired to prevent entry by birds or animals.



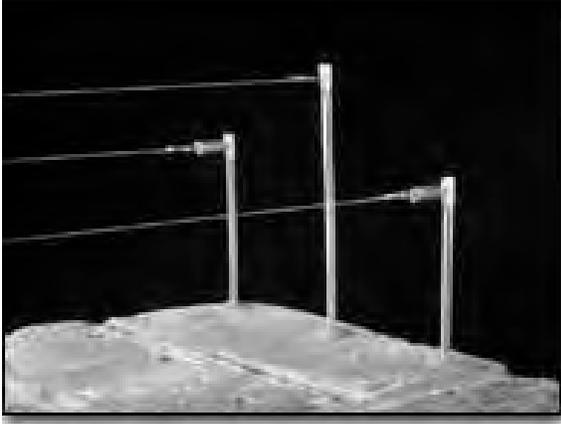
Structural repair is a concern for individual home owners as well as within commercial settings. Broken windows and any structural defects which permit bird entry or nesting should be repaired. Commercial buildings should be fitted with systems in order to deter bird entry through doors, loading

docks and other large openings. Loading dock seals are designed to fit tightly around trucks while they are being loaded, or unloaded, but are effective only if used properly. Air curtains may deter entry around smaller doors, and double vestibule entry systems also are very effective but are too costly for retrofitting.

### **MONOFILAMENT AND STEEL LINES**

These materials have been used successfully on ledges and other relatively flat surfaces on which birds roost or perch. Advantages of using monofilament line include ease of installation, lower cost, and it is rarely noticed by the casual observer. However, the lines occasionally weaken from exposure to sunlight, stretch, and/or break and must be replaced. Lines that have stretched and are sagging can entangle a bird and twist around its wing and/or foot when the bird flies into it. A live bird hanging from a line can cause significant public relations problems.

Monofilament line is used to deny gulls and other large water birds access to water resources, e.g., reservoirs, fish ponds, and other large open areas. The lines are installed in a parallel, zigzag, or crisscross fashion from 1 to 20 feet (30 cm - 6 m) above the water surface or ground. The space between the lines is species specific. For example, to exclude gulls, the spacing should be 4 feet (1.2 m).



Pin and Wire – Bird Barrier America

Stainless steel wire (10-gauge) can be used in the same environments as monofilament line. It offers the advantage of durability and rarely needs repair or replacement. However, it is much more expensive and more difficult to install because it kinks.

Coiled wire systems have also been developed for use in these areas. The coiled steel wire is stretched between two stainless steel posts which are securely fastened to a ledge or other surface being protected. Additional support posts are required if the span distance is more than 6 feet (2 m). Coil wire systems are designed for ledges approximately 5 inches (12 cm) wide, however, on wider surfaces, more than one Row should be used. These products have been used effectively to repel gulls and pigeons on buildings, billboards, electric signs, and in amusement parks.

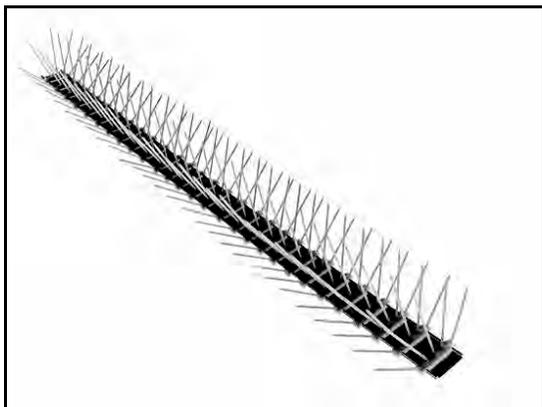
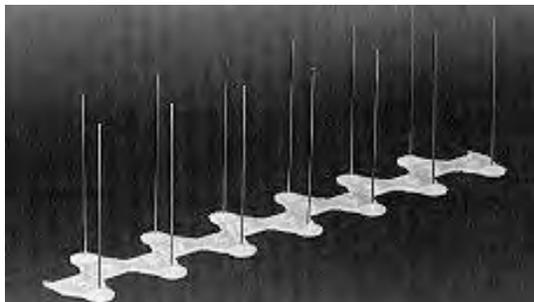
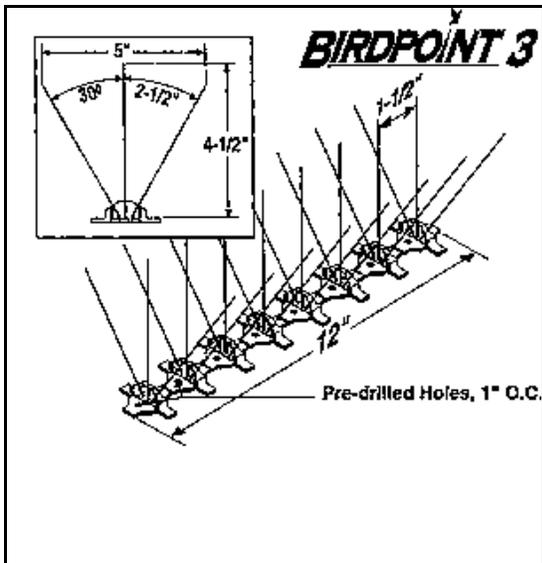


Coil Wire – Bird Barrier America

### **PLASTIC AND METAL SPINES**

A variety of spine and spike systems are available. These products use a system of long sharp metal or plastic spikes designed to repel birds from roosting and resting sites. Some manufactures offer stainless steel spikes in a variety of colors which makes them less obvious as they blend into their surroundings. Such products have been successfully used on ledges, gutters, signs, roofs, beams, architectural details, trees, air conditioners, awnings, and a variety of other narrow surfaces.

Spike systems are designed for ease of installation on a variety of surfaces and structural configurations. Single strips of the spines are designed to protect surfaces approximately 2 to 4 inches (5-10 cm) wide. In situations where wider ledges require protection, multiple strips can be used. The strips are attached to the ledge, preferably extending slightly beyond the front edge, with adhesives or stainless steel hardware. If they are installed too far back from the front edge, birds might be able to perch on the front of the ledge.



These products are more expensive than pin and wire/monofilament line systems and gel repellents which are discussed later. However, they are relatively permanent and require little maintenance. Maintenance usually involves the removal of debris that collects in the spines. Clients should be advised that if the debris is not removed, it will reduce the effectiveness of the spikes, and birds might be able to build nests among the spines. Another infrequent occurrence with certain systems is the impalement of birds trying to land on the ledge.

## NETTING

Netting is probably the best solution to most bird problems involving more than just a few birds because it provides a long term, normally 5 to 10 years or even longer, solution to most bird problems. It also is cost effective, and, when installed correctly, is rarely noticed. In addition, it can be used to protect both vertical and horizontal spaces, and can be attached to most surfaces

with little difficulty. However, it does require more skill and experience to install correctly. Check with local fire officials before using netting as some jurisdictions will not allow it to be used where it could block fire sprinklers and enclose balconies.

Bird netting has undergone significant changes in the past 10 years. The quality and durability of these products has been improved by using materials, such as polyvinyl chloride covered polyester yarn and polypropylene that are ultra violet (UV) light stable. Netting is available in a variety of mesh sizes, strand thicknesses, and colors. The mesh size best suited for pigeons and starlings is 2 inches (5 cm) and for sparrows is ¾ inch (2 cm). Price should not be the deciding factor in netting selection. Rather, how the nets are tied, the installation system, and thickness and quality of the material are more important in the decision-making process.



Stealth Net – Bird Barrier America

Most large openings are protected by installing a cabling system around the perimeter of the opening and attaching the net to the cable. Cables are installed using anchor eye bolts at the corners of the opening and attaching the cable using a tension bolt. This allows the cable to be drawn tight and adjusted periodically. The netting is then attached to the cable using plastic ties.

Netting is also installed on unusually-shaped structures using pins and ties. The pins are inserted in discrete locations and in sufficient numbers to allow the netting to be securely fastened over the object or surface being protected. Flower, seed, and fruit crops are frequently protected with netting.

### **ELECTRIC SHOCK**

This type of exclusion device is still available. However, with improvements to the previously-described systems and materials, it is not used as often as in the past. This system usually uses two wires that carry high voltage and low amperage. It poses little risk to humans, and although debris can cause shorts, the risk of fire is low. An alternative system uses a single wire mounted approximately 1½ to 2½ inches (4-6 cm) above the surface being protected. Current is intermittently transmitted through the wire in pulses. The electrical shock to the bird is felt sufficient to cause the bird to fly away and emit a distress call which, in turn, frightens other birds from the area.

At least one report indicates that this system is ineffective on birds because the skin on their feet is too thick for the current to affect them. Other deterrents to the use of electric

shock is the high cost of installation and the need for frequent service and maintenance.

A newer electric deterrent system involves the use of electric track.



Flex Track – Bird Barrier America

#### **GELS AND PASTES**

Gels and pastes are tacky, serve as repellents, are designed to be sticky enough to make a bird uncomfortable, but not so sticky that the birds are trapped. After a few attempts, the birds stop trying to land on the treated surface. These products are formulated as caulk, sprays, pastes, gels and aerosols. Probably the most frequently-used formulation is caulk. Most of these materials are nontoxic and effective against pigeons and starlings roosting, nesting and perching on ledges, and similar surfaces. Sparrows are not as easily deterred using these products because they are able to land on narrower surfaces.

Gels and pastes can be applied to virtually any type of construction material. Before applying, clean ledges that are covered with bird droppings, feathers, and nesting materials with a wire brush, paint scraper, high pressure hoses, or by steam cleaning.

Ensure that surfaces are clean and dry. To avoid staining, porous surfaces should be sealed prior to application. The surfaces can be sealed with a commercial sealant or waterproof tape can be used with the gel or paste applied on top of the tape.



Bird Proof Application – Bird X, Inc.

Gels or pastes should be applied in a 3/8 inch (9 mm) wide band on narrow ledges for crows and seagulls; 1/4 inch (6 mm) for pigeons; 1/8 inch (3 mm) for starlings; and 1/16 inch (1.5 mm) for sparrows. The pattern of application will depend on personal preferences. Apply a band 2 inches (12 mm) from the outer edge. On wider ledges, additional bands should be applied at 2 inch (5 cm) intervals for starlings and 3 inch (8 cm) intervals for pigeons. Alternatively, bands can be placed in a zigzag fashion. Another option combines placing a straight line 2 inches (12 mm) from the outer edge and an “S” curve 3 to 5 inches (8-13 cm) back. Place breaks in the bead every few feet to avoid trapping water against the building.

Gels and pastes are less expensive and easier to apply than other exclusion materials. Their major drawbacks are durability, at best 1 to 3 years, and they are difficult to remove once applied. However, this time can be shortened by heat, which causes the material to run and stain unsealed surfaces, or by cold, that causes the material to become brittle and crack. These products often become fouled with dust and debris, thereby making them unsightly and ineffective. The ability to remove the product should be considered prior to application because this could be an expensive liability should the customer be dissatisfied. Occasionally, birds contact too much gel or paste, and it sticks to their bodies, or they become entrapped and killed, which causes public relations problems. The latter situation is more of a problem with sparrows.

Repellent sprays can be applied to trees, bushes and broad surfaces where the caulking gels and pastes are too expensive and time-consuming to apply. This can be effective in trees used as roosts, but it can be messy and difficult to apply on high trees without a lift.

### **FRIGHTENING AGENTS**

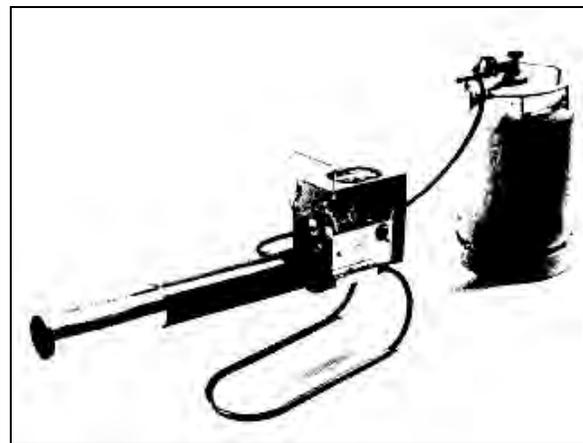
Most products used to frighten birds involve light, sound, or a predatory model. These products vary in their ability to frighten birds and deter them from returning to the area. Several devices are virtually ineffective in frightening birds, and even those that are effective initially lose their effectiveness as the birds become accustomed to the frightening element and then ignore it. The ability of a given product to remain effective usually depends on periodic movement of the device, or, in the

case of light or sound devices, a change in the intensity and frequency of use.

### **SOUND**

Sound devices are characterized as being either audible or ultrasonic and the latter is undetectable by humans. Audible devices include gas-operated cannons, pyrotechnics, whistles, distress calls, etc. Before using any type of exploding or loud noise-making device, check with local authorities. The use of noise-making devices of this type can be enhanced by occasionally shooting a few birds when the device is sounded.

Cannons are effective in open areas, such as agricultural fields, airports, and landfills. Cannons produce a gas generated boom which frightens the birds from the area. It is important that the device be moved periodically and that the sound is used at irregular intervals, ideally no more than once every 1 to 5 minutes for periods of an hour or less. These devices should not be used in populated areas.



Zon Propane Cannon – Sutton Agricultural Enterprises.

Exploders and firecrackers occasionally are used to frighten birds. However, some states have prohibitions on their use. When used, extreme caution must be exercised because of the potential for severe personal injury. Personal protective equipment such as safety glasses and hearing protection should be worn. Caution must be used in dry areas to ensure that exploders do not present a fire hazard.

Shell crackers are shotgun shells without pellets which explode after traveling 200 to 300 feet (656-984 m). Other explosive devices include report cartridges, whistle cartridges, and launchers which are fired from special modified .22 caliber (15 mm) guns with ranges of 75 to 300 feet (246-984 m). Most of these devices do not explode but do make noise as they travel through the air.

Recorded alarm and distress calls have been used effectively against gulls, blackbirds, and starlings. The system uses a tape and speakers to broadcast the sound which, to be effective, must be at a 100 to 120 decibels (db) in front of the speaker and located within 300 feet (984 m) of the birds. This technique is relatively species-specific. However, if the flocks are of mixed species, alarming one may cause the other(s) to disperse. It is best to use this technique to disperse starlings and blackbirds in the evening when they begin to settle in the roosting area.

Other electronic sound generating equipment has been used to frighten birds. However, studies have shown that the birds quickly adapt to the noise generated by the devices and that distress calls are far more effective.

Ultrasonics or sounds undetectable by humans have been tested against a variety of birds. Krzysik (1989) cites one study which indicates that while dogs, bats and some insects can hear these sounds, birds are unable to do so. He further cites studies that have examined the effectiveness of ultrasonics in dispersing birds, and in all cases the devices failed.

## **LIGHT**

Strobes, yellow flashing, rotating, and bright spot lights have been used to dislodge birds from their roosts. Most studies using light, including an attempt by the U.S. Air Force to accomplish this with the three major pest bird species, were unsuccessful.

Reflecting tape is a method of using natural light to disperse birds. One manufacturer produces the tape in three widths and two color combinations, red/silver and silver/silver. In the case of the red/silver tape, each side is a different color. Most uses of the tape have involved stretching a long piece of the tape between two poles at 21 to 31 feet (7-10 m) intervals above the structure or area to be protected. Another manufacturer produces a holographic iridescent diffraction foil that reportedly disturbs pest birds visually, aurally, and physically.

## **MODELS**

These products range from scarecrows to bird corpses, and are designed as plastic models, balloons, kites, etc. Unfortunately, models have little effect on most bird

species. Quite often, the birds initially are disturbed by the presence of a model, but they readily adapt to its presence, particularly if it is static or does not appear threatening. The effectiveness of predator models, such as hawks, owls, etc, is dependent on movement and whether the model attacks prey. Reportedly, the hawk kite models are the most effective model type. Scare eye balloons are available. These 2 to 4 feet (61-122 cm) diameter vinyl balloon models have two large eyes painted on either side and are designed to hang from structures, relying on the wind for movement.



Terror Eye – Bird-X, Inc.

Bird corpses can be used to repel crows and gulls; however, their success is dependent on how true-to-life the model is. Unfortunately, these products are not commercially produced. Actual corpses preserved in formalin or taxidermically-prepared have been used but do not last for very long.

## SHOOTING

This technique occasionally is employed in combination with other frightening techniques and as a method to kill individual birds or small populations. Areas in which shooting is permitted is limited by local or county ordinances on the discharge of firearms. In addition, federal and/or state permits may be required in order to shoot any protected species, such as seagulls. This should be determined before this expensive pest management strategy is used which often is unsuccessful in situations where birds readily migrate back into the area and/or when faced with lack of public acceptance.

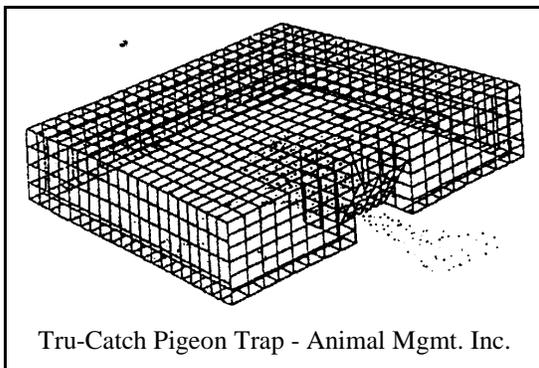
The success of repelling birds outdoors by shooting depends on maintaining the frequency of the shooting and subsequent harassment of the population. A .410 shotgun is best used at close range; while a larger bore shotgun can be used in more open areas. A .22 caliber rifle firing dust shot or a high powered air gun can be used to pick off individual birds indoors.

## TRAPPING

Trapping has proven to be more successful with flocking species. Trapping individual birds inside structures can be difficult. Traps range from simple cage traps to sophisticated cannon-net traps. Trapping offers the advantages of public acceptance and the ability to release non-target species unharmed. It is relatively expensive because of the high cost of equipment and labor intensive requiring frequent pre-baiting, baiting, and inspection to prevent the death of trapped birds.

Five factors to consider when implementing a trapping program are trap type, placement, bait and water, decoys, and disposal of birds. A variety of commercial traps are available, or for the occasional trapper, they can be fabricated easily and inexpensively.

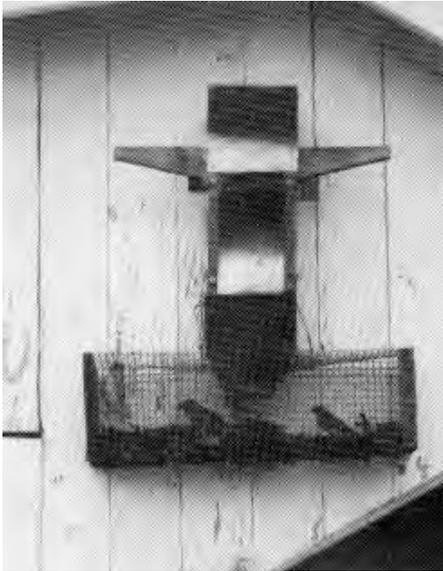
- The walk-in bob trap is an effective way to remove a few pigeons. These traps are usually 8 feet long x 4 feet wide x 4 feet high (2.4 m x 1.2 m x 1.2 m), but can be any size that is convenient to remove the pigeons. They should be large enough to crouch and enter or small enough so the birds can be reached from the outside. The basic trap design is a cage with a one-way door that swings in and is constructed of heavy rods which allows the birds to push the door in and enter the cage but not to push it out and escape. Several live decoy birds and bait should be placed in the cage in order to attract the birds.
- A low line trap for ground-feeding birds that is 24 to 48 inches long x 16 to 42 inches wide x 12 inches high (61-122 cm x 41-107 cm x 30 cm) can be fabricated or purchased. The trap is designed to let birds enter through a one way drop gate as they



are feeding on bait placed around the entrance to and just inside the trap.

- Funnel traps channel ground feeding birds, such as, sparrows and pigeons through a series of two funnels into a holding cage. These traps are baited and similar in size to other traps previously described. One design is a screen trap with two funnels leading to a holding chamber in the back of the trap. The first funnel has an opening at ground level which allows the birds to walk into the first chamber. The second opening, in the middle of the funnel, requires the birds to walk up or fly into the back chamber where they can be removed through an access door. These traps need to be checked frequently because the escape rate is relatively high.
- Nest box traps are used to remove starlings and sparrows during nesting season. This trap consists of a nesting box with a drop floor. As the bird enters the box and settles onto the floor, the weight of the bird causes the floor to drop it into a collection bag or cage. The floor automatically resets. Another box trap uses a modified mouse trap door to capture individual starlings. As the bird enters the nesting box the trigger, which is attached to door flap, is tripped and the door closes behind the bird. Still another design uses a chamber that tilts after the bird enters it through the opening of the box. The bird's weight causes the chamber to tilt, thereby dumping the bird into a holding cage or bag.

- Another type of trap is the center drop trap. The overall dimensions of center drop traps are comparable to the walk-in bob trap. The difference between this trap and the bob trap is that the top of the center drop trap is V-shaped, and the entrance panel is at the bottom of the V. Center drop traps originally were designed for



Last Perch Sparrow Trap

crows but can be modified to capture starlings. The main difference is in the size of the opening through which the birds enter. The crow trap openings are 18 inches (46 cm) x 6 inches (15 cm), while the openings for starlings are no more than 1-3/4 inches (4.5 cm) wide. This trap is effective in capturing starlings during flocking season, late summer through winter. Grain and fruit baits used in combination with a few live decoy birds are the best attractants.

Selection of the trap site is a critical element to the success of a trapping program. One of the most obvious considerations is

identifying areas where the birds are feeding. This is determined during the site survey. Another consideration is accessibility to children and other individuals, and/or animals which tamper with the traps. Finally, the aesthetics of trap placement and public concern over the fate of trapped birds must be considered. Traps may need to be placed in less than desirable locations, such as roof tops, behind obstacles, or other less obvious locations.

Pre-baiting with a material on which the birds are already feeding, having already identified as part of the site survey is the best way to determine a good trapping site. This should be done in several locations with the intention of identifying alternative trap sites.

Usually the most difficult part of trapping is motivating the birds to feed in a non-feeding area so that they will follow the bait into the trap. Before placing the trap, it is best to establish feeding on the type of bait to be used in the traps. Sparrows can be baited using poultry feed, fine cracked corn, grain sorghum, wheat, bread crumbs, or similar materials. Probably the best pigeon bait is whole corn or a mixture of one part wheat to five parts cracked corn.

Once the traps are placed, they should be baited by sprinkling bait on the bottom of the cage, and around the entrance with a smaller amount in the general vicinity of the trap. The trap should also have water. Chicken waterers come in a variety of sizes and can be used to provide water for the captured birds. Live decoy birds, which can be used as an additional attractant, should be caged securely and separately from the entering birds. For the first few days, the trap can be propped open without setting it

which allows the birds to become accustomed to the trap.

Traps should be inspected 1 to 3 times per week in order to remove captured birds and replenish the water and bait. The bait should be replaced at least once per week or more often if it deteriorates more rapidly due to weather. Birds will not eat stale or moldy bait. If the birds are still creating a nuisance but abandon the trap site, or if trap catch declines, other feeding sites should be established and the traps relocated.

Bird disposal is a very difficult issue to address. Release of pest birds usually results in their return to the area on which much effort and customer resources have been expended in the effort to remove them. Destruction of pest birds should be quick and humane. Protected birds should be released away from the capture site and provisions made to exclude them from the trapping area.

Trapping the occasional sparrow that has entered a building or mall can present one of the most difficult challenges. While shooting may work, it can be done only when no one is in the structure. Damage to the structure also is a risk. A net can be used in buildings with low ceilings, however, much time is spent running around the building. Use of glue boards presents another alternative, but they must be checked daily to prevent undue suffering to the trapped bird. Pre-bait several discrete sites that are not visible to either employees or customers, with the glue boards covered. Then after the feeding has been established, remove the cover and bait the glue board.

## CHEMICAL CONTROL

Chemical control involves the use of pesticides (avicides) designed to repel, alarm, or kill birds. All products must be registered with United States Environmental Protection Agency (EPA) and respective state agencies, and must be applied in accordance with the product label. **ALWAYS READ THE LABEL** prior to using any product. Federal, state and local laws may prohibit the use of these products or require a permit before use, even for pest bird species. In Maryland, any time a chemical toxicant is used to control wildlife, a site-specific permit must be obtained from the Maryland Department of Natural Resources Wildlife and Heritage Service. (See special note below on gulls.) Always check before using a bait to manage bird populations.

This section discusses the three most widely-used products for bird management. The use of product names is for identification only and does not imply any endorsement of these products or their use.

### **AVITROL® (4-Aminopyridine)**

This product is a restricted-use poison bait with flock-alarming properties. Within 15 minutes of eating a toxic dose of Avitrol®, birds will flutter erratically and go into convulsions. They may fly away from the baiting site or dive into the ground. Most severely affected birds will die within a few hours, but some survive longer. Only a small percentage of the flock, usually 5 to 15%, needs to be affected for an Avitrol® program to be successful. The flock becomes frightened by the convulsions and distress of the poisoned birds and from 65 to 85% of the birds will leave the area.

Avitrol® is formulated differently depending on the birds to be baited:

- Corn Chops: sparrows, red-winged, yellow-headed, rusty and brewers blackbirds, grackles cowbirds, and starlings
- Corn Chops Double Strength: red-winged, yellow-headed, rusty and brewers blackbirds, grackles cowbirds, and starlings
- Corn Chops FC-99: red-winged, yellow-headed, rusty and brewers blackbirds, grackles cowbirds, and starlings
- Mixed grains: all of the previously listed birds, except gulls and crows
- Concentrate: gulls
- Powder: starlings

The first three products are registered for use “in, on, or in the area of structures, feeding, nesting, and roosting sites, in such a way that part of the flock may react and frighten the rest away. Birds that react and alarm a flock usually die.” The concentrate formulation is labeled for use, “at, in, near or in the vicinity of sanitary landfills, airports and structures where gulls feed, nest, loaf or roost”. The Maryland Department of Natural Resources Wildlife and Heritage Section has a moratorium annually from April 1 through June 30 on the use of Avitrol® within a 2 mile (3.2 km) radius of an active peregrine falcon nest. Gulls are protected by law therefore, both Maryland and Federal permits are required to use Avitrol® for gull control.

According to the label, Avitrol® must not be used in a manner that will endanger desirable and protected bird species. It can be used in areas where food, grain or meat,

will not be contaminated. It is essential that a site survey be done to determine if non-target birds are feeding in the area, if they are, this product must not be used. Prebaiting should be done with the same bait base that will be used in the bait, such as, whole corn. In most situations, prebaiting should be done on the ground. When prebaiting within structures, the bait can be placed on beams and other areas using bait trays. Record the amount of prebait material consumed by the flock.

The objective of the pre-baiting program is to get at least 40% of the flock to accept the untreated bait. Prebaiting may require from 3 days up to 3 weeks. Remove all of the prebait material before switching to Avitrol®. The better the acceptance of the bait, the better the chance to move the flock quickly.

These products are designed to be diluted with the same bait base as the formulated product prior to placement. Specific dilution ratios are found on the product label. Generally, the dilution ratio for most species is 1 part formulated bait to 9 parts (1:9) untreated bait. This ratio may need to be decreased to 1:5 to get the necessary response with sparrows. A ratio of 1:29 is usually sufficient for the control of pigeons. In some cases, this may have to be reduced to 1:19 or 14, however, a dilution ratio less than 1:9 is not recommended. Reduced dilution ratios occasionally are necessary when there are competing food sources. A ratio of 1:29 will kill approximately 5% of the flock, while a ratio of 1:9 will kill about 15%. The amount of Avitrol7 bait set out should equal the amount of prebait consumed by the flock each day. Use the ratio that best fits the job and keep in mind that the object is to relocate the flock and not to kill every bird.

For better control of starlings within feed lots, corn chops may be more attractive when 4 parts bait are mixed with 1 part peanut butter. This mixture must be kept off the ground and out of the reach of other animals that might be attracted to it.

Avitrol<sup>®</sup> bait can be used as a spot treatment in those areas where feeding patterns have been established, target birds are actively feeding, and where non-target birds are not feeding. It should be used only in amounts necessary to achieve the desired effects. The best time to expose the treated bait is before sunrise, when the birds are hungrier and their metabolism is high. If the bait may be a hazard to non-target birds or animals, it should be picked up at the end of the day.

The bait may have to be reapplied on successive days until the desired effects are achieved or if it gets wet.

Baiting for gulls is a completely different process which involves a prebaiting program using bread squares. Care must be used in prebaiting and baiting efforts that more gulls are not attracted to the bait site than would normally be at the site, particularly when working at airfields. Many gulls may be attracted from surrounding areas by the gulls towering over the bait site. Some of them may cross in front of incoming or outbound aircraft and cause a crash.

Slices of bread are broken into twelfths and tossed in the air, either by a person walking or from a vehicle early in the morning. The same vehicle should be used, and the same clothes should be worn during this process.

To prepare the bait, cut two pieces of bread into twelfths and place them in the bag with the concentrate powder. Shake the bag until all the powder adheres to the bread. Use

gloves to handle the treated bread, and place it in a container with 10 other pieces of bread that have been broken into twelfths. This is enough bait to treat a flock of over 5,000 gulls. For best results, the bait should be evenly dispersed at eight sites. For smaller flocks, half the amount of bait is required. All treated bread cubes must be picked up so they are not eaten by humans and other non-target animals. Other baiting considerations previously discussed are applicable for gulls.

It is important to remember that the less the formulated bait is diluted, the higher the bird mortality. Exposing the bait in the morning during lower temperatures will increase bird mortality. Both these factors should be considered when lower mortality is a concern.

One Avitrol<sup>®</sup> application normally is adequate for most jobs. At large commercial operations, the bait might need to be placed daily for a few days. Make sure to pick good sites for the baiting. If the birds become bait-shy, wait about 3 weeks and then begin a new prebaiting program. If a site has been getting monthly Avitrol<sup>®</sup> maintenance baiting, birds can become extremely bait-shy. Prebaiting for as long as 3 to 4 months might be necessary, but it is usually best to switch to another control method.

### **REJEX-IT MA<sup>®</sup> (methyl anthranilate)**

This is a biological feeding deterrent derived from concord grapes, neroli oil, orange, acacia and gardenia blossoms. Three formulations currently are manufactured. According to the manufacturer's literature, it is effective against Canadian geese, mallards, starlings, and ring-billed gulls, and it is particularly useful against geese and

ducks grazing in turf areas of ponds and lakes, golf courses, sports fields, pools, airports, cemeteries, boat docks and marinas, and landfills.

Because of unknown risks to bee pollinators, it is conditionally registered by the EPA. The product can not be applied where it might drift to blooming crops and weeds if bees are visiting the treatment area. Label restrictions also prohibit its use in water, areas where surface water is present, or to inter-tidal areas below the mean high water mark.

The product is applied to turf areas or in the case of gulls, to garbage. It protects the area

by making the once-attractive food source unpalatable. The product is non-hazardous to humans and non-target species. To date, the only limitation to its use is loss of longevity and efficacy due to heavy rainfall. Therefore, to increase persistence, it should be applied with a spreader sticker.

Care must be taken in any bird control program to minimize the threat to non-target species and to use programs that pose the least risk. Remember to identify the non-target species in the area; use tactics that pose the least risk; modify those tactics to further minimize risks; and monitor the operation to be sure that no non-target species are being adversely affected.

## Chapter 3 Non-Commensal Rodents

### Eastern Chipmunk (*Tamias striatus*)



#### Identification

There are fifteen native chipmunk species found throughout the United States. The eastern chipmunk is the most common species in the Maryland area.

Eastern chipmunks are 5 to 6 inches (13-15 cm) long and weigh approximately 3 ounces (90 g). They are distinguished by their:

- two tan and five blackish longitudinal stripes running down their backs;
- two tan and two blackish stripes on each side of their faces;
- 3 to 4 inch (8-10 cm) long and hairy (but not bushy) tails.

#### Biology

Eastern chipmunks mate twice each year, in

the early spring and in late summer to early fall. The gestation period is approximately

31 days. Each litter contains 2 to 5 young that are born in April through May and in August through October. They reach sexual maturity in one year and can live up to 3 years.

Young chipmunks appear outside the burrow when they are 4 to 6 weeks old and leave the burrow at 6 to 8 weeks of age. During the winter, chipmunks do not enter a deep hibernation but feed on food they have stored in the burrow. Occasionally, they leave the burrow on warm winter days and become fully active in early March. The density of the chipmunk population varies depending on the availability of food and harborage. Under ideal conditions, there can

be as many as 10 per acre with overlapping ranges.

## **Habits**

Chipmunks typically inhabit mature woodlands and woodlot edges. However, with urban encroachment, they readily inhabit areas around homes. While their home ranges can be up to ½ acre (0.2 ha) in size, adults defend only a 50 foot (15.2 m) area around the burrow.

In residential areas they construct burrows near objects, buildings, patios, woodpiles, stumps, basements, and other protected areas. The main entrance to the burrow is approximately 2 inches (5 cm) in diameter. The opening to the burrow is not easily recognized because the excavated earth and debris is spread out away from the entrance. The main tunnel typically is 20 to 30 feet (6-9 m) long and contains a nesting chamber and one or more food chambers. Typically, there are side burrows within the tunnel and backdoor escape openings.

Chipmunks typically forage for food in the early morning and late afternoon. Their food primarily consists of grains, nuts, berries, seeds, mushrooms, insects, dead animals, young birds and bird eggs. While they are considered ground nesting, they do climb trees to gather food. Some of the food they gather is stored in the burrow.

## **Damage**

Chipmunks are considered nuisance pests because they undermine patios, stairs, retention walls, and patios. They aggravate gardeners by eating flower bulbs, seeds, and tender vegetation. They also eat readily-

available pet foods that are not stored in rodent-proof containers.

## **Management**

### **Inspection**

Inspect the property for nesting sites, such as, dense ground cover next to buildings, log piles, stone walls, and flagstone patios. Also discuss with the customer where chipmunks are seen running. Attics and higher areas in a structure may need to be inspected for chipmunks.

### **Habitat Modification**

Landscaping, such as ground covers, shrubs, and trees, around structures should not be continuous with natural woodlands as this provides ideal cover for chipmunks, and once near the structure, they may enter. Woodpiles, debris and dense ground covers should be relocated away from the structure's foundation. Bird feeders should be located as far as practical from the structure, or at least 15 to 30 feet (4.5-9 m) away.

### **Exclusion**

Exclusion is the best method to keep chipmunks out of structures using similar techniques and materials as those used for rats and mice. Holes ½-inch (12 mm) or larger should be permanently sealed using mortar, wire and foam, sheet metal, hardware cloth, or other durable materials. Attic openings should also be sealed. Chimneys should be capped with a wire cage or other animal-proof cover.

## Trapping

Small wire traps [5 inches x 5 inches x 16 inches (12.5 cm x 12.5 cm x 40cm)] or “Sherman” box traps [3 inches x 3 inches x 10 inches (7.5 cm x 7.5 cm x 25 cm)] can be used to remove chipmunks from around buildings. They should be placed along runs and near the openings to nests and baited with materials such as peanut butter, pumpkin and sunflower seeds, peanuts, corn, and rolled oats. Pre-baiting the area may facilitate trap capture. Traps should be checked at least once a day so that non-target animals can be released and chipmunks can be disposed of humanely.

In Maryland it is permissible to release chipmunks. If this is done, they should be relocated into remote forest areas at least 5 miles from the trap site.

Snap traps can be used in attics, garages, basements, and other indoor locations where they are active. Outdoors, the traps should be placed in tamper-resistant bait boxes in order to avoid injury to children, pets, and other non-target animals, particularly birds. They can be baited with products previously

described. If traps are used in the open, they should not be baited with seeds and nuts.

## Pesticides

In Maryland, there is a feeding repellent containing capsaicin and castor oil that is currently registered for chipmunks. However, there is no area repellent currently registered.

No toxicants (baits) are registered for chipmunk control. The use of any toxicant to kill chipmunks is prohibited.

In Maryland nine fumigants currently are registered for burrow treatment. The fumigant pellets or tablets react with moisture in the air and release phosphine gas. ***Fumigants are restricted-use pesticides and can only be applied by or under the direct supervision of a certified applicator.*** Be sure to follow all label directions when using these products. Because burrows may extend beneath structures fumigants should not be used in burrows near them.

**Mice (Deer and White-Footed)**  
*(Peromyscus maniculatus and P. leucopus)*



**Identification**

There are fifteen native mice of the genus *Peromyscus* found throughout the United States. They are distinguished by the following characteristics:

- bodies and tails are distinctly bi-colored;
- heads and bodies are 3½ to 4 inches (8.5-10 cm) long;
- tails are 2½ to 4 inches (6.3-10 cm) long and are covered with short hairs (fur);
- they have white feet, white bellies and brownish sides and backs;
- weigh approximately 3/8 to 1½ ounces (10.6-42.5 g).

**Biology**

Deer and white-footed mice mate throughout the year, but most breeding occurs from spring through fall. Mating pairs remain together throughout the breeding season but may take new mates the

following year. Females have 2 to 4, or more, litters each year. The gestation period ranges from 21 to 37 days, and each litter usually contains 3 to 5 young. The young mice are weaned when they are 2 to 3 weeks old, reach sexual maturity in 6 to 8 weeks, and can live up to 2 to 3 years. During the winter the mice do not hibernate. However, when it is extremely cold they become totally inactive.

**Habits**

Deer mice occupy almost any habitat within their range from grasslands to woodlands. White-footed mice prefer wooded and brushy areas. Their home range is 1/3 to 4 acres (0.1-1.6 ha) in size. Population densities can reach approximately 15 mice per acre (37/ha).

Nests are constructed from stems, leaves, twigs, grass, and other fibrous materials and lined with fur, feathers, and/or shredded cloth. They typically are found in underground cavities beneath tree stumps,

logs, boards, rocks, or burrows abandoned by another rodent. Above ground the mice occasionally nest in hollow logs, fence posts, rock piles, wood piles, and items such as, cupboards, cabinets and boxes stored in garages and unoccupied buildings. In addition, white-footed mice spend significant time in trees and frequently nest in abandoned squirrel and bird nests.

They are nocturnal typically feeding on seeds, acorns, nuts, fruits, insects and their larvae, fungus, and similar available items. Some of the food they gather is stored near their nest site. These caches grow in the fall when nuts and seeds are more abundant.

## **Damage**

These mice are involved in two important disease cycles, hantavirus and Lyme disease. For this reason generate significant concern. In addition, they also enter houses and other structures. Their nesting activities can cause severe damage to upholstered furniture, mattresses, clothing, paper and other materials used for nesting. The nests and droppings left by these mice are indistinguishable from those made by house mice. The major differences are they don't have a "mousy" odor, and they tend to store more nuts, seeds, and acorns than house mice.

## **Management**

### **Inspection**

Inspect the property for nesting sites. Inside look for nesting materials and nests in upholstered furniture, mattresses, clothing, stored boxes, and papers. Look for droppings, points of entry, and caches of nuts

and seeds. Outdoors look for newly constructed nests or nests in old bird and squirrel nests up in bushes and trees. Attics and higher areas in a structure may need to be inspected for these mice.

### **Habitat Modification**

Food items, seeds, and pet foods should be stored in rodent-proof containers. Eliminate areas that can be used for nesting purposes. For example, in cabins that are infrequently used, remove drawers from cabinets and store them upside down; remove upholstered cushions and store them off the floor, on end, and separate. Landscaping, such as ground covers, shrubs, and trees around structures should not be continuous with natural woodlands. This provides ideal cover for mice and once near the structure, they may enter. Woodpiles, debris, and dense ground covers should be relocated away from the structure's foundation. Bird feeders should be located as far as practical from the structure, at least 15 to 30 feet (4.5-9 m) away.

### **Exclusion**

Exclusion is the best way to keep mice out of structures using similar techniques and materials as those used for rats and house mice. Holes ¼-inch, or larger, should be permanently sealed using mortar, wire and foam, sheet metal, hardware cloth, or other durable materials. Install door sweeps on exterior entrance and garage doors. Seal attic openings and access to crawlspaces, and cap chimneys with a wire cage or other animal-proof cover. Newly-seeded areas should be protected with screen covers, with mesh that is less than or equal to ¼ inch, and has the edges buried 2 to 3 inches (5-7.5 cm) in the ground.

## Trapping

Live and snap traps are effective in controlling these mice. Snap traps designed for house mice are effective in controlling them. For quick results, set more traps than needed, place them against walls and along other paths where the mice are traveling. Bait the traps with peanut butter, sun flower seeds, or moistened rolled oats. When live traps are used, they should be inspected daily and mice removed and released or disposed of in a humane manner. If caught outside, do not release the mice outside the structure. Instead, transport them off site for release.



Snap Traps



Live Multi-Catch Trap

## Frightening

There are no frightening devices known to effectively keep white-footed and deer mice out of structures. There is no independent scientific research that indicates that electronic, ultrasonic, and electromagnetic devices keep these mice out of structures. In fact, the Federal Trade Commission and EPA have issued cease and desist orders to stop the sale of some of these devices.

## Pesticides

The only toxicants currently registered in Maryland for the control of white-footed and deer mice contain zinc phosphide and warfarin. There are no repellents or fumigants currently registered.

**Muskrat**  
*(Ondatra zibethicus)*



**Identification**

The name muskrat is derived from the musk odor secreted during mating season from a pair of glands located at the base of the tail. The muskrat can be distinguished by the following characteristics:

- 18 to 24 inches (46-61 cm) long including the tail;
- the belly color is light gray to silver to tan;
- the remaining body color is dark tan to reddish brown, dark brown and black;
- the most distinguishing characteristics are webbed hind feet, smaller front feet adapted for digging and feeding, and a laterally flattened tail that is almost as long as the body;
- weigh approximately 1 1/2 to 4 pounds (0.7-1.8 kg).

**Biology**

Muskrats mate several times each year typically producing 5 to 6 litters each year which contain an average of 4 to 8 young. Most of the litters are produced from October through April. The gestation period is 25 to 30 days. Adults can live up to 4 years.

Muskrats tend to have a small home range and can be territorial. Dispersal occurs during mating season when males leave the den with the young, who are reaching sexual maturity, in order to expand the breeding territory.

**Habits**

Muskrats are well-adapted for swimming and spend their lives in aquatic habitats, such as streams, ponds, lakes, marshes,

roadside canals, swamps, and other wetland areas. In shallow bodies of water, they use grasses to construct cone-shaped houses. In some areas, they construct bank dens, while in others, they construct both types of harborage. Whether it is a house or den, they construct several underwater entrances along their runs. Sometimes they construct smaller feeding harborages. They can swim at speeds greater than 3 mph (4.8 kmph). While feeding, they typically swim backwards and can remain underwater for 20 minutes.

They typically forage for food at night and less frequently in the early morning and late afternoon. Their food primarily consists of vegetation such as cattails, pickerelweed, bullrushes, water lilies, sedges, young willows and agricultural crops. In non-agricultural settings, they can subsist on Bermuda grass, orchard grass, Johnson-grass and clover. While not preferred, they also feed on crayfish, mussels, turtles, frogs and small fish.

## **Damage**

The greatest concern regarding muskrats is the damage caused by their burrowing activity. Frequently, this damage goes unnoticed until significant damage has been done to ponds, dams, reservoirs and shorelines. When the water is relatively clear, inspection of the banks for underwater runs is the best way to determine the extent of burrowing activity. Droppings frequently are found on logs and along the banks where activity is suspected.

## **Management**

### **Inspection**

Muskrats typically cause problems around streams, lakes, marshes, canals, roadside ditches, ponds, and dams. Their dens can be identified by walking along the body of water where they are nesting. When the water is clear, their runs can be identified along the banks and traced back to the den. In shallow water, look for their characteristic grass cone houses which protrude from the water. Each den has more than one entrance.

### **Habitat Modification**

Eliminating the aquatic habitat and aquatic food sources are the best ways in which to remove muskrats from a specific location. In the winter, dens can be eliminated by drawing the water level down at least 2 feet below the normal water line and then filling the bank, dens, burrows, and runs with stone.

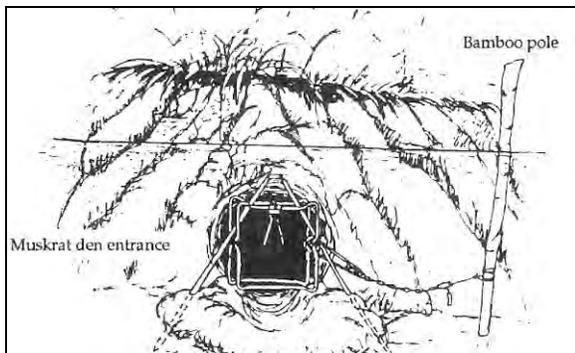
### **Exclusion**

In new construction and renovation of waterways and bodies of water, consideration should be given to creating an incline on the water side of the bank that rises 1 foot (0.3 m) for every 3 feet (0.9 m) of bank. On the non-water side, the incline should rise 1 foot for every 2 feet (0.6 m) of bank; and the top of the bank should ideally

be 10 to 12 feet (3.0-3.6m). In some situations in which muskrats are leaving their dens to feed on surrounding vegetation, a fence can be used to prevent access.

## Trapping

Conibear®, leghold, and coil spring traps are very effective in trapping muskrats. The most effective trap sets are those placed within the runs and as close to the den entrance as possible.



- The Conibear® is the simplest to use, requiring a trap stake and the trap. It is placed at a minimum of 6 inches (15 cm) beneath the water surface and at the opening of the den.

- Leghold traps are almost as efficient even when placed at water depths up to 2 feet (0.6 m).
- Another method of trapping is the “stove pipe” set which, as the name implies, uses a piece of stove pipe with a one-way flap installed at both ends and mounted to a board. The trap is placed below the water surface at the opening of the den. It allows muskrats to enter from both ends, and the one-way door prevents them from exiting so they subsequently drown.

## Frightening

There are no conventional frightening devices which drive muskrats from their denning area.

## Pesticides

No toxicants, repellents, or fumigants are registered in Maryland for the control of muskrats. The use of any toxicant to kill muskrats is prohibited.

## Tree Squirrels



### Identification

Four species of squirrels are common to Maryland, including the eastern gray squirrel (*Sciurus carolinensis*), northern flying squirrel (*Glaucomys volans*), southern flying squirrels (*G. sabrinus*), and in western Maryland red pine squirrel (*Tamiasciurus hudsonicus*). Maryland does have the Delmarva Peninsula Fox squirrel (*Sciurus niger cinereus*), a species of squirrel found on Maryland's Eastern shore, that is classified as an Endangered Species. All squirrels have a distinctly bushy tail and are distinguished by the following characteristics:

#### Eastern Gray Squirrel:

- 16 to 20 inches (41-51 cm) long from head to the tip of the tail;
- variable in color, for example, some have a reddish cast to their gray coat, while some are black;
- weigh approximately 1¼ to 1¾ pounds (567–794 g).

#### Red Pine Squirrel:

- 10 to 15 inches (25-38 cm) long from head to the tip of the tail;
- red brown above with whitish bellies;
- weigh approximately 1/3 to 2/3 pounds (151-303 g).

#### Southern and Northern Flying Squirrels:

- 8 to 10 inches (20-25 cm) and 10 to 12 inches (25-30 cm) long respectively from head to the tip of the tails;
- difficult to separate the two species apart other than by size and range;
- various shades of gray or brown on top with a lighter underside that is separated from the top with a sharp line of demarcation;
- large eyes, with a webbing of skin between their front and hind legs;
- distinctly flattened tail separates them from other tree squirrels;

- weigh approximately 1¾ to 2¾ ounces (50-80 g) and 1¾ to 6½ ounces (50-184 g) respectively.

## **Biology**

Mature gray squirrels can mate twice each year in December through January and again in June. The gestation period ranges from 42 to 45 days and each litter usually contains 3 young. Young squirrels are weaned at 10 to 12 weeks which is about the same time as they begin to venture outside the nest. Typically, they do not live more than 4 years.

Red squirrels usually mate in early to late spring. The gestation period is about 7 weeks. A litter of 2-6 young are born in late spring or early summer with a second possible in late summer. Their eyes do not open for about 5 weeks and by early fall the young squirrels can survive on their own.

Southern flying squirrels are sexually mature at about one year. They can mate twice per year in February and March and from late May through July and under favorable conditions females will produce two litters per year consisting of 3-4 young and occasionally up to 7 young. They have a gestation period of 40 days. The young are weaned at 6-8 weeks and can glide shortly thereafter. Young typically remain with the female until the birth of the next litter.

## **Habits**

Gray and pine squirrels are active during the day, while flying squirrels are active at night. In the fall, gray squirrels feed on

acorns, walnuts, Osage orange fruits, and hickory nuts and store some of the nuts for the winter. Nuts are not cached in nests. Instead they are buried individually away from the areas where they were found for consumption during winter. In the late winter and early spring, they feed on tree buds, particularly maple and elm. Nesting typically occurs in tree cavities and leaf nests at least 25 feet (7.6 m) off the ground. The home range of gray squirrels depends on the season and availability of food and varies from 1 to 100 acres (0.4-40 ha) in size. In the fall, entire populations may migrate up to 50 miles (80 km) seeking a better habitat. Populations typically are 2 to 20 squirrels per acre (5-50/ha).

Red pine squirrels prefer to feed on the cones and buds of pine trees but also feed on the same items as gray squirrels. They tend to store green conifer cones and seeds in caches in the crotches of trees. They nest in tree cavities or branch nests composed of leaves, twigs and bark. However, they also are known to nest in fallen trees and ground cavities. The home range of red pine squirrels is approximately 200 yards (182 m). Populations are typically 3 squirrels per acre (1.2 ha).

While the diets of flying squirrels are similar to other squirrels they tend to be more carnivorous and readily feed on bird eggs, nestling birds, insects, and other animal matter. They store some of their food in the nest and tree crotches. They typically nest in woodpecker holes which are 6 to 20 feet (1.8-6.1 m) off the ground. While they are called flying squirrels, they do not fly but instead glide up to 80 yards (73 m). They are very agile in the air but are very awkward on the ground.

## **Damage**

Squirrels damage trees by feeding on the bark of trunks and limbs, and occasionally damage ornamental plants by feeding on the tender shoots and branches. In addition, they damage lawns and ornamental plantings by digging holes to cache nuts for the winter and/or to retrieve them.

They travel power lines, telephone wires and cable lines to access the roof of structures, frequently damaging the wires and electrical equipment, such as, transformers. Squirrels damage structures when they chew holes in wood and even soft metal materials in order to gain entry to attics and other voids for nesting purposes. Much like rats, they may damage wires, and in so doing are suspected of starting fires. Flying squirrels frequently enlarge the openings in bird houses in order to nest there and eat the eggs and young chicks, especially those of songbirds.

## **Management**

### **Inspection**

If squirrels are suspected of being within a structure, inspect the roof line, attic, louvers, roof vents, and soffit areas for points of entry, gnaw marks, droppings, nests, and food caches. At times they can be seen traveling utility lines, climbing trees, and using branches as a bridge to the structure. Lawns and flower beds should be inspected to see if holes have been dug for burying and digging up nuts.

## **Habitat Modification**

Tree limbs should be trimmed back 6 to 8 feet from structures. People experiencing squirrel problems should not feed them as this encourages them to seek harborage nearby. When squirrels present an ongoing problem, discourage the backyard feeding of birds as the seed is highly attractive to squirrels. Devices used to prevent squirrels from getting at the feeder, even when successful, do not prevent the seed from dropping to the ground.

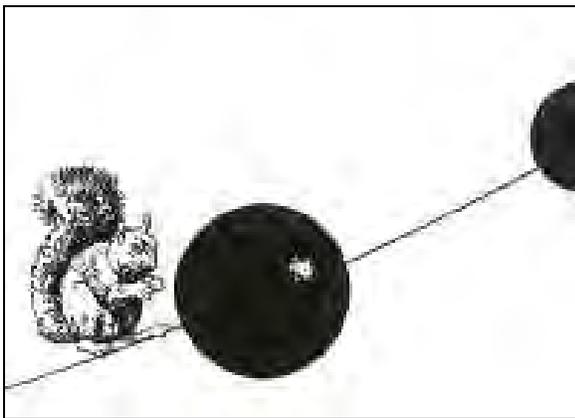
### **Exclusion**

Rodent-proofing is the best and most permanent way to keep squirrels out of structures. Sheet metal and ½ inch hardware cloth are the best materials for sealing up entry points into structures. When sealing structures, it is important that animals are not left inside because a trapped squirrel trying to get out can cause extensive damage. Likewise, if they enter the living space and can not get out, massive destruction can occur. If it is uncertain whether squirrels may be trapped in the sealed space, opt on the side of caution, and install several traps in order to capture them.

Squirrels can be stopped from climbing trees and utility poles by placing metal sleeves, such as aluminum 18 to 20 inches (45-50 cm), wide around them. There should be no gaps in the flashing or rough areas that would allow the squirrels to climb over the sleeve. In addition, tree limbs should be trimmed at least 6 feet (2 m) off the ground and the protected tree should not be within

jumping distance of an unprotected tree. The sleeve should be installed on the tree so that it can expand as the tree grows.

Plastic tubing can be placed around wires and utility lines used by squirrels to access the roof. The plastic sleeve, such as a golf club sleeve, should be cut down the center, spread open, and dropped over the line. Squirrels hitting the sleeve while running along the wire spin and fall off. Be particularly careful around utility lines.



### Trapping

Live trapping with wire traps [24 inches x 8 inches x 7 inches (60 cm x 20 cm x 17.5 cm)] or [16 inches x 5 inches x 5 inches (40 cm x 12.5 cm x 12.5 cm)] can be used to remove one or a few squirrels from a building. Traps should be left open and unset for a few days, surrounded by bait, so that the squirrels get used to them. Good baits include peanuts,

nut meats, peanut butter, whole corn, sunflower seeds, or rolled oats. After the squirrels become accustomed to the trap it can be set. Good trap locations include the roof, the base of nearby trees, or in the attic itself. Squirrels are nasty biters, so handle them carefully. Experts differ as to whether squirrels should be released or killed. Check the traps at least once a day so that non-target animals can be released and squirrels can be disposed of humanely. If they are released, do so at least five miles from the trapping site so that they do not return.

Where lethal control is permitted, rat snap traps can be used to kill squirrels in attics. The bait should be tied to the trigger and the trap nailed or wired to a beam. The same baits used for live trapping are equally effective for snap traps. Conibear and lethal tunnel traps can also be used for squirrel trapping where there is no risk to non-target animals.

### Pesticides

In Maryland, 31 repellents containing active ingredients such as capsaicin and naphthalene are currently registered. There are no toxicants or fumigants currently registered. The use of any toxicant to kill squirrels is prohibited.

## Voles



### Identification

There are 23 species of voles in the genus *Microtus* found throughout the United States, with two species commonly occurring in the Maryland area. Voles are also known as meadow mice, or field mice. The Meadow vole (*Microtus pennsylvanicus*) is the most common species of vole found in the eastern United States, while the Pine or Woodland vole (*Microtus pinetorum*) is smaller and less widely distributed. They are stocky rodents with short legs and tails, small eyes and their ears are partially hidden. They usually are brown or gray, however, there are many color variations. They are distinguished as follows:

#### Meadow Vole:

- 5-1/2 to 7-1/2 inches (14-19 cm) long from the head to the tip of the tail;
- fur - yellow-brown, belly - light gray, and the tail - bi-colored.

#### Pine or Woodland Vole:

- 4 to 6 inches (10-15 cm) long;

- soft and dense fur - brown, belly - gray with some yellow, and tail - one color.

### Biology

Voles can breed throughout the year, but most often do so in the spring and summer. They have 1 to 5 litters each year which contain an average of 3 to 6 young. The gestation period is 21 days. The young are weaned in 21 days, and the females are sexually mature in 35 to 40 days. Adults can live from 2 to 16 months. They do not hibernate.

### Habits

Meadow voles prefer wet meadows and grassland habitats. Pine voles occupy a more varied habitat, such as deciduous and pine forests, abandoned fields, and orchards that provide heavy ground cover. Their home range is typically 1/4 acre (0.1 ha), however, this varies depending on the

population density and availability of food and harborage. Population densities may range from a few voles per acre to over 100 per acre.

Meadow voles typically live above ground or within shallow burrows or surface tunnels that are 1 to 2 inches (2.5-5 cm) wide. They construct these tunnels and surface runways with numerous entrances. Pine voles use an extensive underground runway system and do not use surface runways. The nests consist of interwoven strands of dry grass and baseball-sized food caches.

Voles are active during the day and night. They typically feed on grasses, sedges, seeds, grain, some insect parts, roots and bark.

### **Damage**

Feeding on the roots of young plants frequently kills the plant. Voles can cause significant damage to young trees and seedlings by feeding on their bark and girdling the trunk. This later feeding activity is more common in the fall and winter. The tunneling activity of voles will ruin lawns, golf courses, and ground covers.

### **Management**

#### Inspection

Meadow voles rarely are found within structures, and when they are, it typically is due to an accidental entry and because they are poor climbers, it typically is at ground level. Look for their shallow runway systems with numerous burrow openings in landscaped and turf areas, feeding on ornamental plants and girdling young fruit

trees. Their girdling activity consists of gnaw marks that occur at various angles and in irregular patches that are in contrast to those made by rabbits which are larger and indistinct.

#### Habitat Modification

Weeds, ground cover, and litter around turf and landscaped areas should be removed. Turf areas should be mowed regularly and mulch should be cleared 3 feet or more from the base of trees. In the ornamental landscape, use plants that are less susceptible to vole feeding.

#### Exclusion

Since voles rarely enter structures, this should not be a major issue for controlling them indoors. However, in those situations where entry is occurring, seal openings in a similar fashion as described for white-footed and deer mice. Fine mesh wire fencing or metal barriers at least 12 inches (18 cm) high are sufficient to prevent voles from entering into landscaped areas, feeding on trees, and falling into swimming pools. Similarly, to prevent them from tunneling into these areas, the barrier should extend a similar distance into the ground.

#### Trapping

Live trapping can be accomplished using Sherman-type box traps [10inches x 3 inches x 3 inches (25 cm x 7.5 cm x 7.5 cm)] baited with a peanut butter-oatmeal mixture or apple slices. Traps should be placed along walls and other hard objects. Check the traps at least once a day so that non-target animals can be released and voles can be

disposed of humanely. If they are released, do so several miles away to prevent their return.



Sherman Trap

Due to their larger size, repeating mouse traps are not effective in catching voles. Instead, mouse traps with expanded triggers can be used indoors as they would be for mice placed perpendicular to the wall. Snap traps also can be used in burrows by placing them in the tunnel perpendicular to the run and near an opening. Bait them with the same materials as listed above. Trapping is most successful in the fall and winter when food supplies are dwindling. Glueboards also can be used effectively indoors.

## Frightening

There are no frightening devices that prevent vole tunneling and damage.

## Pesticides

Two repellents, one containing hot sauce and the other containing castor oil, are registered for vole control. There is no independent research indicating these products are consistently effective in repelling voles or limiting their damage.

In Maryland, one toxicant bait containing zinc phosphide currently is registered for vole control.

Five fumigants that produce phosphine gas are registered in Maryland for vole control. Burrows located away from structures can be treated using a fumigant. The pellets react with moisture in the air and release phosphine gas. ***Fumigants are restricted-use pesticides and can only be applied by or under the direct supervision of a certified applicator.*** Be sure to follow all label directions when using these products. Because burrows may extend beneath structures fumigants should not be used in burrows near them.

**Woodchuck**  
*(Marmota monax)*



**Identification**

Woodchucks are members of the squirrel family, and are commonly referred to as ground hogs or whistle pigs. They are distinguished by the following characteristics:

- very stocky;
- front feet have long claws developed for digging;
- 16 to 20 inches (40-51 cm) long including head and body;
- usually brown in color, but occasionally white and black;
- short furry tails that are 4 to 7 inches (10-18 cm) long;
- average weight is 5 to 10 pounds (2.2-4.5 kg).

**Biology**

Woodchucks breed in March and April, producing a single litter of approximately 4 young after a gestation period of 32 days.

The young are weaned after about 60 days and begin to venture outside the burrow. Adults typically live 3 to 6 years. Woodchucks are one of the few mammals that hibernate, typically from late October to early November through late February or March.

**Habits**

Woodchucks typically prefer open farmland and fields and the brushy and wooded areas immediately adjacent to them. Their typical foraging range is 50 to 150 feet (15-30 m) from their burrow, although this is expanded when insufficient resources are available.

Burrows are constructed in a wide variety of locations, e.g., open fields, pastures, fence rows, stone walls, hillsides, near building foundations, and at the base of trees. In residential areas, they construct burrows under decks, porch stoops and patios. The main entrance to the burrow is easily identified by the large mound of dirt outside

the entrance. The main opening usually is 10 to 12 inches (25-30 cm) in diameter. Burrows commonly are 5 feet (1.5 m) deep and 8 to 66 feet (2.4-19.8 m) long and contain a nest chamber, blind tunnels, and one or more secondary entrances (back doors) that are inconspicuous because of their location and the absence of dirt which is excavated to the interior. The burrow offers protection from predators, and a site to hibernate, mate and wean the young.

Woodchucks typically feed in the early morning and evening hours. When they are out in the heat of the day they can be found basking in the sun or lounging on fence posts, logs, stones and other objects near the burrow entrance. Despite their size and awkward appearance, they are good climbers and occasionally are found in the lower branches of trees. They are strict vegetarians who commonly feed on vegetables, grasses, legumes, and a variety of agricultural crops.

When startled they emit a shrill whistle or alarm, followed by an abrupt “phew” which ends with a low rapid warbling that sounds like “tchuck” ... “tchuck”.

## **Damage**

Most of the damage attributed to woodchucks results from their burrowing activity. The burrows can undermine foundations and structures. Their burrows and dirt mounds found around the burrows present hazards to horses, riders, other livestock, and people along with farm, and lawn and garden equipment. Their underground tunneling has cut power lines, thus, disrupting service. Fruit trees and ornamental plants can be damaged by their

gnawing and clawing at the woody stems and trunks.

## **Management**

### **Inspection**

Look for burrows, under runs, and foraging trails leading from the burrow. Determine if the burrow is active by filling all of the openings and then returning in two days to see if they have been reopened. A reopened burrow likely is occupied by a groundhog. Early morning is the best time to observe the burrow area for activity.

### **Habitat Modification**

Groundhogs are very opportunistic and frequently dig burrows in wide open spaces. There is no way to practically discourage this activity. They are vegetarians, typically graze on natural vegetation near their burrow, and often feed on vegetables in small garden plots. Exclusion techniques discussed below should be used to discourage feeding in garden plots, thus, minimizing the likelihood of burrowing nearby.

### **Exclusion**

One of the most effective ways of preventing groundhogs from entering pastures and undermining structures is to install ½ inch mesh hardware cloth buried at least 24 inches (60 cm) in the ground curving the bottom edge outward. In order to prevent groundhogs from climbing up fence posts and other structural elements, a band of 12 inch (30 cm) sheet metal can be placed in their path and an electric wire can be placed at the top of fences. In situations

in which they are burrowing under decks and porches, these areas can be screened with ½ inch hardware cloth buried 24 inches (60 cm) in the ground.

### Trapping

Live trapping of groundhogs is relatively easy by using a wire cage trap [32 inches x 12 inches x 10 inches (78 cm x 30 cm x 25 cm))] which should be placed at the entrance of the burrow, near an under run, and along well worn runways. Baiting is unnecessary, however, if desired, bait the traps with a large leaf lettuce, apple pieces, carrots, cabbage, and sweet potatoes sprinkled with a few drops of vanilla. Check the traps at least once a day so that non-target animals can be released and woodchucks disposed of humanely. If they are released, do so at least five miles away to prevent their return.



Leghold traps are quite effective when there are a large number of animals to trap. They should be set directly in the burrow opening, or at openings under buildings. Lightly cover the traps with soil, dry grass, or leaf litter and secure the trap near the opening so it can not be drug into the burrow.

Lethal traps, such as Conibears, also are very effective when large numbers of animals are present. They should be set directly in the burrow opening or at openings under buildings. If there is even the remotest possibility that these traps will kill a non-target animal, or would be accessible to children, they should not be used.

### Shooting

This method for removing woodchucks is rarely justified or a suitable technique for residential and commercial areas. A .22 caliber rifle with a scope is sufficient for killing woodchucks. A Department of Natural Resources permit does not allow for the use of firearms for wildlife control. If a firearm is used in animal control operations a permit may be needed, and you should contact both Wildlife and Heritage Division and the Maryland State Police.

### Pesticides

In Maryland nine fumigants that produce phosphine gas are registered for ground hog control. The pellets react with moisture in the air and release phosphine gas. ***Fumigants are restricted-use pesticides and can only be applied by or under the direct supervision of a certified applicator.*** Be sure to follow all label directions when using these products.

Two smoke bombs are registered for ground hog control. Because burrows may extend beneath structures fumigants and smoke bombs should not be used in burrows near them.

No repellents or toxic baits are registered for ground hog control.

## Chapter 4 Carnivorous Mammals

### Feral House Cats



#### Identification

Feral cats are house cats living in the wild. Most can be distinguished as follows:

- 14 to 24 inches (36-61 cm) long excluding tails which add another 8 to 12 inches (20-31 cm) to their length;
- on average weighs 3 to 8 pounds (1.4-3.6 kg);
- color varies from black to white to orange and tan, as well as, other variations in pattern and fur length.

#### Biology

Feral cats can breed anytime of the year. Females typically have up to 3 litters each year and produce 2 to 10 kittens per litter. While their indoor counterparts can live up to 27 years, feral cats typically live only 3 to 5 years.

#### Habits

Feral cats prefer to live close to humans, and as a result, take up residence in abandoned buildings, barns, post piles, junk vehicles, brush piles, haystacks, crawlspaces, culverts, storm drains, and other protected areas that are covered.

Cats are very territorial and active over a home range of approximately 1.5 square miles (4 square km). After several generations in the wild, they should be considered totally wild in both habits and temperament.

Occasionally they are active during the day, but most of their activity is confined to dusk and evening hours. Their food primarily consists of rodents, rabbits, shrews, moles, birds, insects, reptiles, amphibians, fish, carrion, garbage, vegetation, and accessible pet food.

## **Damage**

They readily prey on songbirds, other small rodents, and animals which some individuals consider aesthetically more appealing. They compete for the same food sources as larger carnivores and lower the carrying capacity of the area, which is the population an area can support, thus, forcing these larger animals to seek other prey.

## **Management**

### **Inspection**

The easiest way to identify where feral cats are active is to make several observations throughout the day. Typically, they hide in abandoned buildings, crawlspaces, under outbuildings, and in large piles of construction debris and/or supplies.

## **Trapping**

Trapping is the most effective method, although often a very difficult way, to remove feral cats. They are very wary of their environment and only cautiously enter baited traps. The size of the trap required should be based on the size of the animal that needs to be trapped. It is best if the cat can easily enter the trap rather than having to crouch in order to enter it. A variety of baits can be used, such as, canned cat food, sardines, chicken bones, tuna fish, or preferably foods similar to what they have been eating in the wild. If cats are living under an enclosed structure, seal off all the exit points except the main entry and placing the trap immediately outside the opening may facilitate it's capture.

Trapped cats must be transported to the appropriate county animal shelter for disposition. The shelter can return tagged cats to their respective owners. It is not recommended that any attempt be made to handle the cat.

## Foxes



### Identification

There are two fox species common to Maryland, the red fox (*Vulpes vulpes*) and the gray fox (*Urocyon cinereoargenteus*). The red fox is the most common species of fox native to the United States. Both foxes are similar in size and weight, but the gray fox can be easily distinguished from the red fox by its color. They are distinguished as follows:

#### Red Fox:

- similar in appearance to a dog but with long legs, long pointed muzzle, long pointed ears that are directed forward, and a long bushy tail;
- long, thick, smooth fur;
- body color is typically orange-red, with lighter under fur, black legs, and white at the tip of the tail;
- females weigh 7.7 to 15.4 pounds (3.5-7.0 kg) and males are approximately 2 pounds (1 kg) heavier.

#### Gray Fox:

- body color is a salt-pepper gray with rusty yellow on the sides of the neck, back of ears, legs and feet, with a bushy tail tipped with black;
- 32 to 45 inches (81-114 cm) long from tip of nose to tip of tail;
- weighs 7 to 13 pounds (3.2-5.9 kg).

### Biology

Mating in foxes occurs once each year from mid-January to early February. The gestation period is 51 to 53 days. Pups are born in March and April. A red fox litter contains 4 to 9 pups, and a gray fox litter has 3 to 7 pups. In the fall, foxes disperse from the den area in order to establish new breeding territories that sometimes are considerable distances away.

## **Habits**

The red fox is adaptable to most habitats within its range but prefers open areas with moderate cover. Their highest numbers are found within areas in which farmlands are bordered by woodlands, and often in areas developed for home construction. Gray foxes, in contrast, prefer more dense cover, typically found near swamps, rivers, and lakes, thickets, and rocky ridges. Both foxes readily survive in urban areas where adequate resources exist. The size of the territory varies depending on the availability of resources, such as food and water. In some cases where resources are abundant, several families are known to den in the same area. Typically, fox territories are 2 to 3 square miles (6-8 square km) in size.

Foxes are solitary except from the winter breeding season through mid-summer when mates and kits remain close together. They use a variety of calls to communicate with each other, and perhaps the most commonly used one is to warn other males of an occupied territory. Foxes also use their urine and feces to mark their territories. Red foxes either dig their own den or confiscate the burrow of another animal, such as a woodchuck. Gray foxes den in wood piles, rock outcroppings, hollow trees, or brush piles.

Foxes are most active at dawn and dusk and also can be seen moving about during the day particularly when it is dark and overcast. They have excellent senses of hearing, vision, and smell that are used to locate the prey on which they stalk and ultimately pounce to kill. They are opportunists feeding on rabbits, mice, bird eggs, insects, fruits, and dead animals. They also will kill young livestock and fawns. Red foxes occasionally

kill more than they can eat and cache the food for later consumption.

## **Damage**

Foxes kill a variety of animals, e.g., chickens, geese, ducks, turkeys, rabbits, lambs, piglets, kids, small pets, and game fowl. While the incidence of foxes with rabies in the eastern United States has declined, it still remains a threat to humans, domestic animals, and wildlife.

## **Management**

### **Inspection**

Because foxes typically carry their prey away from the kill site and bury the uneaten remains, it is difficult to pinpoint where they are active. In most cases, you will have to rely on customer sightings in order to determine where these animals travel and feed. In some situations, you may be fortunate and locate the den.

### **Habitat Modification**

Foxes frequently den near human habitations, such as under sheds, decks and patios. As a result, by removing or excluding areas where foxes might den can encourage them to relocate to other areas. Keeping domestic animals and small livestock, such as rabbits, kid goats, and lambs in secure areas can prevent predation.

### **Exclusion**

Foxes can be excluded from areas by using fencing with a maximum opening of 3

inches (7.5 cm). To prevent digging under the fence, it should be buried 12 to 24 inches (30-60 cm) vertically in the ground and extend out away from the fenced area at a 90 degree angle another 12 inches (30 cm). Foxes are good climbers, so in order to keep them from climbing a fence, a 3 wire electric fence with wires spaced at 6, 12, and 18 inches (15, 30 and 45 cm) above the ground should be used.

## Trapping

Foxes are very difficult to trap even for experienced trappers. Three types of traps are suitable for trapping foxes: live cage, snare, and coil spring. The key to successful trapping is their placement. Some of the best locations are along trails, entrances to fields, and near carcasses.

- Cage traps are most effective for trapping juvenile red foxes in residential areas, but are rarely successful in capturing adults. They can be scented with lures and baited with chicken bones.
- Spring traps require significantly more effort to place properly and bait. One of the best methods is called the “dirt hole” set. Dig a hole 6 inches (15 cm) deep and 3 inches (7.5 cm) in diameter at a downward angle just in front of the area where the traps will be set. Place several drops of scent in the hole. Dig another hole 2 inches (5 cm) deep and large enough to accommodate the trap. The trigger of the trap should be approximately 5 inches (12.5 cm) from the bait hole. Set the trap in the hole, cover it with wax

paper or cloth, and sift sand or dirt over the trap until the ground is at the original level.

- Traps should be cleaned before use by boiling in water and vinegar, handled with clean gloves. Also, do not allow them contact any solvents or other materials with a strong odor.
- Snares made of 1/16 to 3/32 inch (1.6 to 2.3 mm) cable can be used to catch foxes. Snares should be set in trails or crawl holes, such as under a fence. The loop should be approximately 6 inches (15 cm) in diameter, and the bottom of the loop should be 10 to 12 inches (25-30 cm) off the ground.

Since spring traps and the snare can capture non-target animals, the consequences of their use should be weighed carefully.

Foxes can not be released in Maryland so must be euthanized by the trapper, county humane society, or veterinarian by drowning, carbon dioxide, or fumigant.

## Frightening

As with most larger animals frightening devices, such as firecrackers, propane exploders, tape recordings, and other noise making devices, tend to work initially, but the foxes soon adapt to the sound and ignore it. Likewise, flashing lights provide only short term protection. The key to making both types of devices more effective is to vary the timing, intensity, and pattern of their use.

## Shooting

This technique is a method for removing foxes which can be supplemented with rabbit distress calls. However, it is rarely justified and rarely is a suitable technique for residential and commercial areas unless the animal presents a rabies risk to humans or domestic animals. A Department of Natural Resources permit does not allow for the use of firearms for wildlife control. If a firearm is used in animal control operations,

a permit may be needed, and you should contact both Wildlife and Heritage Division and the Maryland State Police.

## Pesticides

No toxicants or fumigants are registered for fox control, and no products are registered or effective for repelling foxes. The use of any pesticide to kill a fox is prohibited.

**Raccoon**  
*(Procyon lotor)*



**Identification**

Raccoons are distinguished by the following characteristics:

- distinctive markings include a black mask across the eyes and a bushy, ringed tail;
- salt and pepper gray and black color on the remainder of the body and black on the upper part of the body; and occasionally some individuals are a dirty yellow color;
- adults are 2 to 3 feet (61-91 cm) long;
- adults, on average, weigh 10 to 30 pounds (4.5-13.5 kg) with a few individuals weighing 40 to 50 pounds (18-22.5 kg).

**Biology**

Mating in raccoons occurs once each year. It may occur any time between December through June, but more commonly occurs

between February and March. Less than half of the one year old females breed the first year. Thereafter, they breed every year. The gestation period is 63 days with most litters being born in April or May. Typical litter size is 3 to 5 young that are weaned when they are 2 to 4 months old. Raccoon populations are predominately (50 to 75%) made up of young raccoons that are less than one year of age. Some raccoons can live up to 12 years in the wild.

**Habits**

Raccoons typically inhabit hardwood forests located near water. Male raccoons tend to be territorial, and their territories are much larger than those of females. A male's territory can range from 3 to 20 square miles (8-52 square km) while a females will be from 1 to 6 square miles (3-16 square km). Raccoon families typically remain together for the first year, and the young will remain with their mother throughout the

winter. In the spring, the group splits up, and the young strike out on their own.

Raccoons typically den in natural areas, such as hollow trees, ground burrows, brush piles, muskrat dens, haystacks, rock crevices, barns, and abandoned buildings. However, in urban settings, they den in crawlspaces, chimneys, under decks and porches, and in attics. They do not hibernate; however, when winter weather is severe, they will hole up becoming inactive for days, weeks, or months depending on the severity of the weather.

They are active at night. Raccoons eat a variety of animal life (e.g., crayfish, clams, birds and their eggs, muskrats and their young, fish, frogs, snails, insects, and pet foods) and plant materials (e.g., berries, fruits, nuts, acorns, and grain products).

## **Damage**

Raccoons cause a wide range of damage from killing small desirable animals, such as chickens, ducks, and box-nesting birds, to damaging structures as they seek areas in which to den. They overturn garbage cans in order to reach food, and have become accustomed to visiting residential areas at night. They also damage gardens and lawn areas when they roll up sod to get grubs and earthworms. The latter activity is more common in mid- to late summer when young raccoons are beginning to venture out and other food resources are disappearing. The incidence of rabies in raccoon populations has increased significantly within the past 40 years. In fact, raccoons are considered the major wildlife host of rabies within the United States.

## **Management**

### **Inspection**

Raccoons are easily recognized by their tracks which look like small “hands”. The holes where they enter structures are larger than those made by smaller structure-infesting animals, and they usually are discolored with black rub marks. Less recognizable is when they den up in a chimney, although the customer typically will point this out. Another common sign of their activity is when they roll or dig up sizable areas of sod in search of grubs.

### **Habitat Modification**

Because raccoons forage over such large distances, habitat modification except on a localized basis is not very practical. Removing food sources and potential harborage sites are the most effective means of minimizing raccoon activity within a specific area. Garbage should be kept in a caged box or metal containers with secured lids. If not completely consumed, pet foods should be brought in each night.

### **Exclusion**

These animals can be prevented from entering buildings by repairing breaks in foundations and screening crawlspace vents with hardware cloth. If the animal is currently living under the building, seal all openings but one, then sprinkle a tracking patch of talc at the opening and examine the area after dark. If tracks show that the animal has left, close this last opening immediately. Seal attic

openings, and cap chimneys with a wire cage or other animal-proof cover. When excluding animals in spring or early summer, be aware that young may also be present. Be sure that all animals have been removed before sealing the building, otherwise, a serious odor problem from a dead animal could result. Raccoons are excellent climbers and jumpers so trees should be cut back at least 6 feet from the roof line.

### Frightening

Many devices, such as lights, dogs, metallic streamers, radios, pie pans, tin can lids, scarecrows, and plastic windmills have been used to frighten raccoons. At best, they are only temporarily successful.

### Trapping

Trapping is the most effective and typically the easiest method of removing raccoons within and around structures. It is also one of the safest methods when non-target domestic animals are in the area. Traps should be at least 10 inches x 12 inches x 32 inches (25 cm x 30 cm x 80 cm) in size and strongly constructed because a large raccoon can severely damage and escape from inexpensive and poorly constructed traps. In some cases, it may be beneficial to screen the back of the trap with ½ inch, or less, wire mesh where the bait is placed because raccoons have a knack for reaching inside and getting the bait.

Traps with double doors can be placed along a run, while single door traps should be situated so the back of the trap is against a wall, tree, or other object. This is to prevent

the raccoon from pulling at the back end to reach the bait. Some of the best baits are cat food containing fish, sardines, fish, and chicken.



Body gripping and leghold traps also can be used for raccoons, but they should be used only in areas where there is no risk to non-target animals, particularly domestic pets. These traps can be placed in boxes attached to trees or in entry points into structures and nesting areas. Body gripping traps can be set along the water's edge where a hole is dug into the bank and the trap is set at the opening of the hole. Alternatively, a dirt hole set also can be used (as previously described for foxes).

Set multiple traps in a number of different locations. Since these animals are active at night, check traps at least every morning and, preferably, twice each day. Check traps often to spot and release non-target animals.

In accordance with Maryland Department of Natural Resources regulations, raccoons can not be released in Maryland and must be euthanized by the trapper, county humane society, or veterinarian. They can be euthanized by drowning, carbon dioxide, or fumigant.

## Shooting

This technique for removing raccoons can be supplemented using dogs to tree the animal. However, it is rarely justified or a suitable technique for residential and commercial areas unless the animal presents a rabies risk to humans or domestic animals. A .22-caliber rifle is sufficient to kill a raccoon. A Department of Natural Resources permit does not allow for the use of firearms for wildlife control. If a firearm

is used in animal control operations a permit may be needed and you should contact both Wildlife and Heritage Division and the Maryland State Police.

## Pesticides

No toxicants or fumigants are registered for raccoon control, and there are no products registered or effective for repelling raccoons. The use of any pesticide to kill raccoons is prohibited.

## Skunks



### Identification

Skunks are members of the weasel family. There are four species of skunks found in the United States. The striped skunk (*Mephitis mephitis*) and spotted skunk (*Spilogale putorius*) are the most widely distributed species. Both can be found in Maryland although the striped skunk is more prevalent. They can be distinguished as follows:

#### Striped Skunk:

- approximately 29 inches (74 cm) long;
- weighs approximately 8 pounds (3.6 kg);
- jet black color with lateral white stripes down the back is the most distinguishing feature.

#### Spotted Skunk:

- smaller than the striped skunk;
- approximately 21 inches (54 cm) long;

- weighing approximately 2.2 pounds (1 kg);
- more weasel-like in appearance with white spots and short broken white stripes in its jet black coat.

### Biology

Skunks breed once each year usually in February, although younger females will not mate until late March. The gestation period is 7 to 10 weeks. A single litter typically is produced from May through June and contains from 2 to 16 young although the average is 4 to 6 young per litter. They reach sexual maturity in one year and on average live up to 3 years.

### Habits

Skunks prefer open areas, such as clearings and pastures that border wooded areas. Their home range normally is within ½ to 2 miles

(2-5 km) of the den. However, during breeding seasons males will venture out 4 to 5 miles (6.4-8 km).

They use hollow logs and hollow branches in trees for dens. In urban areas, they create dens beneath decks, stoops, concrete slabs, crawlspaces and other protected areas. They do not hibernate but become dormant and inactive for up to a month during the winter. In some cases, they den together in order to keep warm.

They are active at night, and because of their notorious chemical weapon, do not move quickly even when approached. They feed on plant and animal materials preferring insects, such as grasshoppers, crickets and beetles which are eaten almost exclusively during the spring and summer when they are readily available. When these food resources are scarce, they feed on mice, rats, rabbits and other small animals.

## **Damage**

Skunks become a major nuisance when they seek food and harborage around structures. They also damage gardens, lawns and golf courses when they dig holes while searching for grubs. They also attack poultry but do not climb to gain entry. Odor is one of the most noticeable indications of skunks. In certain parts of the country, skunks are major carriers of rabies, and rabid skunks are one of the major vectors for the spread of the virus.

## **Management**

### **Inspection**

Skunk tracks are easily recognized by the following characteristics:

- the front and rear feet have five toes and the claw marks usually are visible, but the heels of the front feet are not;
- their droppings are ¼ to ½-inch in diameter, 1 to 2 inches long, and contain undigested insect parts;
- a less reliable indicator of their presence is their characteristic odor.

### **Habitat Modification**

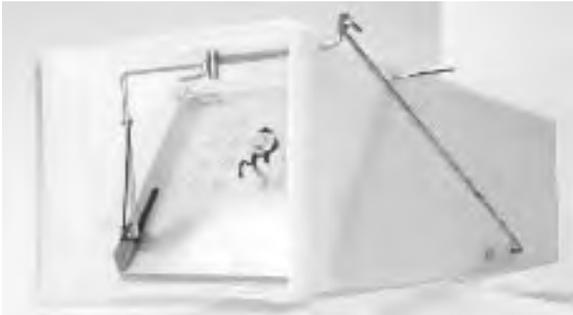
Removing food sources and potential harborage sites are the most effective means of minimizing skunk activity within a specific area. Garbage should be kept in sturdy and covered containers. If not completely consumed, pet foods should be brought in each night. Skunks are attracted to areas occupied, or previously occupied, by other animals, such as rodents. Thus, eliminating these pests may discourage skunks. Eliminate harborage by removing debris, junk cars, old equipment, and lumber piles.

### **Exclusion**

Skunks can be prevented from denning under buildings, decks, patios, and porches by sealing potential entry points with wire mesh, sheet metal, and concrete. To prevent digging under the wire, it should extend 18 to 24 inches (45-60 cm) beneath the soil line. Cover window wells and crawlspace openings with wire mesh in order to prevent skunks from nesting in these areas. Skunks are not good climbers, and as a result, higher openings such as roof areas do not need to be considered.

## Trapping

When trapping skunks, either use an enclosed box trap or a cage trap wrapped in plastic or covered with burlap, or canvas, to provide a dark and secure place for the animal. This will also help minimize the probability of a scent discharge, since skunks do not like to "spray" if they can't see their target. The traps should be placed at the entrance to the burrow. Consider using more than one trap because there might be more than one animal in the burrow. Traps should be baited with canned cat food, sardines, chicken parts, and eggs. Once the animal is caught, approach the trap slowly and transport it gently.



Leghold traps should not be used to trap skunks on residential and commercial properties because of the potential problem of a scent discharge.

Skunks can not be released in Maryland and must be euthanized by the trapper, county

humane society, or veterinarian. They can be euthanized by drowning, carbon dioxide, or fumigant.

## Shooting

This technique is not recommended for skunk control because it typically causes a scent discharge.

## Frightening

Lights and sounds may deter skunk activity but for obvious reasons, be careful not to get too close when startling a skunk!

## Pesticides

Two smoke bombs are currently registered for skunk control.

Two repellents containing one or more of the following active ingredients: capsaicin, black pepper, and piperidine are registered for skunk control. Repellents are not very effective in keeping skunks out of an area once they have nested there.

The use of any toxicant bait to kill skunks is prohibited.

## Chapter 5 Other Mammals

### Bats



#### Identification

Forty species of bats are found in the continental United States. They generally are classified in two categories: those living in colonies of varying size and solitary bats that live alone. Both types occasionally enter structures and become problematic, but bats that live in colonies are of greater concern due to the numbers involved. This section focuses on the colonial bats commonly encountered in Maryland structures, which are the little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), and evening bat (*Nycticeius humeralis*). There is also the Indiana bat (*Myotis sodalists*), a species of bat found in Maryland that is classified on the federal list of Endangered Species. Without handling the bat (handling is not recommended), and without experience, it is difficult to identify

the species involved. The bats are distinguished as follows:

#### Little Brown Bat:

- wingspan of 9 to 10.6 inches (23-27 cm);
- dark brown, glossy, and sleek fur;

#### Big Brown Bat:

- wingspan of 12.8 to 13.8 inches (32.5-35 cm);
- reddish brown-copper to dark brown.

#### Evening Bat:

- wingspan of 10.2 to 11 inches (26-28 cm);
- medium brown.

## **Biology**

Bats use inaudible high frequency sounds in order to locate obstacles and prey, and audible sounds in order to communicate with one another. They mate in the fall and winter however, the female retains the sperm within her uterus. Fertilization does not occur until spring, and the young are born from May through July. Young bats begin flying at three weeks of age and are weaned July through August. Subsequently the nursery colonies disperse.

A little brown bat female has a single pup, but occasionally twins are born. Males sometimes separate from the colony and roost in cooler areas. Typically, with the onset of winter, these bats migrate to caves and mines that might be very close to the roost, or as far as a few hundred miles away. The lifespan of the little brown bat can be up to 30 years although most probably only live three years of age.

Typically, a big brown bat female has only two pups in each litter. They live up to 18 years of age.

An evening bat female typically has two pups in each litter. The summer maternity colonies of the evening bat can contain up to 200 bats.

## **Habits**

The small brown bat is the species commonly found roosting in and around structures near water where they forage for insects. Summer maternity colonies can be large (100's to 1,000's of bats), and they prefer roosting in dark, hot attics. Colonies also can occupy areas under siding, shingles, soffits, in hollow trees, and beneath bridges.

Big brown bat roosts commonly are found behind chimneys, in soffits, hollow walls, attics, barns, behind shutters and exterior sliding doors. Their colonies can contain from 12 to 200, or more, bats. Outdoors, the colonies can be found in hollow trees, and beneath bridges and loose bark. This species is more commonly associated with human encounters, by entering homes, particularly when there are significant temperature changes, such as occur in winter and summer. They are known to migrate up to 150 miles (240 km) in order to hibernate in caves, burial vaults, storm drains, mines, and other underground harborages. Some species, such as the big brown bat, fly on warm winter days.

Little is known about the habits of evening bats except that they are known to roost in tree cavities, under loose bark, and in buildings. While little is known about their winter habitat, they do not enter caves.

## **Damage**

Typically bats cause little structural damage except for their large deposits of guano (feces) and urine. They produce rub marks where they enter structures. Frequently, an infestation is discovered by the noise produced as a result of their crawling through the attic and walls, grooming, scratching, and vocalizing with other bats. Numerous arthropod parasites, such as mites, fleas, ticks and bat bugs, are associated with bats and many will feed on humans once the bats are gone or when there are insufficient numbers of bats.

Probably the greatest concern regarding bats is their association with several diseases, especially rabies. They rank third behind skunks and raccoons in incidence of wildlife

rabies within the United States. The infection rate in a bat colony is usually less than 1%, and an infected bat within a colony does not indicate that the entire colony is infected. Infected bats typically become noticeably ill from the disease, and their behavior becomes very uncharacteristic. Histoplasmosis is the other disease commonly associated with bats and their guano. It usually is contracted when accumulations of guano are disturbed and the spores inhaled.

## Management

### Inspection

Inspect for two things, the bats entry and exit points and their roost. Inspect for entry points around loose flashing, vents, shingles, and siding. Inspect for damage and openings beneath eaves and soffits, at cornices, louvers, and doors, by chimneys and windows, and anywhere pipes and wiring enter structures. Look for droppings under these areas and smudges around holes, and notice any odors.

In situations in which it is difficult to identify entry points, observe the suspect area from just before to an hour after sunset as the bats leave the building to feed, or when they return in the morning before sunrise. Listen for their squeaking sounds at the exits just prior to their flight. If the night is chilly or rainy, the bats may not come out.

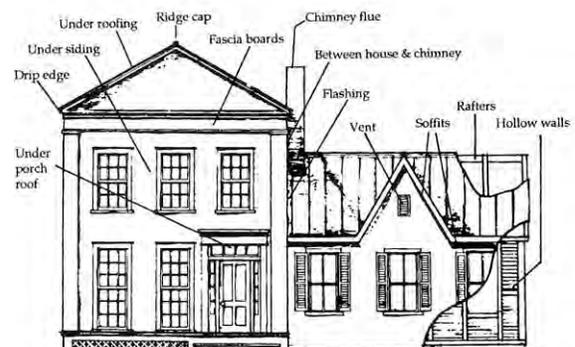
Locate the roost by looking in attics, unused rooms, chimneys, behind shutters, and vents during the daylight. Bang on the walls and listen for squeaks and scratches as roosting bats are disturbed.

Look for bat droppings, which contain insect parts, and are found below roosting bats.

Droppings can often accumulate to a depth of more than several inches. The sweet, pungent, penetrating, and musky smell of large roosts is the result of rotting droppings and bat urine.

### Exclusion

Exclusion is the best method of ridding a building of bats. It involves sealing or screening all of the openings used by the bats to enter a building using materials, such as: ¼ inch hardware cloth, screening, sheet metal, caulking, expanding polyurethane foam, steel wool, and duct tape. This can be difficult because all openings in the upper part of the structure that are 3/8 inch and larger must be sealed. This is the only permanent method of ridding a building of bats. When there are more openings than can be sealed economically, large sections of plastic bird netting can be draped over the roof areas of these structures in order to keep the bats out.



Prior to bat-proofing a structure, ensure that there are not any bats remaining inside the area to be sealed. Accomplish this by sealing all but one or two main openings, wait 3 to 4 days for the bats to adjust to using the remaining openings, and then seal those openings in the evening just after the bats have left for their nightly feeding. Alternatively, "one-way bat valves" also can

be placed over the remaining openings and allow the bats to leave, but not to return.

***“Non-lethal exclusion is the only method permitted by the Maryland Department of Natural Resources (Wildlife and Heritage Division) for nuisance bat colonies. Exclusion of colonies must take place from September 1 to March 1, providing bats are not hibernating in the structure.”*** See Appendix C for more specific Wildlife and Heritage Division requirements regarding bats.

Other methods which limitedly discourage bats from roosting in an attic include lighting all the corners, using cool air from fans and air conditioners, and using repellents, such as moth balls. Ultrasonic devices do not repel bats.

## Trapping

When a single bat finds its way into a house, office, or store, simply opening the doors and windows often allows it to escape. If this doesn't work, capture it with an insect net, a coffee can, or even with a gloved hand, and release it.

## Pesticides

In Maryland three repellents are registered for bat control. I have observed many situations where these products were used and failed to force bats out of a roost. They maybe more effective in preventing bats from entering an area to roost. There are not any pesticides registered for bat control, and the use of any pesticide to remove bats from a roost is prohibited.

Guano (dropping) Clean-up - See Section II above.

## White-Tailed Deer *Odocoileus virginianus*



### Identification

White-tailed deer are the most widely-distributed, easily recognized, and one of the largest mammals found in Maryland. They are distinguished by the following characteristics:

- fawns are recognized by white spots which disappear within 3-4 months when their winter coat turns grayish brown; the summer coat turns reddish brown;
- undersides of the belly, tail and neck are white;
- antlers grow on male deer throughout spring and summer with their size dependent on the deer's age and nutrition; they are shed in mid-winter; white-tailed deer antlers differ from other species because the tines arise from a central beam;
- in the northeast, a mature buck may weigh up to 200-300 pounds (90-135 kg), while does average 25 to 40% less.

### Biology

Deer mate in the fall with peak activity occurring in November. Bucks typically mate with several does' but do not pair up. While does can mate at 6 months of age, most do not mate until the second year. The gestation period is 202 days, and most fawns, which typically are twin-born, are born in May or June. Fawns continue to grow and gain weight for the next 5.5 - 6.5 years. They can live up to 20 years with an average life expectancy of 10-12 years.

### Habits

Deer prefer forest edges to mature wooded areas. They thrive in agricultural areas that are interspersed with wooded and watershed areas, and prefer an abundance of brush and saplings. Their home range usually is several hundred acres, but this depends on the season, food-availability, sex of the deer, and habitat-availability. In the north during the winter, they gather together in dense cover.

Typically, deer move and feed in the early morning and evening hours. Their diet consists primarily of leaves, stems and buds of woody plants. Fruits and nuts, especially acorns, are an important dietary item when available. A number of agricultural crops often are eaten, such as corn, soybeans, grains, alfalfa, fruits, and vegetables. However, surprisingly, grasses are not. The type and amount of food eaten varies with season, reproductive cycle, and the individual animal.

## Damage

In residential areas, deer are responsible for significant damage to ornamental plantings, vegetable gardens, and young trees by eating flower buds, tender foliage, and bark off young trees. In Maryland, hundreds of collisions with deer are reported each year by vehicle-drivers, and occasionally these accidents result in death to vehicle occupants. In residential areas, deer have become frightened by children and dogs and leapt through picture windows and sliding glass doors causing significant structural damage to houses. Of greatest concern in the northeast is their role in the transmission of Lyme disease. As the ultimate host of the deer tick (*Ixodes scapularis*), which is the major vector of Lyme disease, deer are involved in sustaining this tick's life cycle.

## Management

### Inspection

If they are not actually observed causing damage, deer activity is easily recognizable. Deer tracks are very distinctive, with a cloven hoof that is 2-1/2 to 3 inches long. Their browsing activity is also distinctive

because the twigs and stems of foliage are jagged on the edges compared to other vegetation-feeders that leave a clean-cut edge. They graze from the ground up to 6 feet (1.8 m). In addition, their droppings are a telltale sign of their visits.

### Habitat Modification

One of the most effective methods of preserving an ornamental landscape when deer pressure is heavy is through the selection of deer-resistant plants. A list of such plants can be obtained from the extension service or a local nursery. The only available alternatives for protecting existing landscape plants from deer feeding is the use of exclusion and repellents.

### Exclusion

Fencing and netting are the most effective methods of preventing deer damage, but can be very expensive depending on the size of the area to be protected and the product used. Netting and fencing provide a physical deterrent to deer attack, while electric fences provide the additional advantage of a psychological deterrent. To protect areas from deer attack, the following options provide varying degrees of protection:

- Netting and small wire fences can be used to protect ornamental plants. Depending on the size of the plants, temporary fence posts may be needed to secure the netting. By draping the net over the plants, damage is limited to the tips of the bushes that project through the net.

- Temporary electric fences can protect a few acres effectively. They are relatively inexpensive, easily constructed, do not require rigid corner posts, and the materials are readily available.
- Polytape fences are another style of electric fence that are portable and can be used to protect areas up to 40 acres. Posts need to be set about every 60 feet. Placing peanut butter on the tape at frequent intervals encourages nose to tape contact and a shock.



- Year-round and large area protection can be achieved with high-tensile electric fencing. These fences require significantly more support because they are typically 6 or more feet high. They are expensive to construct, and only the best materials should be used. Examples of this type of fencing include the offset or double fence, the seven-wire vertical deer fence, slanted seven-wire deer fence, and permanent woven wire fencing. When using an electric fence keep it charged at all times, and post warning signs at no more than 300-foot intervals.



- The bark of young trees can be protected from grazing and antler rubbing by using woven wire cylinders, plastic tree wraps, or corrugated drain pipe.

## Repellents

Repellents are characterized as either contact or area repellents. Repellents do not completely prevent damage, they are expensive, and some must be re-applied quite frequently or after it rains. For these reasons, repellents are best suited for protecting smaller areas and/or selected plants.

Contact repellents are best applied when trees and ornamentals are dormant and on a dry day and when temperatures are above freezing. Trees and plants must be treated to a height of 6 feet, and in the case of mature trees, only the tips of the branches need to be treated. During the growing season, these products can be effectively used at half their winter rate of application. Rain and natural aging of the products affects their longevity. Check the product's label for specific instructions on how and when to apply it.

Area repellents are applied around the trees and plants to be protected. They repel deer by odor alone. Some area repellents that reportedly work are putrid meat scraps, human hair, and bars of soap. Most have only limited effectiveness. When food is in short supply, deer rarely are affected by contact and area repellents.

A device that became available within the last few years incorporates an attractant (acorn) and a battery-operated electric shocking device mounted on a metal stake. The concept is to place these devices near the plants to be protected and teach the deer to associate the shocking device with the plants, and, thus, avoid the area.

#### Frightening Devices

The key to using these devices is to take action immediately when deer are found to be browsing on the plants and trees one wishes to protect. If action is not immediate and reinforced at every occurrence, the deer

rarely will be discouraged from entering the area. A number of devices, such as firecrackers, gas exploders, and gun fire (blanks) are available, but in residential areas are not likely to be tolerated for a long period of time. The time when these devices are used must be varied or the deer soon adapt to the pattern of activity and ignore the devices.

#### Pesticides

Other than repellents there are not any pesticides registered for deer control. The use of any pesticide to kill deer is prohibited.

Other techniques used for deer control include live capture, relocation, and shooting. Discussion of these topics is not appropriate for this manual. For further information on these methods, contact the Maryland Department of Natural Resources.

**Eastern Mole**  
*(Scalopus aquaticus)*



**Identification**

Seven moles are reported to occur in North America. Of these seven, three occur in the Maryland area: the eastern mole, hairy tailed mole, and the star-nosed mole. This section focuses on the most common mole in the northeast, the eastern mole.

Moles are insectivores, not rodents, and thus are closely related to bats and shrews. They most often are confused with voles and shrews but can be distinguished by the following characteristics:

- hairless pointed snout;
- small eyes and ear openings hidden in the fur;
- large front legs with the palms wider than they are long, because they are modified for digging;
- small, narrow, slender hind feet with sharp claws;
- 6½ to 7 inches (16.8-17.6 cm) long excluding the tail, tht adds another 1¼ inches (3.3 cm) to overall length;

- average weight is 3 to 4 ounces (85-115 gm).

**Biology**

Moles mate once each year with 2 to 6 young that are born in March through early May. The gestation period is approximately 42 days. Reports indicate that only about 50% of the young survive long enough to reproduce. Moles do not hibernate and typically are active year-round. Three to five moles per acre (7-12 per ha) is considered to be a high number.

**Habits**

Moles prefer loose soil with an abundant supply of earthworms, insects, and/or grubs typically found in fields and woods shielded by vegetation and residential lawns.

Most research indicates that moles live

independently within burrows beneath the soil surface, and are rarely seen outside their tunnel system. Deep runways that are 6 to 8 inches (13-20 cm) deep are interspersed with small dens and connect to sub-surface feeding tunnels that are 1¼ to 1½ inches (3.2-3.8 cm) in diameter. These feeding tunnels occasionally are reused, but many collapse and gradually refill with soil. The nest areas and deep runs occupy higher ground. However, the feeding tunnels are found in damper and lower locations where the food supply is more abundant.

Moles are voracious feeders that eat nearly their total body weight in insects and earthworms each day. While they often are blamed for plant damage, the little damage caused by them is the result of their tunneling under the plants, and not from eating their roots. Studies have shown that their primary food sources include earthworms, grubs, beetles, other insect larvae, and various other soil-dwelling arthropods.

## **Damage**

In one sense, moles can be considered beneficial, since they eat some of the insect larvae (grubs) that feed on grass roots and some emerge as adult beetles to feed on ornamentals, such as Japanese beetles. However, their feeding activity (tunneling) disfigures lawns and other landscaped areas and destroys flower beds and small gardens. Sometimes as they excavate deep runs and nests, they expel large piles of soil that are 2 to 24 inches (5-60 cm) high. Frequently their tunnels are exploited by other small animals, such as voles and shrews, which cause direct plant damage.

## **Management**

### **Inspection**

Typically, it is not difficult to see where moles are active. However, for management purposes, it is important to differentiate between exploratory tunnels, that are shallow runs frequently associated with small dirt mounds, and regularly-used surface runs that are typically long and straight. Active burrows can be identified by tamping down the run, or by making small holes in the run and flagging the areas for future identification. The flagged areas should be inspected in two days in order to see if the hole is plugged with dirt, indicating the tunnel has been reopened.

### **Habitat Modification**

It may be possible to discourage mole activity by packing down the soil and allowing the area to dry out, or by reducing the food supply. Controlling (treat in early spring) one of the mole's preferred foods, grubs, in turf areas may discourage their feeding activity. However, there are not any pesticides registered for earthworm control and most available products do not control them, thus the moles' most preferred food can not be removed from their foraging area.

### **Trapping**

Although time-consuming, the most effective method of control is trapping. There are three types of traps in general use for controlling moles: harpoon, scissor-jawed, and choker traps.

- A harpoon trap consists of two prongs that straddle the tunnel and a set of spring-driven spikes. The spikes are raised above the tunnel and catch in the trigger release. When the mole trips the trigger, the prongs are released and driven through the sod, impaling and killing the mole.



- A scissor-jawed trap consists of a cast metal frame with two scissor-like jaws. Two slits are cut in the tunnel and the jaws are placed in the slits straddling the runway and mole's path. When the mole trips the trigger, the jaws close, and the mole is immediately crushed.



- The choker trap is similar to the scissor-jawed trap except two loops are used instead of two pairs of jaws. Similarly, two slits are cut in the

tunnels and the loops inserted in the mole's path. As the mole reopens the tunnel and trips the trigger, the loop is immediately pulled snug, thus, choking the mole. Alternatively, the scissor-jawed and the choker traps can be set by excavating the tunnel, setting the trap's trigger in loose soil, and refilling the area with loose dirt.



When using traps, a plastic pail with a warning sign should be placed over each trap. Trapping a mole may require as many as 3 to 5 traps per acre. Check the traps every two days, and if nothing is caught for two days, move the traps to new locations.

### Frightening Devices

A number of devices, such as electronic, ultrasonic, magnetic, and vibrational, are sold that according to the manufacturers and user testimonials, work to rid areas of moles. However, there is no scientific and/or independent research to support these claims, and these devices do not work.

### Pesticides

Four repellents, three containing castor oil and one containing essential oils registered

for mole control. There is no independent research indicating these products are consistently effective in repelling voles or limiting their damage.

In Maryland, at least 20 toxicant baits containing active ingredients such as zinc phosphide, bromethalin, warfarin, and chlorophacinone are currently registered for mole control. Until recently baits have been relatively ineffective in controlling moles. Within the last two years, two new bait products have been registered for mole control. Research indicates that, if used properly, these products will kill moles:

- Bromethalin anticoagulant rodenticide is formulated into worm-shaped bait that is inserted into the tunnel where moles are foraging. Because the shape and feel of the bait mimics the mole's natural food, earthworms, it reportedly is readily accepted and eaten.

- Warfarin anticoagulant rodenticide is formulated into gel bait that is injected into active tunnels.

Nine fumigants that produce phosphine gas are registered in Maryland for mole control. Burrows located away from structures can be treated using a fumigant. The pellets react with moisture in the air and release phosphine gas. ***Fumigants are restricted-use pesticides and can only be applied by or under the direct supervision of a certified applicator.*** Be sure to follow all label directions when using these products. Because burrows may extend beneath structures fumigants should not be used in burrows near them.

Two smoke bombs are registered for mole control. Because burrows may extend beneath structures fumigants and smoke bombs should not be used in burrows near them.

**Opossum**  
*(Didelphis virginiana)*



**Identification**

Opossums are the only marsupials, mammals with a pouch, found in North America. They can be distinguished by the following characteristics:

- up to 40 inches (102 cm) long including a rat-like tail which is almost half the body length;
- long and narrow face;
- 50 teeth contained in the jaw;
- rounded, hairless ears;
- whitish - grayish colored under-fur, interspersed with longer hairs;
- on average are 4 to 7 pounds (1.8–3.2 kg), but can weigh up to 14 pounds (6.3 kg).

**Biology**

Mating occurs within the first year from January through July. Typically, opossums average no more than two litters each year with 7 young per litter. The gestation period

is a short 13 days. After they are born, the young remain in the mother's pouch for 7 to 8 weeks and then are weaned 6 to 7 weeks later. Most of the young die within one year, but those which survive can live up to 7 years of age.

**Habits**

Opossums primarily live solitary lives. Their home range is approximately 10 to 50 acres (4-20 ha). The young tend to roam until they find a suitable area to occupy.

Opossums seem to occupy almost any habitat but appear to prefer areas near streams and swamps. They often den in the burrows of other animals, as well as, in hollow trees, woodpiles, brush piles. In residential areas, they can be found in attics, garages, and sheds where they construct a messy nest.

They are active at night feeding on a wide variety of items such as insects, carrion,

fruits, and grains. In residential areas, they frequent garbage cans and eat pet foods.

When approached, opossums may exhibit some unusual defensive behaviors, such as baring teeth, hissing, screeching, biting, and exuding a rank anal gland fluid. If these behaviors do not work to keep the attacker at bay they may curl up and play dead, hence, the term “to play possum”. While they are not quick on their feet, opossums can readily escape by running into burrows and climbing trees.

### **Damage**

Opossums harbor a number of ectoparasites and endoparasites that can feed on, or parasitize, humans and domestic animals. Of greater concern to most people, however, is the mess they create when they overturn trash cans, eat pet foods, and nest in structures.

### **Management**

#### **Inspection**

Opossums can be distinguished from similar sized animals by the following characteristics:

- Look for tracks: the front and rear opossum prints look like a distorted hand with the “thumb-like” digit widely separated from the other four; their prints differ from the back footprint of a raccoon which has all the digits shaped more typical of a little “hand”; talc can be used to dust areas so that the animal and direction of travel can be identified.

- Typically, their droppings are large, elongated and contain seeds.

#### **Exclusion**

These animals can be prevented from entering buildings by repairing breaks in foundations and screening crawlspace vents with hardware cloth. If the opossum is living under the building, seal all openings but one, and then sprinkle a tracking patch of talc at the opening.

Examine the area after dark. If tracks indicate that the animal has left, close this last opening immediately. Seal attic openings, and cap chimneys with a wire cage or other animal-proof cover. When excluding animals in spring or early summer, be aware that young may also be present. Be sure that all animals have been removed before sealing the building, otherwise, a serious odor problem from a dead animal could result or the animal may find a way into the living space.

If they are climbing over a fence, an electric wire can be used to repel them. Use metal garbage cans and pet food containers, and secure their lids so they can not be opened.

#### **Trapping**

The live, leghold, and body-gripping traps are available and can be used effectively to trap opossums. However, the latter two traps are not recommended in residential and commercial settings because there is a significant risk of killing non-target animals including domestic animals. Because opossums are not very trap-wary, they

typically can be easily caught using a live trap.

The best way to remove animals from around buildings is to trap them. For outdoor situations, it is best to set the traps in locations along fences, walls, and trails frequented by the animal. Also, set traps as close to the den as possible where damage is occurring, such as at corners of gardens, breaks in stone walls, or along obvious animal trails. Set multiple traps in a number of different locations. Traps should be baited with apple slices, chicken parts and entrails, fresh fish, sardines, or canned cat food. Place bait in the back of the traps so the animal can not reach it from the outside.



Since these animals are active at night the traps should be checked at least every morning, preferably twice a day. Check traps

often to spot and release non-target animals. When transporting a trapped animal, cover the trap with burlap or other material in order to keep the animal calm.

If the animal must be killed, lower the trap into a tub of water or gas it with a fumigant or carbon dioxide. Under the current Department of Natural Resource regulations, opossums can be released. If the animal is to be released, do it far away from human dwellings. Try to use what you have learned about the biology of the animal in order to find a suitable habitat. The release site for these large animals should be over ten miles away. Remember to periodically check with the Department of Natural Resources regarding animals that can be released and for areas where releases are permitted.

#### Pesticides

There are not any toxicants or fumigants registered for opossum control. In addition, there are not any products registered or effective in repelling opossums. The use of any pesticide to kill opossum is prohibited.

**Eastern Cottontail Rabbit**  
(*Sylvilagus floridanus*)



**Identification**

Nine species of cottontail rabbits occur in United States. The most prevalent species within the Maryland area is the eastern cottontail. Cottontails differ from their jackrabbit cousins because they have smaller bodies and ears. They are distinguished by the following characteristics:

- 15 to 19 inches (37-48 cm long);
- weigh 2 to 4 pounds (0.9-1.8 kg);
- at a distance, appear gray to brownish-gray in color, and on closer examination, more basic colors are apparent; their color remains the same despite molting twice per year;
- fluffy white cotton-ball sized tails;
- large ears;
- back feet that are much larger than the front feet.

**Biology**

While they typically have 2 to 3 litters each year, they are able to have as many as six which contain 5 to 6 young per litter. The first litter usually is born in March or April with a gestation period that normally is 28 to 29 days and within 24 hours of bearing the litter, the female usually breeds again. A pair of rabbits typically produces 18 young per season. Fortunately, many factors play a role in keeping populations in check.

Although the young are born practically furless and with their eyes closed, they leave the nest within 2 to 3 weeks. The life expectancy of a cottontail is 12 to 15 months. In good habitats, the population density can reach one rabbit per acre.

## **Habits**

They do not distribute themselves widely, but typically occupy a range of 10 acres. Cottontails tend to concentrate in areas where food and cover are readily available, such as fence rows, along the edges of fields, gullies, brush piles, near crop fields, and landscaped backyards. Rarely are they found in heavily-wooded areas and open fields. They frequently relocate seasonally in order to find better resources.

Cottontails do not dig burrows for nesting purposes, but do not hesitate to occupy the abandoned burrows of other animals, such as groundhogs. In the spring and fall, they build a sheltered nest of grass and straw in small depressions on the surface of the ground. In the summer, lush green vegetation alone offers protection, and they are less likely to construct nests.

Cottontails eat a wide variety of plant materials throughout the year. In spring and summer they will eat flowers and vegetables, and in fall and winter eat bark and tender branches from woody plants. Their favorite flowers include tulips and lilies while vegetables may include beans, peas, carrots, and beets.

## **Damage**

Most of the damage caused by rabbits results from their feeding on vegetables, flowers, ornamentals, and trees. They damage a variety of fruit trees and bushes, such as apple, black and red raspberry, blackberry, cherry, and plum, as well as nut, shade, and ornamental trees, such as ash, basswood, red maple, sugar maple, locust,

red and white oak, and willow. They also eat shrubs, e.g., dogwood, rose, sumac, and Japanese barberry. Even evergreens are not immune to their attacks.

## **Management**

### **Inspection**

Look for characteristic gnawing on older woody growth and the clean-cut angled cutting of tender plant stems. Their round pellet-shaped droppings also indicate their presence.

### **Habitat Modification**

To discourage rabbits from hiding and nesting near areas with plants and trees that need protected, remove brush piles, weed patches, stone piles, and other debris from the property. This technique is very effective around structures where the cover typically is less available.

### **Exclusion**

Exclusion is probably the most effective way of preventing rabbit damage in residential and commercial settings. A 1-inch (2.5 cm) diameter chicken wire fence no more than 24 inches (60 cm) high and fitting tightly to the ground or buried a few inches below the soil line, is all that is needed to exclude rabbits from an area. Trees and individual ornamental plants can be protected by placing a ¼ inch hardware cloth cylinder around the base of the tree or the plant. Small flower beds can be protected by placing a chicken wire dome over the bed.

## Trapping

Trapping is the most effective way of removing rabbits from an environment where they are causing damage. A small wire live trap should be placed where the rabbits feed or rest. They should not be placed in areas requiring the rabbit to cross a large open space. In the winter, traps can be baited with dried cob corn or dried apples. In the summer, rolled cabbage leaves, carrots, apples, and other fresh green vegetables can be used. Consider using baits similar to the items the rabbits are eating. To encourage entry, cover the trap with a piece of burlap or other cloth material.

The traps should be inspected at least once daily for serviceability, to refresh the bait, and to remove trapped animals. If rabbits are released, they should be at least 2 miles from the capture site.

## Shooting

This technique is a very effective way to remove rabbits, however, it is neither justified nor a suitable technique for residential and commercial areas. A Department of Natural Resources permit does not allow for the use of firearms for wildlife control. If a firearm is used in animal control operations a permit may be needed and you should contact both Department of Natural Resources Wildlife and Heritage Division and the Maryland State Police.

## Pesticides

No pesticides and fumigants are registered for rabbit control. The use of any pesticide to kill a rabbit is prohibited.

Repellents are characterized as either contact or an area repellent. The problems with repellents are that they do not totally prevent damage, are expensive, and some must be re-applied very frequently or after it rains. For these reasons repellents are best suited for protecting smaller areas and/or selected plants.

There are a variety of taste repellents on the market that are designed to stop rabbits from feeding on treated plants. These products are most effective if applied at the first signs of damage. Rain and natural aging of the products affect their longevity. Check the product's label for specific instructions on how and when to apply the product.

Area repellents are applied around the plants to be protected and repel rabbits by odor alone. Some area repellents that reportedly work are dried blood meal. Most of these have limited effectiveness, and dried blood meal does not weather very well so must be re-applied.

Generally, the taste repellents are more effective than the area repellents. The efficacy of these products is highly variable and when the rabbit population is large and the food supply is limited, repellents may not provide the desired level of control.

## Chapter 6 Snakes



**Black Rat Snake**



**Timber Rattlesnake**



**Northern Copperhead**

### Identification

Snakes are unique animals that have elongated legless bodies covered with scales. While perceived to be slimy, instead their bodies are smooth and dry. Depending on the species, they vary in size from several inches to 6 feet in length. Snakes can be divided into two groups: poisonous pit vipers such as rattlesnakes and copperheads and non-poisonous snakes, such as black rat snakes, garter snakes, and water snakes, etc. There is one exception to the poisonous snakes, the coral snake is not a pit viper. Most of the snake calls received in Maryland deal with non-poisonous snakes.

It is important to distinguish between poisonous and non-poisonous snakes:

- Pit vipers have a pit in their heads halfway between their eyes and nostrils; non-poisonous snakes do not.
- There is a single row of scales behind the vent (anus) on the underside of a pit viper; non-poisonous snakes have two rows of scales.

- The pupils of pit vipers are vertical slits; the pupils of non-poisonous snakes are round.
- All snakes have teeth; in addition, pit vipers have fangs.
- Except for their coloration, coral snakes look like non-poisonous snakes. In both coral and king snakes, colors are red, black and yellow bands. However, in the coral snake, the red bands touch yellow. In the non-poisonous king snake, in contrast, the red bands touch black.

Timber Rattlesnake (*Crotalus horridus horridus*) is the only venomous snake in the State with a segmented rattle at the end of its tail. It has brown or black chevron-shaped markings on a yellow background, down its back. The background color may vary from a bright yellow to a dull gray. Entirely black specimens also occur. This snake rarely exceeds six feet in length. It commonly occurs in the remote rocky, mountainous sections of the State.

Northern Copperhead (*Agkistrodon contortrix mokasen*) This is the other venomous snake species in Maryland. The color is rich, reddish brown with a series of

darker hourglass markings down its back. Its head is usually a bright copper color and its belly is pinkish. It seldom exceeds three feet in length. Copperheads exist throughout the State in remote rocky, wooded areas.

## **Biology**

Depending on the species of snake, they can reproduce by: laying eggs; hatching the eggs internally; or by live birth that is the case with the pit vipers.

Snakes are cold-blooded animals which must adapt to the extreme temperatures that occur in summer and winter. In the summer snakes may simply rest, while in the winter some will hibernate. In either case, their search for food ceases as they rely on the digestion of food consumed prior to the onset of these weather conditions.

Because they do not have ears, snakes rely on sight and their long forked tongues that detect odors in order to find their food. Their jaws are not fused but hinged with ligaments to allow their mouths to open wider than their head-size in order to swallow their prey whole. As a result, a single meal can last them several weeks.

## **Habits**

Snakes are agile and can easily climb trees, buildings with rough surfaces, and fences. Habitat requirements for their survival are often very specific. Some live underground, in trees, in the ocean, and in other areas where food is easily found. They prefer and are attracted to cool, damp, and dark areas such as areas around structures, cellars, cluttered basements, firewood on the ground, piles of lumber, brushy areas,

heavily-mulched flower beds, shrubbery against buildings, attics, barn lofts, and other areas where rodents and other small prey are abundant. Snakes can not dig holes, but they might occupy ground holes dug by other animals.

Snakes are predators, and depending on the species, their diets can include insects, rodents, frogs, birds, worms, or toads.

Most snakes attempt to avoid human interaction, crawling away when disturbed. They do not chase, or attack humans, but when cornered they may roll over and play dead, hiss, coil, strike, open their mouths, and bite. When grabbed, some release a musky odor.

## **Damage**

Although non-poisonous snakes can not injure humans other than to break their skin, draw blood, and possibly cause minor infections, they, nevertheless, are feared by many people. Poisonous snakes, however, are rightfully feared as they can inject a poisonous venom with their fangs which can cause an almost-immediate reaction, such as swelling, tissue discoloration (turning the skin dark blue-black), a tingling sensation, nausea, and in extreme situations death.

## **Management**

Snakes are beneficial in reducing rodent populations so they should *not* be killed. Only poisonous snakes which pose an imminent threat to human health should be killed if they can not be safely relocated. Because snakes are attracted to places that have rodents and insects, sanitation and the

control of the snake's food source is an important of their control.

### Habitat Modification

Remove brush piles, wood piles, rock piles, and other debris; trim shrubbery away from foundations; and cut high grass.

Often snake problems follow rodent problems. Thus, eliminating the snakes' food source, such as, rodents, will result in the snakes moving elsewhere.

### Exclusion

Snakes often enter structures through broken block foundations, cracked mortar, damaged vents, at the base of damaged doors, and around where pipes and wires enter walls. All openings larger than ¼ inch (0.6 cm) should be sealed.

A snake-proof fence can be installed around a backyard or play area by burying 36 inch (90 cm) wide galvanized ¼ inch hardware cloth six inches (15 cm) in the ground and slanting it outward at a 30 degree angle. Keep all vegetation away from the fence.

### Trapping

Place damp burlap sacks on the floor, and cover them with dry sacks. Check them every few hours to see if the snake has crawled beneath them. The snake and bags can then be lifted with a shovel, taken outside, and the snake released.

Rat glue boards can capture all but the largest snakes. The glue boards should be tied down or attached to a plywood base. Place the glue boards along wall and floor junctions. Captured snakes can then be released by pouring vegetable oil over the snake and glue.

Funnel traps in combination with drift fences can be used to trap snakes outdoors. However, this involves considerable effort, material, and luck in order to catch snakes by this method;

Non-poisonous snakes can be manually removed.

When dealing with larger snakes, it is strongly recommended that one wear gloves in order to avoid bites.

### Frightening

Frightening does not work with snakes.

### Pesticides

Several repellents are registered for snake control. However, these products which contain sulfur and naphthalene placed as a barrier around a structure, have limited efficacy and only against a few species of snakes.

Other than repellents, there are not any pesticides, including fumigants, registered for controlling snakes.

## Chapter 7

# Public Relations and Regulations

### PUBLIC RELATIONS

Aren't they gorgeous? Aren't they elegant? How many times have you heard this, if it has been said once it's been said a thousand times when fawns and their mothers wander into a yard. That is, until they begin to nibble the persons prized plants. Then they become a stark raving lunatic, looking for anything they can use, including their dog, as they tear out of the house screaming, "Get out of my yard!"

While they are cute, as is true for most urban wildlife, it has been estimated that deer alone cause one billion dollars in damage to agricultural crops, forests, and urban landscapes. This problem gets increasingly worse as their natural habitats are suburbanized.

It is unfortunate that most suburbanites fail to appreciate the dilemma facing these animals. Confrontations with humans generally are the result of the animals seeking shelter and food. For example, raccoons, unable to distinguish an attic or chimney from a tree hole, see it as a warm and protected area in which to nest. Likewise, deer see landscape plants as a source of tender food.

Urban wildlife populations are growing by leaps and bounds because their natural predators are no longer present and they become more accustomed to humans. Human predation by hunting, which assists in reducing deer and other wildlife populations, typically is not allowed within

suburbanized areas. About the only remaining predators for urban wildlife are motor vehicles. Thus, pest management professionals frequently are asked to address these wildlife problems and assist their customers in doing so.

Some of these animals have endeared themselves to some property owners and others. For some prospective home buyers, urban wildlife is a very popular selling point for the features of suburban life. Other individuals spend a great deal of money, time, and effort in attracting wildlife to their back yards by enhancing the wildlife habitats on their property. They want these animals around.

When conducting wildlife control work, keep in mind that emotions can run the gamut from the angry farmer who is losing half his corn crop to crows, to the park visitor who derives great pleasure from feeding hordes of pigeons and squirrels. A growing number of individuals do not want any wildlife control, particularly if it involves killing the problem animal or bird. Removing animals in order to solve a problem for one person might create a major problem for someone else. This type of sentiment can significantly affect what can be done in a given situation. Usually it is better to consider non-chemical and non-lethal approaches as the first course of action, reserving the use of toxicants or lethal trapping to those situations where there are no effective or economical alternatives. It is important to anticipate

these problems and work them out in advance.

Before undertaking any wildlife control work, the effects that it will have on public opinion must be considered. More than any other type of pest control, wildlife management can evoke a variety of emotions. Unfortunately perception plays a significant role in the determination of what is humane versus what is legal. For example, while lethal trapping is permitted for many animals, the perception is that this is inhumane compared to live trapping. Although, it is not uncommon for animals to die from exhaustion in live traps within a few hours by trying to get out or when they remain in traps that have not been checked for long periods of time.

Most public relations problems develop when work is being done in view of the public. Small residential wildlife and bird problems, as well as problems in commercial or agricultural settings, rarely generate any public interest or sympathy.

If you anticipate any public relations problems, the best way to minimize opposition is to educate your customers and the general public on the hazards associated with wildlife and birds, such as property destruction, diseases, ectoparasites, aircraft hazards, food loss, etc. Even the most ardent wildlife and bird lovers occasionally can be convinced that the threat to song birds and other more desirable species is a reason to manage pest bird and other wildlife populations. Use information provided in other parts of this manual to help in developing public information programs, brochures, public service announcements, etc.

Emphasize that you and your personnel are trained professionals who are certified and licensed by the state to perform this type of work. Also, emphasize your use of IPM strategies which utilize a variety of pest management techniques designed (in most situations) to dislodge, exclude, and relocate wildlife and birds, rather than kill them. Cite examples of previous work your company has done and have a list of references and letters of appreciation available.

When wildlife and bird management is going to be visible to the public, it is important to initiate your public relations campaign prior to beginning the work. This could involve town and civic group meetings, public radio and television announcements, newspapers articles and any other means that potentially lessens the impact of the project due to public emotions. Always present yourself factually and authoritatively, in order to build the public's confidence.

This type of information is not necessary for all wildlife or bird jobs, such as in industrial, commercial, and private settings. It usually is not necessary or even recommended that you go to these lengths to inform the public. However, you need to inform and educate your customers, and if appropriate, their employees.

### **USDA (APHIS) WILDLIFE SERVICES (WS)**

Maryland residents, industries, rganizations, and agencies can call on Maryland Wildlife Services (WS) for expertise in protecting agriculture, property, natural resources, and human health and safety from damage or

threats posed by wildlife. Managed by professional wildlife biologists, WS responds with effective, selective, and humane strategies to resolve wildlife conflicts.

WS has teamed up with the Wildlife and Heritage Division of Maryland's Department of Natural Resources (DNR) to provide professional guidance to citizens who have concerns and problems with wildlife. As the operators for the DNR's toll-free Nuisance Wildlife Information Line, WS provides technical assistance to thousands of callers on a one-to-one basis. WS has worked with several Maryland airports to help protect human safety and aircraft from dangerous wildlife/aircraft collisions.

WS offers information, advice, equipment, and materials that enable many people to resolve wildlife conflicts on their own. Often, this technical assistance can be provided over the phone. WS also provides on-site expertise, or direct assistance, to manage complex wildlife problems that cannot be safely resolved by others.

Major assistance activities to DNR Wildlife and Heritage Division include:

- Providing technical assistance and educating the public about wildlife, particularly in urban areas.
- Protecting natural resources and reducing nutria damage to the Chesapeake Bay.
- Protecting public health through monitoring of West Nile virus.
- Reducing wildlife hazards to aviation.
- Managing problems caused by Canadian geese.

Contact Information:

WS State Director MD, DE, and DC  
1568 Whitehall Road  
Annapolis, MD 21401  
Phone: (410) 349-8055  
FAX: (410) 349-8258  
Toll-Free Number: 1-866-487-3297  
Web site: [www.aphis.usda.gov/ws](http://www.aphis.usda.gov/ws)

## **REGULATIONS**

Wildlife control can be affected by federal, state and/or local regulations. This section discusses the Migratory Bird Treaty Act, the Endangered Species Act (ESA), Federal Insecticide Fungicide and Rodenticide Act (FIFRA), and applicable Maryland Department of Natural Resources Wildlife and Heritage Division laws and how they relate to wildlife management. Information is provided on how to contact the various agencies involved in wildlife management.

Wildlife control is directed either at individual animals and birds, or entire populations of animals and birds, such as sparrows, feral pigeons, and starlings that are not protected by federal law. However, pigeons are protected by Maryland law. In general, all other birds should be considered protected.

## **MIGRATORY BIRD TREATY ACT**

The Migratory Bird Treaty Act originally was passed in 1918 in order to protect migratory birds. The act makes it unlawful to “pursue, hunt, take, capture, kill, attempts to take, capture or kill, . . . any migratory bird, any part, nest or egg . . .” Sections omitted from this quote are acts that pest control operators would not intentionally or unintentionally engage in as part of bird

management programs. In the Act, “Take” is defined as shooting, poisoning, trapping, killing, hunting, wounding, capturing, trapping, or collecting.

Wildlife control cooperator permits can be issued to take migratory birds if they pose a threat to the health and safety of humans and domestic animals, or to agricultural, horticultural, and fish cultural interests. No permit is required to harass or herd migratory birds except for endangered and threatened species. Several other migratory bird species can be taken without a permit if they are causing damage to ornamentals, shade trees, agricultural crops, livestock, or wildlife, or if their numbers are sufficient to affect health or create a nuisance. These species include blackbirds, cowbirds, grackles, crows, and magpies. Consult the appropriate enforcement agency (discussed below) before instituting control methods for these or non-protected species which occur in the same habitat.

Permits are issued by the Special Agent in charge of the local law enforcement district of the U.S. Fish and Wildlife Service, Migratory Bird Permit Office, P.O. Box 779, Hadley, MA 01035-0779. The following information is required for the permit:

- the bird species;
- location;
- nature and extent of damage;
- control methods to be used;
- time and place of the operation;
- the name of the responsible pest management specialist;
- the method of bird disposal.

In general most permits also require the prior approval of the Maryland Wildlife and Heritage Division. A report, which must be filed within thirty days of the permit’s

expiration shall include information on the disposition by species and number of wildlife taken, possessed, or otherwise handled or treated as well as any other information as prescribed by the Wildlife Service.

Situations have occurred in which baiting programs for non-protected species resulted in the deaths of several migratory birds. This resulted in substantial fines for the pest control operator. Misdemeanor fines for such violations may be as much as \$5,000 for individuals and \$10,000 for companies, in addition to the possibility of six months imprisonment. Charges can also be filed as felony violations and fines for individuals and companies that violate provisions of the Act can range up to \$250,000 and \$500,000 for individuals and companies, respectively, and in addition to the possibility of up to two years imprisonment.

#### **ENDANGERED SPECIES ACT**

The Endangered Species Act (ESA) originally was passed in 1973 and reauthorized in 1988. The ESA regulates activities which can affect animal and plant species which are considered endangered or threatened. An endangered species is any animal or plant listed by regulation as being in danger of extinction. A threatened species is an animal or plant that is likely to become endangered in the foreseeable future. The U.S. Fish and Wildlife Service (USFWS) of the Department of Interior is the agency responsible for maintaining the list of endangered and threatened species.

Under the provisions of the ESA, the U.S. Environmental Protection Agency (EPA) must ensure that the use of pesticides

registered by the agency will not result in harm to the species that are listed as endangered, or threatened, by the USFWS, or to habitat critical to those species' survival. EPA's decision to register a pesticide is based in part on the risk of adverse effects the pesticide may have on an endangered species', or its habitat.

The EPA has published the final notice on its enforceable program for the protection of Endangered Species. The Endangered Species Protection Program (ESPP) will address, to the degree possible, issues relating to endangered species within EPA's existing pesticide programs of registration, reregistration, and in the future reregistration review.

If pesticide use limitations are necessary within specific geographical areas EPA will create an Endangered Species Protection Bulletin that will contain a map of the species location and enforceable use limitations for a pesticide. If a pesticide has the potential to impact an endangered species, or its habitat, the label will direct users to the bulletins for further information on the use of the pesticide. Copies of the bulletins referenced on the pesticide product labels can be obtained from EPA's website, [www.epa.gov/espp](http://www.epa.gov/espp), or by calling 1-800-477-3813.

This may ultimately affect where pesticide products, including those for wildlife control, can be used. However, EPA cannot adequately protect endangered species without having some impact on pesticide users. In order to minimize the impact, EPA tries to assist users in dealing with the impacts of the program.

A list of all animal and plant species protected under the ESA is listed in the Code of Federal Regulations 50 CFR 17.

Other prohibitions in the Act which may affect wildlife management operations are the taking (see definition above) or possessing of an endangered species within the United States or its territorial seas.

Individual violations of the Endangered Species Act may result in fines up to \$100,000 and one year in prison. Companies may be fined up to \$200,000. Any fish, wildlife, plants, and vehicles used in the violations are subject to forfeiture.

#### **MARYLAND DEPARTMENT OF NATURAL RESOURCES LAWS**

The Maryland Department of Natural Resources (Wildlife and Heritage Division) is the agency within Maryland that is primarily responsible for protecting the wildlife. As in the case of state laws, which can be more restrictive than federal laws, Maryland law protects pigeons and requires a permit for their control. This permit is issued by the Wildlife and Heritage Division of the Maryland Department of Natural Resources, Tawes State Office Building, Annapolis, MD 21401. The law further requires that a permit be issued before a toxicant can be used in any bird management project.

In addition, anyone wishing to control wildlife must have a Nuisance Wildlife Control Cooperator's Permit before they can perform this type of work. This permit is also issued by the Wildlife and Heritage Division of the Maryland Department of Natural Resources. The Cooperator's Permit will list the restrictions, and

guidelines that must be followed for each species of wildlife. They should be consulted prior to any trapping, taking, or removal of any wildlife in regards to the legal requirements associated with that particular species of bird or animal.

As discussed under the Bat Control section, nuisance bats have a separate set of guidelines, issued by the Wildlife and Heritage Division that must be followed. These requirements state, that when “handling bat problems, non-lethal methods must be used. Live removal through exclusion from buildings and sealing the entrance holes is the only effective long-term solution to preventing bats from roosting in buildings. All exclusions and sealing of entrance holes must take place during the fall and winter months from September to February. For bat colonies consisting of greater than ten individual bats: the Wildlife and Heritage Division must be contacted prior to the eviction of a colony from a building.”

The Maryland Natural Heritage Program, of Maryland Wildlife and Heritage Division is responsible for protecting rare, threatened, and endangered species found in Maryland and publish a list of these species. This list, as well as any county or local ordinances, should be reviewed prior to instituting any wildlife management project.

#### **FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT AND STATE PESTICIDE LAWS**

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulates the registration, labeling, and use of all pesticide products, including repellents and avicides (products to control birds). Most pesticides, except those classified as minimum risk, and

those devices used in wildlife management programs must be registered by the U.S. Environmental Protection Agency (EPA). Minimum risk pesticides are exempt from federal registration, but they must be

registered with the Maryland State Chemist’s Office of the Maryland Department of Agriculture (MDA). Under Maryland law, only those pesticides that are registered with MDA can be legally used. All pesticides must be applied in strict accordance with their labels. As with any pesticide, the labels should be reviewed periodically, because they change frequently. Some changes are voluntarily made by the manufacturers, while others are mandated by EPA as part of the pesticide reregistration process.

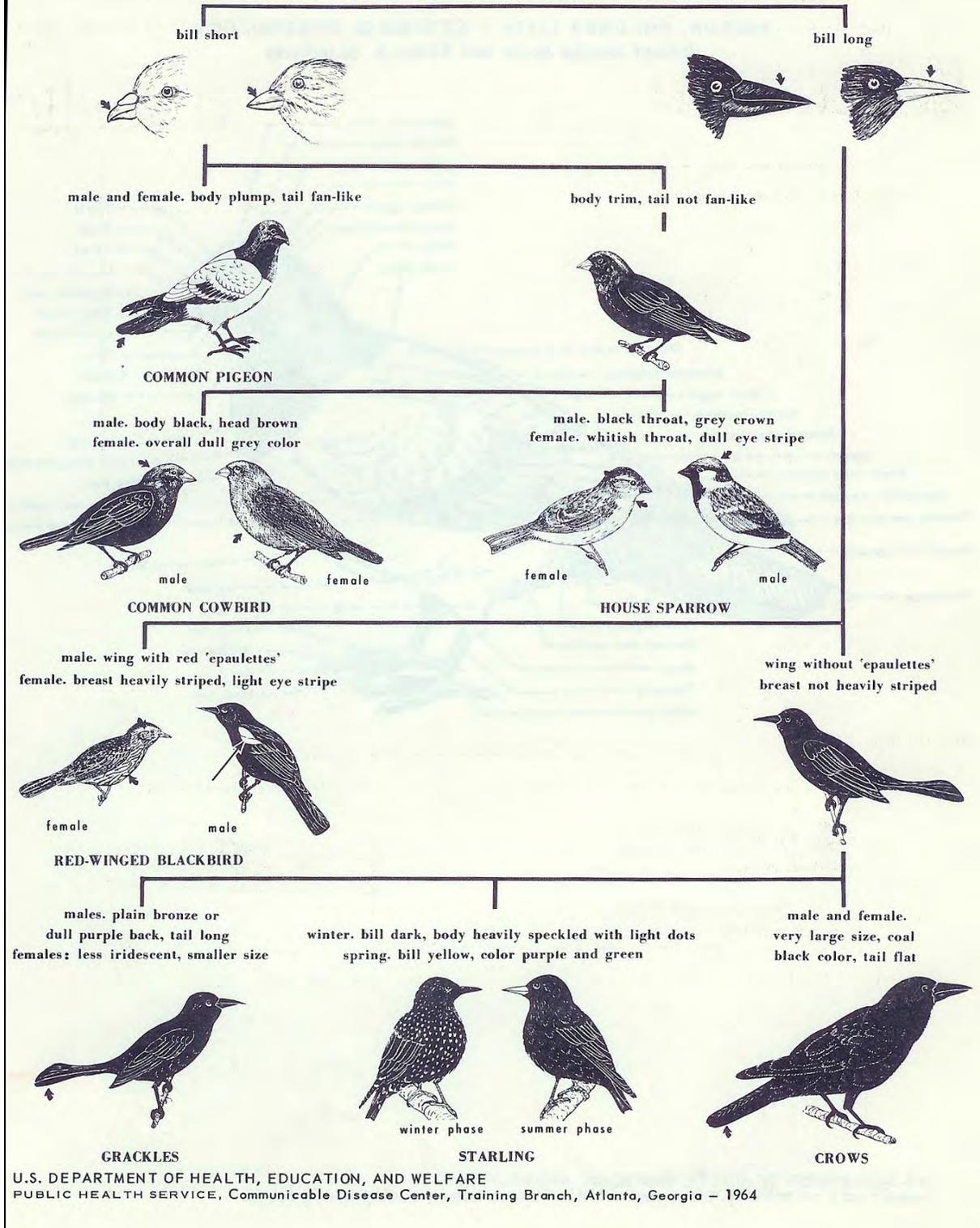
#### **READ THE LABEL!**

**APPENDIX A**

**TAXONOMIC KEYS TO PEST WILDLIFE**

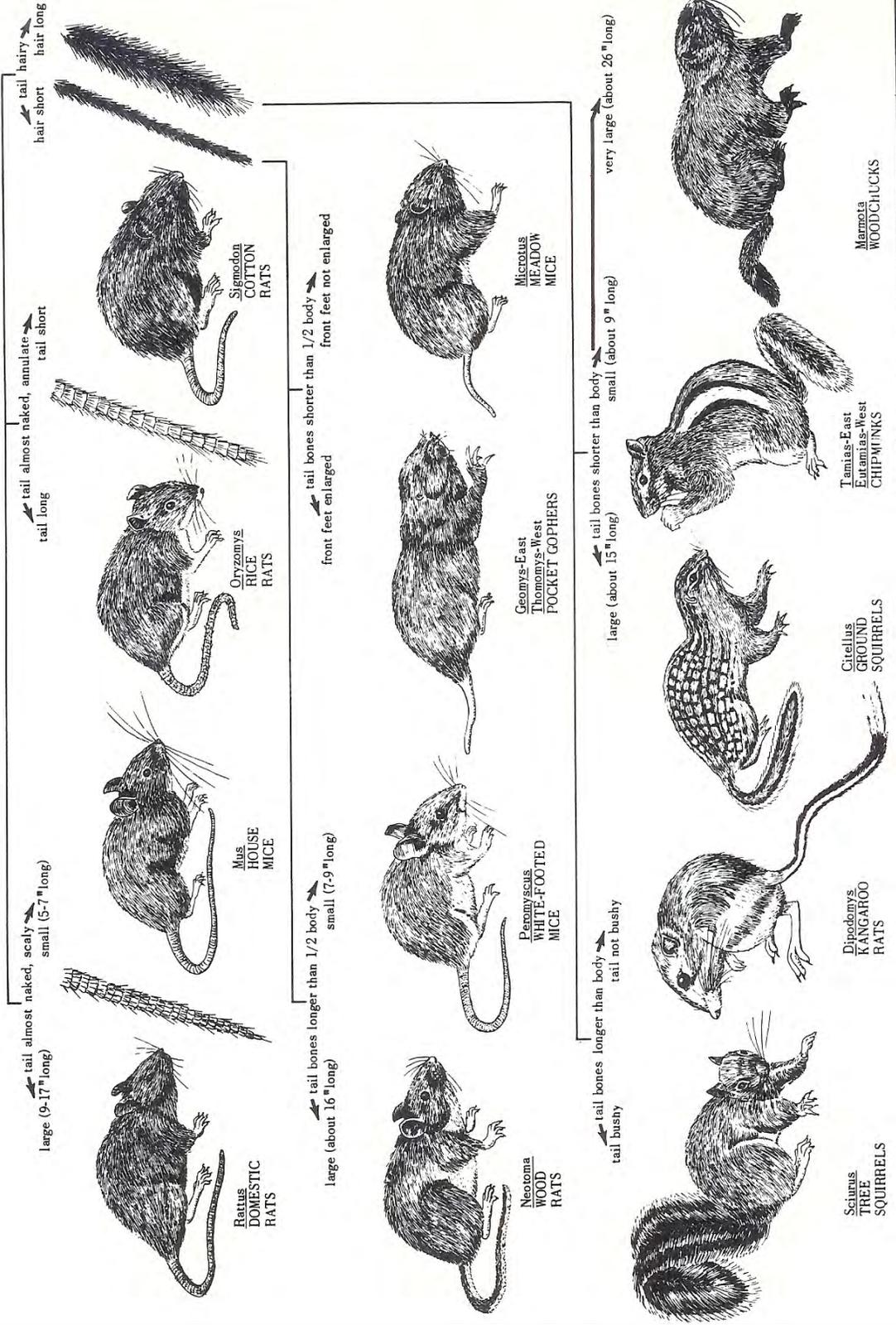
**BIRDS: PICTORIAL KEY TO SOME COMMON PEST SPECIES  
OF PUBLIC HEALTH IMPORTANCE**

Margaret A. Parsons and Chester J. Stojanovich



**RODENTS: PICTORIAL KEY TO SOME COMMON UNITED STATES GENERA**

Harold George Scott and Margery R. Borom



## **APPENDIX B**

### **REFERENCES**

- BAKER, E.W., T.M. EVANS, D. J. GOULD, W.B. HULL, AND H.L. KEEGAN. 1956. A Manual of Parasitic Mites of Economic Importance. Dunn Loring: National Pest Management Association.
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- HYGNSTROM, S.E., R.M. TIMM, AND G.E. LARSON (eds.). 1994. Prevention and Control of Wildlife Damage Vols. I & II. University of Nebraska Cooperative Extension Service.
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- PETERSON, R.T. 1980. A Field Guide to the Birds East of the Rockies. Boston: Houghton Mifflin Company.
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**APPENDIX C**  
**REGULATIONS**



MARYLAND DEPARTMENT OF NATURAL RESOURCES  
WILDLIFE AND HERITAGE SERVICE

**APPLICATION FOR NUISANCE WILDLIFE CONTROL COOPERATOR  
PERMIT/LICENSE**

**INSTRUCTIONS**

- A. THIS IS AN APPLICATION FOR A WILDLIFE PERMIT/LICENSE. COMPLETE ALL THE INFORMATION IN PARTS 1-11 AND 15-17.
- B. RETURN WITH FEE SHOWN IN PART 14 TO PERMITS COORDINATOR, WILDLIFE AND HERITAGE SERVICE, 580 TAYLOR AVE., E-1, ANNAPOLIS MD 21401. MAKE CHECKS

**CURRENT INFORMATION**

1. NAME

2. STREET

3. CITY

4. STATE/ZIP

5. COUNTY

6. PHONE - HOME

7. PHONE - WORK

8. DATE OF BIRTH

9. NAME AND TITLE OF PRINCIPAL OFFICER (IF #1 IS A BUSINESS)

10. SOCIAL SECURITY OR FEDERAL TAX #

11. LOCATION WHERE ACTIVITY WILL BE CONDUCTED (IF APPLICABLE):

12. TYPE: NUISANCE WILDLIFE CONTROL COOPERATOR

13. NEW PERMIT/LICENSE WILL EXPIRE ON THE FIRST DEC. 31<sup>ST</sup> FOLLOWING THE DATE OF ISSUANCE.

14. FEE: \$0.00

15. COMPLETE THE FOLLOWING:

LIST ALL SPECIES THAT YOU WILL HANDLE:

16. CHECK ONE OF THE FOLLOWING TO COMPLY WITH MARYLAND'S  
WORKMEN COMPENSATION ACT (ARTICLE 1-401).

I AM:

SUPPLYING DNR WITH A CERTIFICATE OF INSURANCE.

SUPPLYING DNR WITH INSURANCE BINDER NUMBER

SELF-EMPLOYED OR EMPLOY ONLY FAMILY MEMBERS, AND THEREFORE I AM NOT REQUIRED TO COMPLY WITH THIS LAW.

17. I HEREBY APPLY FOR THE ABOVE PERMIT/LICENSE AND CERTIFY UNDER PENALTY OF PERJURY THAT THE INFORMATION HEREIN IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION AND BELIEF.

SIGNATURE OF APPLICANT

DATE

QUESTIONS? CONTACT PERMITS COORDINATOR, WILDLIFE & HERITAGE SERVICE, TAWES STATE OFFICE BLDG., ANNAPOLIS, MD 21401; (410) 260-8540 DNR-FPWS-0405 (01/2000)

**WILDLIFE CONTROL COOPERATOR GENERAL CONDITIONS**  
**PAGE TWO**

**ATTACHMENT 1**

E. Except as provided for in paragraphs (2)-(5) any animal taken under the authority of this permit must be (a) released on site; (b) transported and released on a Wildlife Management Area or on other suitable area with permission from the landowner or managing authority; or (c) euthanized. (2) Coyote, bobcat, nutria, beaver, muskrat, mink and otter must be (a) released on site; or (b) euthanized. (3) Raccoon, skunk and fox must be (a) released on site; euthanized, or (c) if they are orphaned, healthy, and young of the year, they may be transported to a person licensed to rehabilitate rabies vector species. (4) Deer must be: (a) released on site; (b) euthanized; or (c) if they are orphaned, healthy and young of the year they may be transported to a person licensed to rehabilitate fawns. (5) Sick or injured animals must be: (a) transported to a licensed wildlife rehabilitator authorized to handle that animal; or (b) euthanized. (6) The permission of the landowner or client is required to release animals on site as allowed in (E)(1)-(4). (7) Euthanasia, as allowed in E(1)-(5), must be done either on-site or after transport, by the permittee, the local animal control entity, or a licensed veterinarian. (8) Otter must be tagged if taken during the legal trapping season.

F. When handling bat problems, only non-lethal, exclusionary methods may be used. Lethal methods of removing bats from unwanted locations are prohibited. No aerosol fogger is USDA or MDA approved for use in bat situations. Therefore, you may not fog an area that has an active colony until the colony is excluded from the area. Live removal through exclusion from buildings and sealing the entrance holes is the only effective long-term solution to preventing bats from roosting in buildings. All exclusions and sealing of entrance holes must take place from September 1 to March 1, provided bats are not hibernating in the building. If bats are hibernating, then exclusion cannot occur until after spring emergence by the bats. For bat colonies consisting of greater than 10 bats, the Wildlife and Heritage Service must be contacted at 410-260-8556 prior to the eviction of a colony from a building. You may not do any bat work unless they are specifically listed on your permit.

G. Prior to removing any nuisance beaver outside of the regulated trapping seasons in Anne Arundel, Calvert, Charles, Prince George's, or St. Mary's counties, you must first contact Pete Bendel, a Southern Region biologist, at 410-260-8547 and request a site inspection.

H. If you are using Avitrol or any other poison to control pigeons, starlings, or English sparrows, you must get a separate Control Permit from this office.

I. This permit shall be carried when performing permitted activities.

J. This permit does not authorize the handling, possession or transportation of any species classified as threatened or endangered at the State or Federal levels.

K. This permit does not pre-empt local restrictions on the discharge of firearms.

L. A report must be filed before permit will be renewed. This report shall list the date, species, location where found or obtained, and the disposition of each animal handled.

**Wildlife and Heritage Service Policy Paper**  
**Wildlife Control Cooperators and Nuisance Bats**  
20 October 2004

**1. Pesticide applicators must follow DNR guidelines for bat exclusions.**

All companies that do nuisance bat work in the state of Maryland must have a wildlife control cooperators permit from the Maryland Department of Natural Resources, including pesticide applicators that are licensed by the Maryland Department of Agriculture and national pesticide companies with offices in Maryland. Each branch office of a single company must be licensed individually. Pesticide applicators who are found to be in violation of their pesticide applicator's license by fogging bat colonies that are in the building, applying chemicals, or otherwise improperly excluding bats will be reported to DNR police and the Maryland Department of Agriculture. These actions may result in revocation of the wildlife control cooperators permit.

**2. Cooperators wanting to do bat work must inform DNR and demonstrate proper knowledge of bat exclusion techniques.**

Only non-lethal methods may be used for the removal of nuisance bats by wildlife control cooperators. Cooperators who wish to do bat work must indicate "bats" specifically on their permit form and not small mammals. Only those cooperators who list bats will be listed on DNR's bat web page at <http://www.dnr.state.md.us/wildlife/bats/nhpbatintro.asp> and referred to customers by DNR. Cooperators are strongly advised to become familiar with information on DNR's bat exclusion policy and refer customers to the web site whenever possible. Wildlife cooperators who build and install bat boxes will also be listed on the web site.

**3. A single bat found within the living quarters may be removed without DNR approval regardless of the time of year.**

A single bat found within the living quarters or working space (e.g. bedroom, living room, kitchen, hallway, office) may be captured and released at any time of the year without prior approval from the Maryland Department of Natural Resources. The cooperator should make an effort to find out how the bat got inside the living quarters or working space and whether or not a colony is present. If the bat was found in the living quarters or working space during March 1-August 31, the cooperator should immediately examine the building for potential colonies and temporarily or permanently seal ways of entrance into the living quarters or working space from non-living quarters. If the cooperator finds or suspects that a colony exists in any non-living quarters (e.g. the attic, roof, soffit, walls, etc.) then the cooperator must diagnose the situation further and determine the main entrance holes and potential future access holes. An exit count of the colony at dusk is helpful and can be done by the cooperator or the owner of the house. Potential access holes can be sealed leaving the main exits open until September 1.

**4. Health department officials should be contacted immediately if a person is bitten by a bat.**

Health Department officials may authorize the submission of individual bats for rabies testing if that bat has bitten an individual person, or if exposure to the animal cannot be ruled out (i.e. exposure involving young children that cannot talk, mentally-impaired individuals, etc.). Only humane methods of euthanasia can be used for securing the specimen for rabies testing. Bats submitted for testing should be identified to species if possible. A key to bat identification is available on the web site.

**5. Bat colonies may not be excluded from buildings from March 1 to August 31.**

Non-lethal exclusion is the only method permitted by the Maryland Department of Natural Resources for nuisance bat colonies. Exclusion of colonies must take place after August 31 but before bats begin hibernation. Once the bats have left or have been successfully excluded, sealing of the main entrance is required and must be completed. Repellents are not effective and are not long-term solutions to nuisance bat situations, including pesticides used to treat insect pests while bats are still present in the colony. Information on exclusion techniques is available on

DNR's bat web page: [www.dnr.state.md.us/wildlife/bats/batsinhome.asp](http://www.dnr.state.md.us/wildlife/bats/batsinhome.asp).

**6. If the customer is reluctant to wait until September 1 for exclusion, the cooperators should survey the roost, outline work to the customer that can be done prior to September 1, and then direct the customer to call DNR with the survey results. The customer should never be told that nothing can be done until September 1.**

If the colony is visible, the cooperators must survey the roost and report the stage of development of the young (fur present or absent, relative size of pup to female) to the Department of Natural Resources. Bats may give birth anytime between April through June. Colonies may be excluded prior to September 1 only with prior written approval from the Department of Natural Resources Wildlife and Heritage Service and only for the following reasons: 1) dates when young should be flying have been determined by the Department and permission has been granted to exclude after that time period, 2) pups are not present in the roost, 3) extenuating circumstances warrant exclusion before September 1. Homeowners must request an exception letter (not a permit) by calling Dana Limpert at 410-260-8556. No letter is needed if the exclusion occurs after September 1. Once the main exits have been identified, sealing of other possible entrances may and should occur prior to exclusion. There is always work that can be done in preparation for the exclusion. This tact is ultimately more satisfying for the customer and the one DNR recommends for cooperators.

**7. Cooperators should always present factual information on bats, particularly related to health issues such as rabies and histoplasmosis.**

For customer service purposes, the cooperators must take the time to allay the customer's fear of bats if necessary. Cooperators must be knowledgeable in answering a customer's questions about bats and diseases or bat behavior. The DNR bat web page should be consulted if necessary for information on rabies and histoplasmosis. Excluding bats at the wrong time of year can lead to far greater problems for the homeowner than the one he or she currently faces such as bats dying and creating an odor problem or more bats getting inside the living quarters. Female bats that have been excluded and have flightless young trapped inside the house will fly around the outside of the house and try to find another way to get to their pups. This situation increases the likelihood that the bats may come in contact with people.

**8. Cooperators need to file an annual report on bat colony exclusion activity.**

Cooperators must include the following information in an annual report to the Department: date, street address, city, zip code, species, estimate of colony size, and work performed.

**9. DNR reserves the right to revoke a cooperators permit to do bat exclusion if the cooperators fails to follow DNR bat exclusion policy as stated above.**

**For more information, please contact:**

Maryland Department of Natural Resources  
Wildlife and Heritage Service  
Tawes State Office Building, E-1  
Annapolis MD 21401  
410-260-8540  
Toll-free in Maryland: 1-877-620-8DNR, Ext. 8540



## United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Assistant Regional Director (RW)  
U.S. FISH AND WILDLIFE SERVICE  
P.O. Box 779  
Hadley, MA 01035-0779

### INSTRUCTIONS FOR COMPLETING PERMIT APPLICATION FORM

A standard License/Permit Form 3-200 has been designed to assist persons applying for all U.S. Fish and Wildlife Service permits. In addition to the Form 3-200, attachments are necessary to provide the additional information required for each specific type of permit. A complete application prevents delays caused by the applicant having to supply more information at a later date.

Most of the application form is self-explanatory, but the following provides some further assistance for completing each numbered block.

1. **"Application for"** - The permit box should be marked. Import/Export licenses and exception to designated port permits are issued by the Service's Valley Stream, NY office (516)825-3950, ext. 236.
2. **"Brief description of activity for which requested license or permit is needed"** - Include a brief statement of the purpose of the activity.
3. **"Applicant"** - If the applicant is an individual, use complete name including middle name or initial of the responsible party, who will also be the permittee if a permit is issued. If the applicant is a business, use the complete business name. Provide the complete address and phone number, including zip and area codes.
4. **"If applicant is an individual, complete the following"** - Enter information that identifies the applicant. If the applicant is a corporation, institution, or other legal entity, block 5 should be filled out, and block 4 should be marked "not applicable."
5. **"If applicant is a business corporation, public agency, or institution, complete the following"** - Give a brief description of the type of business the applicant is engaged in, the name and phone number of the person fully or partly in charge, and if the company is incorporated, the state in which it was incorporated. If block 4 is completed, mark "not applicable" in this space.
6. **"Location where proposed activity is to be conducted"** - Give the address or geographical location where the desired activity is to take place. This should include such information as the location where wildlife would be removed from the wild, or where specimens would be held. If specific locations are unknown at this time, provide the names of all counties in which you foresee working; specific locations/maps prior to conducting activities in a specific location - No P.O. Boxes.
7. **"Do you hold any currently valid Federal Fish and Wildlife license or Permits?"** - Check the appropriate box. If "yes," list the complete license or permit numbers. If you are re-applying for an expired or non-renewable permit, list the former permit number.
8. **"If required by any state or foreign government, do you have their approval to conduct the activity you propose?"** - Identify any required state or other Federal approvals/permits held for the proposed activities (e.g., permission to work on Federal state lands, state protected species permit, Federal bird banding permit). Attach copy or give agency name, permit number if any. If you do not have this permission at this time,

INSTRUCTIONS FOR COMPLETING PERMIT APPLICATION FORM (CONT'D)

provide an explanation/describe steps you have taken to secure approval (use attachment if necessary). If the proposed activity is not regulated write "not required" in this block.

9. **"Personal check or money order (if applicable)"** - There is a permit processing fee unless you are fee exempt. The check (does not need to be certified) or money order should be made payable to the U.S. Fish and Wildlife Service and attached to the application form. If fee exempt, write "exempt." The fee is \$25.00.
10. **"Desired effective date"** - Insert the earliest date you want to conduct the activity. Permits will be processed on a priority basis by date received.
11. **"Duration needed"** - Most permits have a limited duration, but the applicant should insert the duration of the permit. Otherwise the permit will be limited to the shortest reasonable time needed, in the Service's best estimate, to complete the permitted activity.
12. **"Attachments"** - This refers to information application requirements of the regulations of 50 CFR 10, 13, 14, 17, 21 and 23. Be as complete and descriptive as possible. If there is any doubt as to the information's relevance, include it with the application. **An incomplete or unclear application may be denied or will cause delays in processing.**

**"CERTIFICATION"** - The individual applicant named in block 4 or the person named in block 5 **must sign and date** the application in the space provided. This signature binds that person to the statement of certification. Be sure to read the statement and re-read the application before signing.

Submit the completed application to:

U.S. Fish and Wildlife Service  
Migratory Bird Permit Office  
P.O. Box 779  
Hadley, MA 01035-0779

Any questions? Call 413-253-8643

CONTINUATION SHEET/DEPREDAATION (50 CFR 21.41.)

IN ORDER TO EXPEDITE THE PROCESSING OF YOUR APPLICATION FOR A DEPREDAATION PERMIT, MAKE SURE YOU INCLUDE THE FOLLOWING INFORMATION WITH YOUR COMPLETED FISH AND WILDLIFE LICENSE/PERMIT APPLICATION, FORM 3-200.

SUBMIT ALL REQUESTED INFORMATION TO:

U.S. Fish and Wildlife Service  
Migratory Bird Permit Office  
P.O. Box 779  
Hadley, Massachusetts 01035-0779  
(413) 253-8643

1. Describe in detail what activity you propose to conduct. For example: How you will accomplish this. When activity will take place and the expected results.
2. Submit long range plan.
3. Identify the specific damage being caused. Document any health hazards that are involved.
4. List the species and number of migratory birds involved.
5. Provide documentation of the economic cost (loss) suffered as a result of the migratory bird depredation and how you determined that estimated loss.
6. What non-lethal control techniques or actions are you presently using to alleviate the problem and how long have these techniques been in use?
7. Supply the names of all persons/companies that would be actively involved in this activity.
8. Identify the location where records will be kept.
9. Contact the State Director of the Animal Damage Control Office (USDA) within your state at the following telephone numbers:

603-225-1416 (NH, VT)	413-253-2403 (MA, CT, RI)
207-622-8263 (ME)	410-269-0057 (DE, MD, DC)
804-739-7739 (VA)	304-636-1785 (WV)
518-431-4190 (NY--ZIP 10500 or higher)	908-735-5654 (NJ, PA) (also, LI and Manhattan, NY--ZIP 10499 or below)
10. Supply a copy of your State license authorizing requested authority, if applicable.
11. There is a \$25 processing fee payable to U.S. Fish and Wildlife Service in check or money order. **Those applicants holding tax exempt status are not required to submit the processing fee. When requesting a waiver of the processing fee, applicant must submit evidence of tax exempt status.**
12. List the telephone number, including area code, where you can be reached between 8:00 a.m. and 4:00 p.m.

10/1/95

## APPENDIX D

### GLOSSARY

**Acute** – Pesticides that only require one exposure to achieve toxic effects.

**Adaptation** – The ability of an animal to adjust to its environment.

**Air curtain** - A blower mounted above a doorway designed to keep birds and flying insects from entering the structure.

**Antibiotics** - A medication most often used to treat bacterial infections.

**Anticoagulant** – A type of rodenticide that effects the clotting of blood.

**Arthropod** - Any segmented invertebrate animal of the phylum Arthropoda, having jointed legs.

**Baiting** – The act of placing rodenticides or food on traps for animal control.

**Bill** - Beak.

**Brood** - The number of young birds produced or hatched at one time.

**Burrow** – A tunnel or digging beneath the ground surface used for feeding or harborage.

**Cache** – A place where food is stored.

**Carnivore** – A predatory animal that eats or feeds on animal fluids or tissues.

**Clutch** - The number of eggs produced or incubated at one time.

**Commensal** – Rodents living in close association with humans and whose needs are supplied by humans.

**Conjunctivitis** - An inflammation of the inner lining of the eyelid and/or the outer covering of the eyeball.

**Crown** - Top of the head.

**Deciduous tree** - A tree, including most broad leaf and hardwoods, which drops its leaves seasonally, being without leaves for part of the year.

**Dermatitis** - Inflammation or redness of the skin.

**Ectoparasite** - An external parasite that benefits by association with a host animal, usually by feeding on it.

**Endoparasite** - An internal parasite that benefits by association with a host animal, usually by feeding in it.

**Environment** – The conditions that surround the development of an organism.

**Epaulettes** - Colored patches on the wings below the nape, when the bird is at rest.

**Eye stripe** - A horizontal line running from the base of the bill through the eye.

**Fledgling** - A young bird which has feathers and is capable of flight.

**Flock** - A large group of birds, often of one species.

**Fumigant** – A pesticide gas that is taken in while breathing.

**Gastroenteritis** - Inflammation of the human digestive tract.

**Gestation** – period of time that young develop in the uterus; period of pregnancy.

**Habitat** – An area, or region, where an animal lives.

**Harborage** – An area, or place, that offers safety or protection to an animal or pest.

**Hibernation** – the act of becoming inactive during the winter.

**HEPA filter** - High efficiency particulate filter capable of removing particles, such as bacteria and fungal spores, larger than 0.3 microns.

**Insectivores** - Organisms, usually animals, that eat insects.

**Intermediate host** - The host in which the asexual stages of a parasite are passed.

**Iridescence** - Displaying a shifting/change of lustrous colors (shines by reflection) when the angle of view changes.

**Leg Hold Trap** – A device that catches and holds the leg(s) of an animal.

**Loafing** - Loitering behavior during the day which is exhibited by some species.

**Maggots** - Immature stages of flies, i.e., fly larvae, which are pointed at the head end and blunt at the posterior end.

**Monofilament line** - A line made of plastic material, similar to fishing line.

**Mosquito** - (Diptera/Culicidae) a “fly” many species capable of feeding on animal blood and transmitting diseases.

**Nape** - The back side of the neck.

**Pathogens** - Any organism or its product which causes disease.

**PCO** - Pest control operator; a person engaged in pest control as a profession or business.

**Pre-baiting** – The process of placing baits usually food in/on traps that have not been set.

**Predaceous** - Feeding on other animals.

**Range** - The geographical area or areas occupied by a species.

**Repeating Traps** – A trap that can capture several small animals alive by resetting itself after each capture.

**Repellents** – Pesticide products that keep an animal away from an area.

**Reservoir** - An animal which harbors within its body a disease causing organism(s) that are then transmitted to other animals by direct or indirect contact and/or by insects, ticks, mites, etc.

**Rodenticides** – Pesticides designed specifically for repelling or killing rodents.

**Rodent-proof** – Something that renders an area inaccessible to rodents.

**Roosting** - Resting on a perch at night.

**Rump** - The dorsal area between the wings just in front of the tail.

**Run** – frequently traveled animal routes.

**Spore** - A small, usually single cell, reproductive body of a fungus and similar organisms.

**Territory** - A specific area that may be defended by males, a pair of animals, or an unmated animal.

**Ultrasonic** - Sound of such high frequency it can not be detected by normal human hearing.