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*Branch of Predator and, Rodent Control, Bureau of Sport Fisheries and Wildlife, Washington 25, D. C.*

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## CONTROL OF OPOSSUMS, BATS, RACCOONS, AND SKUNKS

Howard. A. Merrill

Branch of Predator and, Rodent Control, Bureau of Sport Fisheries and Wildlife, Washington 25, D. C.

### OPOSSUMS

The opossum (*Didelphis marsupialis*) is the only native mammal in the United States which possesses an abdominal pouch for carrying its young. This group of animals represents the survivors of an ancient race that dates back millions of years. The opossum can be found in wooded areas, from the Gulf of Mexico to the Canadian border on the East Coast and westward through Michigan, Wisconsin, Iowa, and Missouri. In recent years, some of these animals were brought into California, and the opossum has now become firmly established in that State also.

Large numbers of opossums are killed, annually for sport, food, and furs. The furs are of low grade and are used, principally in trims on inexpensive clothing.

Opossums at times cause economic losses, especially around poultry farms, truck crops and river bottom corn fields. Under such circumstances, control may be required.

DESCRIPTION. Opossums are generally light gray in color. The average adult measures about 33 inches in length, including a 12-inch tail. One variety, which can be found, in Florida, is somewhat smaller, darker, and longer-tailed. Another kind, in Texas, has two color phases, gray and black.

Opossums normally produce one litter a year. In the warmer sections of the country, however, they frequently produce two, the first

in January or February and the second, in May or June. Each litter may number as many as 18 or more. At the time of birth the young are about the size of bumble bees and are so transparent that the heart, stomach, and other organs may be seen through their hairless skin.

The opossums<sup>1</sup> 12- to 13-day period from conception to emergence is unique among mammals. Following this emergence, the young work their way through the mother's hair to an opening in the belly which forms the pouch. There they attach themselves to the mammary glands and continue development for another 4 to 6 weeks. Since there are only 13 mammary glands, all young over this number are doomed from the outset. Usually less than 10 survive.

HABITAT AND FOOD HABITS. Opossums are sluggish animals, choosing for a homesite a hollow log, rock crevice, hole in a tree trunk, or sometimes pre-empting a squirrel nest high in the branches of a tree. They prefer living adjacent to swamps, along streams, and in wooded country, where some protection from their enemies is available. Where food is plentiful, travel is limited to a short range, often only a few hundred yards.

Opossums are quite omnivorous, eating practically anything available: fish, flesh, crustaceans, insects, mushrooms, berries and other fruits, vegetables, eggs, and even carrion. They are sometimes detrimental to farm poultry and corn fields.

ENEMIES. Opossums are often the prey of predators such as foxes, bobcats, hawks and owls. They have a repulsive, musk-like odor which affords some degree of protection. Their habit of playing "possum",

or feigning death, offers little protection from most of their natural enemies. They are often heavily parasitized.

CONTROL MEASURES. Opossums are easily caught in box traps, or with No. 2 steel traps, either with baits or trail sets placed in locations where they have caused damage, or along nearby paths leading to swamps or streams. Their omnivorous appetites and keen sense of smell permit the use of a wide range of baits (fish and canned dog food are among the best), and, they readily enter box traps in search of food. State or local game laws should be consulted before taking opossums.

In many instances it may be necessary to remove only one animal. This can often be best accomplished at night with the aid of a flashlight. A search of the area will usually reveal the animal and in a short chase it may be easily overtaken and picked, up by the tail. This will result in some snarling and a great show of teeth, but the animal may be readily removed with little danger.

If it becomes necessary to remove opossums from a large area, this may be accomplished, by the use of strychnine-treated, eggs prepared in the following manner:

Strychnine Egg Formula for 100 Eggs

Strychnine Alkaloid	10 grams
Dye (duPont Oil Yellow No. 91804) or vegetable dye	0.1 grams
Heavy Mineral Oil	39.9 grams

.5 gram of solution per egg (about 1h cc). This equals about 0.1 gram of strychnine per egg.

Dissolve the dye in mineral oil. Place the strychnine in a mortar and add the oil containing dye slowly, grinding with a pestle until an even slurry is obtained. Inject 1\ cc. of solution into each egg with a hypodermic syringe. The egg shell is sealed by painting the hole with flexible collodion, the dried egg albumen or a small piece of toilet tissue. A mixture of 20 grams of honey and 20 grams of water with a food coloring may be substituted for the mineral oil.

Eggs may also be treated by making a hole in the end of the shell and inserting 0.1 gram of strychnine alkaloid. This may be mixed in the egg by the use of a small metal wire or rod.

With a red wax crayon or rubber stamp, print the word "POISON" on each egg shell.

#### BATS

When bats invade homes and occupied buildings to establish their roosts, they often become nuisances, necessitating some measure of control. Interest in bats has increased greatly during recent years due to the transmission of rabies to humans. Rabies virus has been isolated from over 20 species of bats in 36 States. Since 1953, five human deaths have been attributed, to rabid bat bites. More recently one field investigator has reported an experience which indicated that rabies transmission from bats might occur without a direct bite. Any bat acting in an abnormal manner should be approached with caution, particularly if found fluttering on the ground. Bat bites should be treated by a physician and the bat should, be captured without injury to the head so the brain can be examined by health authorities. The

Bureau of Sport Fisheries and Wildlife receives many requests for information regarding control measures under these circumstances. Since bats are normally harmless animals and may even be beneficial because they feed largely on insects, they should not be needlessly destroyed. Milder measures should be tried first, directed toward dispossessing and permanently excluding them from the buildings they have invaded.

The habits of bats have a bearing upon their control. They are nocturnal animals, leaving their roosting places at dusk to fly about in pursuit of the night-flying insects that provide the bulk of their food. By day they roost in dark, sheltered places. A few species are solitary, but most congregate in groups or in colonies, the largest of which may number a million animals or more. Bats are mammals-- not birds, as so many people believe. Their "wings" are formed by thin leathery or membranous skin that stretches between the greatly elongated bones of the front legs and "fingers". They are the only mammals thus equipped to fly. The ones found in this country are small, averaging 3 to 5 inches in body length; the wingspread averages between 10 and 15 inches. Normally, bats do not attack humans, nor do they get themselves tangled in peoples' hair.

Some bats migrate with the change in seasons, following a steady source of food supply. Others remain in their roosts if well protected, hibernating only during the colder months. Originally bats roosted, in natural shelters, such as caves and hollow trees. Many still do, but others have found attics, spaces between building walls, and unused areas in upper stories much to their liking. The major objection to their presence in buildings is the highly objectionable odor

from the droppings and urine. This odor persists for a long time after the roost is broken up and may serve to attract new colonies if preventive measures are not taken. The noises created by crawling and squeaking bats are also disturbing to the householder. While they cause little actual damage to structures, their presence in a dwelling is usually undesirable. Exclusion or elimination is then necessary.

REPELLENTS. Frequently control can be accomplished, by the use of repellents. Bats dislike the odor of naphthalene and paradichlorobenzene, two chemicals commonly used as moth and insect repellents. When the roost is located in attics or other closed spaces that can be reached easily, either of these materials can be used to drive them out. Three to five pounds of naphthalene flakes will usually be sufficient to treat the average attic. Simply sprinkle the material liberally over the entire area. So objectionable is this odor to bats that they will usually leave the roost within a short time after it is introduced, even in broad daylight. Both of the chemicals dissipate rapidly on contact with air, however, and applications may have to be repeated if no other control is practiced. Benzene hexachloride (50% wettable powder) at the rate of one pound per gallon of water sprayed, on the infested areas is also reported, to repel bats. It is expected, that with this material a number of the bats will be killed. Due to the offensive odor of the material, however, few householders would care to have it applied. Five percent pentachlorophenol, commonly used as a wood preventive, also has a certain amount of repellency. Bats are quite persistent, and it is often difficult to dislodge them from old, established roosts. New individuals may be

attracted by the odors left by departed guests. For these reasons a thorough clean-up and bat-proofing should, be considered, necessary adjuncts to the use of repellents.

BAT-PROOFING BUILDINGS. Bats may enter buildings through large or even small openings, such as unprotected louvers or vents, broken windows, or other open spaces, or through old worn sidings, around, eaves, or cornices. The smaller species of bats can crawl through slits as narrow as 3/8 of an inch. It is necessary, therefore, to eliminate all possible entrances.

The larger openings should be covered, with sheet metal or with 1/4-inch mesh hardware cloth if ventilation is necessary. It is essential that no openings larger than 1/4 inch are left. In the case of narrow cracks, they are best plugged, with oakum, tow, or similar packing material, and, sealed with caulking compound. This will provide useful weather protection as well. Inspect carefully all old siding frames, and, baseboards to make certain that alternate entrances have not been overlooked, .

If the colony is not completely dislodged, it is necessary to ensure that all bats are out of a building before proofing work is completed. As a general rule, bats will not stay in attics, barns or churches all winter (in northern climates), but will migrate to warmer climate or go to caves to hibernate. The most suitable time for bat-proofing, therefore, is during late fall (November) or early spring (March). During the warmer months when bats are active, normally all occupants leave the roost within 15 to 20 minutes after the first one starts out. If they have been disturbed., however, the normal



routine may be upset considerably, and one or two of the most-used openings should be left open temporarily. In the evening, after the last bat has left the roost for feeding, close the remaining openings. If a number of entrances have been used, wait two or three days before attempting to close the last one, allowing all the occupants to learn to enter through this last opening. It can then be easily located and closed. If any entrances have been overlooked, the bats will soon find them, so it is necessary to watch the building closely at dusk for several evenings.

FUMIGATION. In cases where the use of repellents and proofing will not suffice, it may be necessary to destroy the bats. Best results can be obtained, by fumigation with gas. Calcium cyanide is the material most generally used for this purpose. Operations involving space fumigation are dangerous and must never be attempted by inexperienced persons. Only trained professionals, qualified to handle the materials, should be entrusted with the task.

Chemicals provide satisfactory control under some conditions. DDT in the form of 50 percent wettable powder applied to the entry or the roost area kills bats after two to three weeks exposure. The animals accumulate the material on their bodies and, in cleaning themselves, ingest lethal amounts. DDT may be dusted, on the area or sprayed in solution. Use one pound of 50 percent wettable powder per gallon of water. It is essential that the application be thorough and all avenues of entrance and exit must be treated. High volume spraying is recommended in order to wet all surfaces thoroughly. For the average sized one-family home this may require 10 to 12 gallons of spray.

Materials and, belongings stored, in attics should, be covered thoroughly with rubber or canvas tarpaulins before sprays are applied. Care should, be taken to prevent overspraying which could result in "runoff" and damage to floors below. The residual effect of the DDT will be from 1 to 2 years. Chlordane and dieldrin are also effective, and the rodenticid,e, ANTU has been used with success. These materials are toxic and require care in handling. Avoid, inhaling dust or contaminating food. Always wash thoroughly after using.

Mites, ticks and bat bugs frequently found on bats will usually be killed, by above application of chemicals except ANTU.

The use of poisoned bait is impractical since bats feed primarily upon flying insects they catch in the air.

Bat destruction by the above methods, while accomplishing the immediate objective, has several disadvantages, as carcasses not recovered, decompose with a displeasing odor. Further, they give no degree of permanency, for as soon as the space has been cleared, of gas, or the chemicals dissipate, it is ready for new occupants if no bat-proofing has been done. For the reasons mentioned, proofing, where practical, is recommended, as the most satisfactory and permanent means of bat control.

#### RACCOONS AND THEIR CONTROL

Raccoons are common throughout most of the United. States, and are important game animals in some areas. Raccoons prefer areas around, streams, lakes, or marshes, and require trees, brush, or other cover. They make their homes in hollow trees or logs, in rock dens, and sometimes in burrows. Because they are active mostly at night, they can

be common in an area and yet rarely seen. In colder climates they may hibernate in the winter. From 3 to 6 young are born in April or May,

Raccoons eat almost anything, but mainly insects, crayfish, mussels, fish, frogs, birds' eggs, grain, fruits, berries and nuts. They can be especially destructive to corn fields, particularly when the ears are in the milk stage. Where raccoons become so numerous that they are a serious pest to agriculture, their control is essential.

CONTROL METHODS. Trapping is the most satisfactory method of controlling raccoons. Hunting is restricted to established seasons and seldom removes enough offending animals to stop damage.

Raccoons are easy to trap. The No. 2 double coil-spring fox trap is best suited for this purpose. To remove the factory oil finish and to prevent rusting, the traps, trap wire and other metal materials should be boiled in a solution of water and natural staining materials, such as oak, maple or hemlock bark, walnut hulls, or logwood chips (obtainable at most drugstores), and let stand overnight or until they turn black. Pour the solution from the traps and rinse. Traps should be cleaned this way after use and particularly before storing them. It will keep them in good, condition and ready for use when needed.

In urban areas where there is danger of trapping cats and dogs in "steel" traps, the use of box traps may be preferable. Several types are available from commercial sources, such as:

Allcock Manufacturing Company, Ossining, New York

Havahart Trap No. 3 National Live

Traps, Tomahawk, Wisconsin

Collapsible or Rigid Type 10 x 12 x 32 inches

Several kinds of "sets" are used, commonly and successfully to catch raccoons. The "dirt-hole" set is one of the best. Set the trap about 1/2 inch below the ground,, one to two feet from the side of a trail, and. cover lightly with sifted soil. Cover trap pan with a piece of tissue or canvas to prevent dirt from getting under it and. locking it open. Dig a small hole - about 6 inches deep and, 3 inches across -- at a slant just behind the trap. Place meat or fish in the hole. Be sure the trap chain is securely wired to a stake or a drag.

The "cubby" set is especially useful in winter because it protects the traps, but it may be employed at any season. Make a triangular "house" with large sticks or small logs about 1 foot high and. 2 feet deep. Cover the top with boughs or sticks and, leaves. Hide the trap just inside the open end and place the bait behind, it. A cubby set may also be made with two open ends, with a trap in each end and, bait in the middle. Place the set close to raccoon trails. The use of a drag, instead, of a stake, is desirable so the cubby set will not be destroyed by a trapped animal. A live trap or box trap is an almost identical substitute for a cubby trap set.

"Water" sets are popular in many places, particularly in marshy areas and. along streams. The main advantage of a water set is that it is easy to make one which does not arouse the suspicions of a raccoon. Place the trap 2 or 3 inches beneath the surface, either in a riffle or similar shallow place, or 5 to 6 inches from shore, or at the entrance to a water cubby. Cover the jaws and trap chain lightly with fine silt -- do not use bait. Attach a bright shiny object (such

as a piece of aluminum foil, tin, or a bright button) to the pan of the trap. The raccoon's curiosity causes him to investigate the shiny object on the trap pan. Such a lure can also be used on land sets near raccoon trails.

Ordinary fencing will not keep raccoons from gardens or poultry ranges - if they can't go under it or through it, they will climb over it. However, you can keep out raccoons -- and most other small predators - by adding a single wire strand, electrified by a commercial fence charger, to your fence. This wire should be 8 inches out from the fence and 8 inches above the ground.

Burrowing beneath a fence can be prevented by burying a 2-foot wire mesh so as to extend 6 inches below the surface and 18 inches outward at that depth.

Electric lights, kerosene lanterns, flares, and various noise-making devices such as carbide exploders and radios have been used in an attempt to keep raccoons from damaging crops. Frequently, changing the type of device and the location is helpful, but the overall effectiveness of any of the devices is limited.

In areas where raccoons cause extensive damage to crops, they may be controlled by the use of poisoned baits. Hens' eggs or dry corn on the cob treated with strychnine make effective baits. The eggs may be placed in dummy nests and the corn on stakes along trails and feeding areas known to be used, by raccoons. Eggs slightly buried will be readily found. Only fresh eggs should be used.

Strychnine Egg Formula for 100 Eggs

Strychnine Alkaloid,	10 grams
Dye (duPont Oil Yellow No. 91804) or vegetable dye	0.1 gram
Heavy Mineral Oil	39.9 grams

.5 gram of solution per egg (about  
1½ cc). This equals about 0.1 gram  
of strychnine per egg.

Dissolve the dye in mineral oil. Place the strychnine in a mortar and add the oil containing dye slowly, grinding with a pestle until an even slurry is obtained,. Inject \ cc. of solution into each egg with a hypodermic syringe. The egg shell is sealed by painting the hole with flexible collodion, the dried egg albumen or a small piece of toilet tissue. A mixture of 20 grams of honey and 20 grams of water with a food coloring may be substituted for the mineral oil.

Eggs may also be treated by making a hole in the end, of the shell and, inserting 0.1 gram of strychnine alkaloid. This may be mixed in the egg by the use of a small metal wire or rod.

With a red wax crayon or rubber stamp, print the word "POISON" on each egg shell.

Strychnine Corn Formula for 75 Baits

1. Mix 1 ounce strychnine alkaloid., 1 ounce baking soda,  
one-eighth ounce saccharine.
2. Dissolve 1 ounce Argo starch in one-half cup cold, water;  
then add 2<sup>1/2</sup> cups hot water and stir.
3. Mix one-half cup brown karo with No. 1.
4. Boil starch (No. 2) and mix into No. 3.  
Pour in quart jar and label "POISON".

#### PREPARATION OF BAIT:

1. Cut small stakes ( $\frac{3}{8}$ " diameter and 15-20 inches long) pointed at both ends.
2. Cut ear of dry corn into baits 1 to 2 inches long.
3. Impale corn on stake and dip into the strychnine formulation.
4. Cover dipped bait with double or triple layer of wax paper - twist loose ends of paper around stake and, seal with tape.

Wax paper protects baits from washing rains and usually attracts only raccoons.

Place baits along corn trails and. near den trees. This bait is of little value when either sweet corn or field, corn are available.

Consult your State game laws before applying control measures.

#### CONTROL OF SKUNKS

Skunks are usually beneficial to man since they eat many insects and mice. In cooler parts of their range they are valuable as producers of fine fur. Occasionally, however, they live too near houses or develop a taste for poultry. It then becomes necessary to remove the ones causing damage.

Skunks come out at night to seek their food, -- grubs, insects, small rodents, carrion, soft fruits, berries, unripened corn, and mushrooms. They may at times take birds' eggs and, fledglings from nests on or near the ground. Despite their short legs, skunks may travel considerable distances in their nightly forays. Generally, rather than dig a new den, they choose a convenient hole and. enlarge it. A cavity in a rock pile may serve, or space under the floor of

a summer cottage, farmhouse, or outbuilding may be attractive. Often a den is occupied by a number of skunks, and, the penetrating, nauseous odor from such a place is highly objectionable.

Occasionally, skunks kill poultry and destroy eggs. They are not good climbers and, are limited, to poultry roosting on or near the ground, and to eggs in nests near the ground,. A skunk may take a single bird, at a time, but once in the habit, it repeatedly visits the poultry yard. Such a guilty individual should be eliminated,. In some instances, it will be found, that the real culprits are rats, weasels, or even minks, all of which are adept climbers and. kill far more ruthlessly. The skunks' fondness for insects may result in depredations on beehives. They sometimes dig cone-shaped, holes in lawns, golf courses and meadows in search of beetle larvae and. other grubs. Inexperienced, dogs seldom can resist the temptation to investigate the trail of a skunk, but an encounter usually ends disastrously for the dog. The use of neutrolem alpha has been effective in removing the odor from dogs or clothing and. it may also be used, as a general space deodorant. This material may be purchased, from Fritzche Brothers, Inc., 76 - 9th Avenue, New York 11, New York. Vinegar or household chlorine bleach, in weak solution, has also been suggested, for removing skunk odors from dogs or clothing.

PREVENTIVE CONTROL. Rather than destroy skunks needlessly, it is preferable to keep them from establishing themselves where they will become a nuisance. If they are numerous, seal all openings in the foundations of garages, porches, and outbuildings through which any small animal might enter. If they are already beneath buildings, a suggested, procedure for their elimination is to seal off all openings



except a single exit. Sprinkle a flour patch at the entrance and, examine the area after dark. If trail signs indicate the animal has left the den-site, the remaining opening should be closed off immediately.

Skunks living under buildings can often be driven away temporarily by repellents, and after skunks have left, all openings in or under the foundation should be closed promptly with cement, sheet metal, or wire netting. Napthalene or paradichlorobenzene are sometimes satisfactory for this purpose. About a pound of flakes or mothballs should be placed in the den and scattered about it.

Digging in lawns by skunks can be prevented by using soil insecticides to destroy insect grubs and other soil insects. Chlorinated hydrocarbons such as chlordane or dieldrin should be used, for the control of lawn insects as recommended, by your State or Extension Entomologist. When this procedure is used it may take a few weeks to destroy the food supply and thus discourage the skunks from digging. One treatment, however, should prevent digging for several years.

Skunks can easily be excluded from poultry houses by closing all doors and other openings each night. Proper fencing will keep them out of open chicken range. Surround the range with a 3-foot wire-netting fence, set 2 feet above ground and 1 foot below the surface. Bend outwardly at right angles 6 inches of the part below the surface and bury 6 inches deep. When the skunk starts digging down along the vertical wire fence, it will stop when it strikes the horizontal flange.

REDUCTIONAL CONTROL. Skunks can be caught with No. 1 or No. 1% steel traps set at the entrances to their dens. They are frequently taken in unbaited traps, but with better success if the head of a fowl or a dead, mouse is used, as a bait or if a fetid scent is used, to attract them. The stake to which the trap is fastened should, be placed the full length of the chain from the den entrance; this enables the trapper to kill his catch with as little unpleasantness as possible. An alternate method is to fasten the chain to a long slender pole. This will enable the trapper to pick up the pole and. remove the skunk a distance from dwellings where it can be shot or drowned. Skunks rarely emit their scent when their feet are off the ground.. When a den is used, by more than one animal, time may be saved, by setting several traps near the entrance. Skunks may be caught in any simple trail-set, particularly if bait or scent is used. They are often caught in baited traps set for foxes.

In places where their scent would, be objectionable, use baited box or wire-cage traps covered with burlap. Transfer to a distance and release or drown the animal without removing it from the trap. A few tablespoonfuls of carbon disulphide or chloroform poured, through a hole in a tight box trap will kill the animal painlessly. Shooting is also effective, but requires an excellent shot if the scent discharge is to be avoided.

In some areas it may be desirable to control skunks by the use of poisons or gasses. Strychnine alkaloid, is the preferred, poison. Eggs make an effective bait and. although they are not generally attractive to dogs and cats, care should be taken in making bait

placements. They should be placed in dens, tunnels or other holes used by skunks or along trails where skunks are known to travel.

Strychnine Egg Formula for 100 Eggs

Strychnine Alkaloid	10 grains
Dye (duPont Oil Yellow No. 91804) or vegetable dye	0.1 gram
Heavy Mineral Oil	39.9 grams

.5 gram of solution per egg (about 1% cc). This equals about 0.1 gram of strychnine per egg.

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A mixture of 20 grams of honey and 20 grams of water with a food coloring may be substituted for the mineral oil.

Eggs may also be treated, by making a hole in the end of the shell and inserting 0.1 gram of strychnine alkaloid. This may be mixed in the egg by the use of a small metal wire or rod.

With a red wax crayon or rubber stamp, print the word "POISON" on each egg shell.

An effective method for gassing skunks is to place 1 heaping table-spoonful of calcium cyanide (dust or granules) on a small dry board, spreading the material so that it will be rapidly converted into gas and place the board a little way inside the mouth of a burrow. Do not

plug up the burrow opening. If the ground, is not damp, cyanide may be placed directly on the ground down in the burrow with a long-handled, spoon. As the calcium cyanide absorbs moisture from the air or soil, a highly toxic hydrocyanic acid gas is liberated. Avoid contact with the material and do not breathe the gas. This material should be used with extreme caution and preferably on a day without wind,. Follow printed instructions.

PROTECTIVE LAWS. Many States protect skunks during the greater part of the year but permit an open season when the fur is prime. If skunks are injurious to property, the owner or occupant can usually obtain a permit to control them. Persons wishing to take skunks should, familiarize themselves with local and. State ordinances. Local game wardens or the State Game Department will furnish this information.

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