TOURISM, ARTS AND HERITAGE CABINET
KENTUCKY DEPARTMENT OF FISH & WILDLIFE RESOURCES

**Steven L. Beshear**
Governor

#1 Sportsman's Lane
Frankfort, Kentucky 40601
Phone (502) 564-3400
1-800-858-1549
Fax (502) 564-0506
*fw.ky.gov*

**Bob Stewart**
Secretary

**Gregory K. Johnson**
Commissioner

Dear Prospective Commercial Nuisance Wildlife Control Operator:

Enclosed are materials to help you become a Commercial Nuisance Wildlife Control Operator (NWCO). The annual permit fee is $100.00. Permits are valid from March 1st through the last day of February. Prospective NWCOs are required to successfully pass a written test administered by KDFWR. The test includes 100 multiple choice and True/False questions. Please review the regulations, be familiar with nuisance wildlife problems and solutions, the basic biology of common nuisance species, and wildlife disease concerns.

In addition to the examination, NWCOs who use a gun for nuisance control purposes must provide proof of completion of the Kentucky Hunter Education Program or a course offered by another jurisdiction that meets the course standards set by the International Hunter Education Association. Call 800-858-1549 or check http://fw.ky.gov/ to find out when and where Kentucky Hunter Education classes are available in your area. You must provide a copy of your orange hunter safety certification card, which you can return with your NWCO application or mail to the address below:

Attn: NWCO Permit
# 1 Sportsman's Lane
Frankfort, KY 40601

Please call 800-858-1549 to schedule an appointment to take the NWCO test.

# Commercial Nuisance Wildlife Control Operator (NWCO) Permit Application

| Revised Dec. 2014 | |
|---|---|
| Office Use Only<br>Reviewed by<br>_____<br>Date_____ | Test Y / N<br>Hunt Ed Y / N<br>Report Y / N |

**Fee:** $100.00

**Check one:** ____New Applicant
____Renewal – Prior Permit Number _____

**Applicant Information**

_____
Social Security # (required)

_____
Name of Applicant Title

_____
Business Name (if applicable) FEIN # (if applicable)

_____
Address Zip

_____
Business Phone (required) Home Phone

**Display your business phone number and collecting locality on KDFWR website (circle one)?**
Yes / No

**If yes, collecting locality will show county of your address; Also, show you will work statewide (circle one)?** Yes / No

**Name and SSN of other persons (partners/employees) requesting NWCO authorization under this permit*:**

_____
_____
_____
_____

*Subpermittees must have passed the NWCO exam to receive authorization

**Species or groups of wildlife to be controlled (Check all that apply):**

| | | | | |
|---|---|---|---|---|
| ____Bats | ____Beaver | ____Bobcat | ____Chipmunk | ____Coyote |
| ____Foxes | ____Groundhog | ____Mink | ____Muskrat | ____Opossum |
| ____Otter | ____Rabbit | ____Raccoon | ____Rodents / Moles | ____Skunk |
| ____Snakes | ____Squirrels | ____Weasels | ____Ducks / Geese* | ____Birds* |

- This permit only authorizes the holder to exclude, scare, or herd federally protected birds, other than threatened or endangered species and bald or golden eagles, in accordance with 50 CFR 21.41. Lethal control of federally protected birds requires a permit from the United States Fish & Wildlife Service. This permit does authorize the lethal control of unprotected, exotic birds (e.g. European Starlings, House Sparrows, & Pigeons).

**Do you intend to use a gun in the course of NWCO duties (circle one)?** Yes** / No

I certify that I have passed the Nuisance Wildlife Control Operator Test and have a passing test score on file with KDFWR. **Further, I certify that by indicating my intent to use a gun in the course of NWCO duties, I have provided proof of successful completion of the Kentucky Hunter Education Program or a course offered by another jurisdiction that meets the course standards set by the International Hunter Education Association with this application or have on file with KDFWR.

I, the undersigned, shall indemnify and hold harmless KDFWR and all of its officers, agents, and employees from all suits, actions or claims of any character because of any injuries or damages received by any person, persons, or property resulting from the use of a NWCO permit, to the extent allowed by Kentucky law. No part of this agreement shall constitute, either directly or indirectly, a waiver of sovereign immunity granted under the Kentucky Constitution, Section 231, and the United States Constitution, Eleventh Amendment.

Correct payment must accompany application. Receipt and cashing of payment does not imply approval of permit request.

I certify that I have read and understand the above, 301 KAR 3:120, and that all information contained in this application is correct. I further certify that within the last year I have not been convicted of a violation of KRS Chapter 150 or the administrative regulations promulgated under its authority.

_____ _____
(Signature) (Date)

**Mail completed application and check or money order to: The Kentucky Department of Fish & Wildlife Resources, #1 Sportsman's Lane, Frankfort, KY 40601, ATTN: NWCO Permit**

# ATTN: Medical Personnel

This person works with wildlife and may have been exposed to certain zoonotic diseases not routinely considered in the differential diagnoses of febrile illnesses. In case of sickness in this individual, please consider zoonotic diseases including, but not limited to the following:

**Anthrax, Arbavirus encephalitis, Brucellosis, Giardiasis, Hantavirus, Hendra Virus, Highly Pathogenic Avian Influenza, Histoplasmosis, Leptospirosis, Lyme Disease, Monkeypox, Mycotoxicosis, Nipah Virus, Psittacosis, Q Fever, Rabies, Rocky Mountain Spotted Fever, Salmonella, Sylvatic Plague, Tularemia, Typhus, & West Nile Virus.**

(continued on back)

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**For more information on the occurrence of these diseases in humans, please contact:**
The Centers for Disease Control and Prevention
1600 Clifton Rd.
Atlanta, GA 30333
1-800-232-4636 (1-800-CDC-INFO)
http://www.cdc.gov/

CDC
Centers for Disease Control and Prevention

**For more information on the occurrence of these diseases in wildlife, please contact:**
USGS National Wildlife Health Center
6006 Schroeder Rd.
Madison, WI 53711-6223
(608) 270-2400
http://www.nwhc.usgs.gov/

USGS
science for a changing world

**301 KAR 3:120. Commercial nuisance wildlife control.**

RELATES TO: KRS 150.105, 150.183, 150.275, 150.410
STATUTORY AUTHORITY: KRS 150.025(1), 150.105, 150.275
NECESSITY, FUNCTION AND CONFORMITY: KRS 150.275 authorizes the department to issue permits to qualified persons to take and transport wildlife at any time for commercial nuisance wildlife control, and KRS 150.105 authorizes the commissioner to permit wildlife causing damage to be destroyed or controlled by any means he deems necessary. This administrative regulation establishes the requirements for Commercial Nuisance Wildlife Control permits, and the conditions under which the permits shall be used.

Section 1. Definitions. (1) "Commercial purposes" means taking nuisance wildlife in exchange for payment, barter or trade.
(2) "Federally-protected wildlife" means any wildlife species listed by the U.S. Fish and Wildlife Service as threatened or endangered, and any birds protected under the Migratory Bird Treaty Act and the Bald Eagle Protection Act.
(3) "Nuisance wildlife" means vertebrate wildlife that causes or may cause damage or threat to agriculture, human health or safety, property or natural resources.
(4) "Nuisance Wildlife Control Operator" means the holder of a valid permit, issued by the department, authorizing the taking of nuisance wildlife for commercial purposes.
(5) "NWCO" means a Nuisance Wildlife Control Operator.
(6) "Permit" means the Nuisance Wildlife Control Operator's permit issued pursuant to this administrative regulation.
(7) "Rural area" means an area of the state not included within the boundaries of an incorporated or unincorporated city, village or borough having a population in excess of 1,500 inhabitants.

Section 2. NWCO Permit. (1) A person shall apply for a Nuisance Wildlife Control Operator permit on a form provided by the department.
(2) The department shall not grant a permit to a person:
(a) Less than eighteen (18) years old;
(b) Who has been convicted of a violation of KRS Chapter 150 or the administrative regulations promulgated under its authority within one (1) year of the date of application; or
(c) Who fails to achieve a score of seventy (70) percent or better on an examination administered by the department.
(3) Nothing in this subsection shall prohibit persons under eighteen (18) years old from assisting a NWCO.
(4) A person may appeal the denial of a permit for a violation of KRS Chapter 150 or the administrative regulations adopted under its authority by following the procedures established in Section 7 of this administrative regulation.
(5) A NWCO shall have his or her permit in his or her possession at all times when taking or transporting wildlife.
(6) The permit shall be valid from March 1 through the last day of February.

Section 3. Reporting Requirements.(1) An operator shall file an annual activity report with the department between March 1 and March 30 of each year.
(2) The annual activity report shall be filed:
(a) On a form:
1. Provided by the department, or
2. Photocopied from the department form.
(b) The form shall contain the following information regarding the activity for the period from March 1 of the previous year through the last day of February of the current year.
(3) The department shall not renew the permit of an operator who does not:
(a) Submit the annual activity report as required by this section; or
(b) Does not provide the information required by the annual activity report form.
(4) Report documents shall be made available to KDFWR Wildlife and Boating Officers or Division of Wildlife staff upon request and reasonable notice.

Section 4. Restrictions on Taking Wildlife. (1) A NWCO shall not:
(a) Take federally-protected wildlife unless he has a valid permit issued by the U. S. Fish and Wildlife Service;
(b) Take the following species unless authorized by the commissioner:
1. Copperbelly water snake (Nerodia erythrogaster neglecta);
2. White-tail deer (Odocoileus virginianus);
3. Elk (Cervus canadensis);
4. Black bear (Ursus americanus); or
5. Wild turkey (Meleagris gallopavo); or
(c) Use lethal capture methods to take bats.
(2) A NWCO may take other nuisance wildlife year round using lethal or nonlethal capture methods, provided he has written or oral authorization from the person requesting control.

Section 5. Methods of taking nuisance wildlife. (1) A NWCO using traps shall adhere to the provisions of:
(a) KRS 150.410; and
(b) Section 10(2)(b) of 301 KAR 2:251.
(2) A NWCO using a gun shall provide proof of completion of the Kentucky Hunter Education Program or a course offered by another jurisdiction that meets the course standards set by the International Hunter Education Association.

Section 6. Disposal of captured animals. (1) Unless the permit specifies that certain species shall be euthanized, an operator may euthanize or release captured wildlife.
(2) Methods of euthanizing wildlife shall include:
(a) Captive bolt, gunshot, drowning (only for animals trapped in water sets), cervical dislocation and thoracic compression (for small mammals and birds), and mechanical stunning (stunning shall be followed immediately by a method that ensures death);
(b) Inhalants, including halothane, isoflurane, carbon monoxide, and carbon dioxide;
(c) Noninhalants including Secobarbital/dibucaine; and
(d) Commercially-available agents for striped skunks, in accordance with manufacturer's specifications.
(3) The department may, upon issuing a permit, specify that certain species shall be euthanized.
(a) The requirement that a species be euthanized may apply statewide or to certain geographical regions.
(b) If the requirement that a species be euthanized is made to apply:
1. Statewide, all permits issued in that permit year shall contain the same specification; or
2. To a limited geographical area, all permits issued in that area shall contain the same specification.
(4) A NWCO shall:

(a) Euthanize wildlife that shows obvious symptoms of disease or injury.
(b) Transport wildlife for release in a safe manner that minimizes stress to the animal.
(c) Not release wildlife:
1. Except in a rural habitat suitable for the particular species; and
2. Without the written permission of:
a. The private landowner of at least 100 contiguous acres;
b. The private landowners of contiguous properties totaling at least 100 acres; or
c. The agency responsible for management of public land totaling at least 300 acres; or
(d) Dispose of all wildlife carcasses by:
1. Complete incineration of the entire carcass and all of its parts and products;
2. Disposition of the carcass in a contained landfill approved pursuant to KRS Chapter 224;
3. Burying the carcass and all its parts and products in the earth at a point which is never covered with the overflow of ponds or streams and which is not less than 100 feet distant from any watercourse, sinkhole, well, spring, public highway, residence, or stable. The carcass shall be placed in an opening in the earth at least one (1) foot deep and covered with one (1) foot of earth.
4. Removal of the carcass by a duly-licensed rendering establishment; or
5. Any other proven method of disposal with the prior approval of the department.
(e) Not hold wildlife for more than forty-eight (48) hours except as otherwise provided by administrative regulations promulgated by the department.
(5) A permitted NWCO wishing to sell the pelts of furbearers taken during the statewide furbearer hunting and trapping season shall also possess a valid trapping license or hunting license.

Section 7. Permit revocation, appeal process. (1) The department may revoke without refund the permit of a nuisance wildlife control operator who:
(a) Is convicted of a violation of a federal fish and wildlife law, a Kentucky fish and wildlife law, including KRS Chapter 150 or Title 301 KAR, or another state's fish and wildlife law; or
(b) Knowingly provides false information on:
1. The application for a permit, or
2. The Annual Activity Report.
(2) An individual whose permit has been revoked shall be ineligible to apply for another Nuisance Wildlife Control Operator Permit or be an assistant on another Nuisance Wildlife Control Operator Permit for a period of three (3) years.
(3) An individual whose permit has been denied or revoked may request an administrative hearing pursuant to KRS Chapter 13B.

Section 8. Items incorporated by reference. (1) The following material is incorporated by reference:
(a) "NWCO Application," edition August 2004; and
(b) "NWCO Annual Activity Report Form," edition August 2004;
(2) The material may be inspected, copied, or obtained subject to applicable copyright law, at the Kentucky Department of Fish and Wildlife Resources, #1 Game Farm Road, Frankfort, Kentucky, Monday through Friday from 8 a.m. to 4:30 p.m. (31 Ky.R. 892; Am. 1293; 1405; eff. 3-3-2005.)

**301 KAR 2:251. Hunting and trapping seasons and limits for furbearers.**

RELATES TO: KRS 150.170, 150.180, 150.370, 150.399, 150.415, 150.416, 150.990, 150.995
STATUTORY AUTHORITY: KRS 150.025(1), 150.175(7), (9), 150.360, 150.400, 150.410
NECESSITY, FUNCTION, AND CONFORMITY: KRS 150.025(1) authorizes the department to promulgate administrative regulations to establish open seasons for the taking of wildlife, to regulate bag limits and methods of take, and to make these requirements apply to a limited area. KRS 150.175(7), (9) authorizes the department to issue licenses, permits, and tags for hunting and trapping. KRS 150.410 authorizes the department to regulate trap tags, trap visitation, and trap placement to protect domestic animals. KRS 150.360 requires restrictions on the taking of wildlife and authorizes the department to promulgate administrative regulations establishing the requirements for hunting coyotes at night. This administrative regulation establishes seasons, bag limits, and legal methods for hunting and trapping furbearers.

Section 1. Definitions. (1) "Body-gripping trap" means a commercially manufactured spring-loaded trap designed to kill the animal upon capture.
(2) "Dry land set" means a trap that is not set to submerge an animal in water upon capture.
(3) "Foothold trap" means a commercially manufactured spring-loaded trap with smooth, metallic or rubber soft-catch jaws that close upon an animal's foot.
(4) "Furbearer" means mink, muskrat, beaver, raccoon, opossum, gray fox, red fox, least weasel, long-tailed weasel, river otter, bobcat, coyote, or striped skunk.
(5) "Hunter" means a person hunting furbearers with gun, gun and dog, bow and arrow, dog, or by falconry.
(6) "Otter Zone 1" means the following counties: Anderson, Ballard, Bath, Boone, Bourbon, Bracken, Breckinridge, Bullitt, Caldwell, Calloway, Campbell, Carlisle, Carroll, Christian, Crittenden, Daviess, Fayette, Fleming, Franklin, Fulton, Gallatin, Grant, Graves, Grayson, Hancock, Hardin, Harrison, Henderson, Henry, Hickman, Hopkins, Jefferson, Kenton, Larue, Livingston, Lyon, Marshall, Mason, McCracken, McLean, Meade, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owen, Pendleton, Robertson, Rowan, Scott, Shelby, Spencer, Trigg, Trimble, Union, Webster, and Woodford.
(7) "Otter Zone 2" means all Kentucky counties not included in subsection (6) of this section.
(8) "Snare" means a wire, cable, or string with a knot, loop, or a single piece closing device, the deployment of which is or is not spring-assisted, but any spring-assisted device is not for the purpose of applying tension to the closing device.
(9) "Squaller" means a hand-operated, mouth-operated, or electronic call capable of mimicking the vocalizations of furbearers.
(10) "Trap" means a body-gripping trap, box trap, deadfall, foothold trap, snare, or wire cage trap used to catch furbearers.
(11) "Water set" means a trap set to submerge an animal in water upon capture.
(12) "Youth" means a person who has not reached sixteen (16) years of age.

Section 2. Hunting Requirements. (1) Unless exempted by KRS 150.170, a person shall carry proof of purchase of a valid hunting license while hunting furbearers.
(2) Unless established in subsection (10) of this section, a hunter shall only use the weapons established in paragraphs (a) through (f) of this subsection to take furbearers:
(a) Centerfire gun;
(b) Rimfire gun;
(c) Shotgun;
(d) Bow and arrow;
(e) Crossbow; or
(f) An air gun using pellets at least.22 caliber in size.
(3) Furbearers may be taken during daylight hours only, except for the following, which may also be taken after daylight hours:
(a) Coyote;
(b) Opossum; or
(c) Raccoon.
(4) A person shall not take a raccoon or opossum during daylight hours during the modern gun deer season, as established in 301 KAR 2:172.
(5) A hunter in a boat shall not use a light in conjunction with taking a raccoon or opossum.
(6) A person shall not use the following while chasing a raccoon or opossum from noon on March 1 through September 30;
(a) A firearm;
(b) Slingshot;
(c) Tree climber; or
(d) Any device to kill, injure, or force a raccoon or opossum from a tree or den.
(7) A person may use a squaller year-round.
(8) There shall not be a closed season on:
(a) Chasing red and gray foxes during daylight hours for sport and not to kill; or
(b) Chasing raccoons or opossums for sport and not to kill.
(9) A hunter may use a hand or mouth-operated call, electronic call, or any other attracting device during a furbearer hunting season.
(10) A person may take a coyote after daylight hours, with the following restrictions:
(a) A person shall not use artificial light or other means designed to make wildlife visible at night from June 1 through January 31;
(b) Any artificial light or other means designed to make wildlife visible at night shall not be connected to or cast from a mechanized vehicle;
(c) A person shall not use any weapon other than a shotgun; and
(d) A person shall not use a shell with a single projectile.

Section 3. Trapping Methods and Requirements. (1) Unless exempted by KRS 150.170, a person shall carry proof of purchase of a valid trapping license while trapping furbearers.
(2) A person who is trapping with a dry land set shall not:
(a) Set traps closer than ten (10) feet apart; or
(b) Use any trap except for the following:
1. Deadfall;
2. Wire cage or box trap;
3. Foothold trap with a maximum inside jaw spread of six (6) inches measured perpendicular to the hinges;
4. Body-gripping trap with a maximum inside jaw spread of seven and one-half (7.5) inches measured parallel with the trigger; or
5. A snare.
(3) There shall be no restrictions on the size or type of trap used as a water set.
(4) A trap shall not be set in a trail or path commonly used by a human or a domestic animal.
(5) A trapper may use lights from a boat or a vehicle in conjunction with trapping furbearers.

Section 4. Trap Tags. (1) Each trap shall have a metal tag attached to it that clearly shows one (1) of the following:
(a) The name and address of the person setting, using, or maintaining the trap; or
(b) A wildlife identification number issued by the department and the 1-800-25ALERT department hotline phone number.
(2) A person applying for a wildlife identification number shall apply by:
(a) Completing the Wildlife Identification Number for Trap Tags – Application available on the department's Web site at www.fw.ky.gov; or
(b) Calling the department's information center at 1-800-858-1549.
(3) The following information shall be required for a person to apply for a wildlife identification number:
(a) Name;
(b) Current home address;
(c) Social Security number;
(d) Current phone number;
(e) Date of birth; and
(f) Driver's license number, if available.
(4) A person shall:
(a) Not use a trap tag that has an inaccurate or outdated address;
(b) Not use a trap tag that has a wildlife identification number that corresponds to an inaccurate or outdated address or phone number; and
(c) Contact the department to provide updated address and phone number.
(5) A wildlife identification number shall be valid for the life of the holder.

Section 5. Hunting Season Dates. Except as established in 301 KAR 2:049, a person shall not take the following wildlife except during the dates established in this section:
(1) Bobcat: from one-half hour before sunrise on the fourth Saturday in November through the last day of February;
(2) Coyote: year round;
(3) Raccoon and Opossum: October 1 through the last day of February;
(4) All other furbearers except as established in subsection (5) of this section: from one-half hour before sunrise on the third day of the modern gun deer season through the last day of February; or
(5) Furbearers taken by falconry: September 1 through March 30.

Section 6. Trapping Season Dates. Except as established in 301 KAR 2:049, a person shall not take furbearers except from one-half hour before sunrise on the third day of the modern gun deer season through the last day of February.

Section 7. License-Exempt Season for Youth. For seven (7) consecutive days beginning on the Saturday after Christmas, a youth may hunt or trap furbearers without a license, but all other statewide requirements shall apply.

Section 8. Bag Limits. There shall not be a bag limit on furbearers except as established in this section.
(1) A person shall not take more than five (5) bobcats per season, no more than three (3) of which shall be taken with a gun.
(2) A person shall not take more than ten (10) river otters per season in Otter Zone 1.
(3) A person shall not take more than six (6) river otters per season in Otter Zone 2.
(4) The total river otter bag limit per season shall be ten (10) per person, only six (6) of which can be taken from Otter Zone 2.
(5) A falconer hunting within the falconry season, but outside the dates specified in Section 5(3) and (4) of this administrative regulation, shall not take more than two (2) of any furbearer per day.

Section 9. Harvest Recording. (1) Immediately after taking a river otter or bobcat, and before moving the carcass, a person shall record in writing the following information:
(a) The species;
(b) The date;
(c) The county where taken; and
(d) The sex of the animal.
(2) The information listed in subsection (1) of this section shall be recorded on one (1) of the following:
(a) The hunter's log section on the reverse side of a license or permit;
(b) The hunter's log section in the current hunting and trapping guide;
(c) A hunter's log available from any KDSS agent; or
(d) An index card or similar card.
(3) A person shall retain and possess the completed hunter's log while hunting or trapping during the current season.

Section 10. Checking a River Otter or Bobcat. (1) A person who takes a river otter or bobcat shall:
(a) Check each animal by calling the toll free number listed in the current hunting and trapping guide on the day the river otter or bobcat is harvested;
(b) Provide the information requested by the automated check-in system; and
(c) Write the confirmation number provided by the automated check-in system on the hunter's log established in Section 9 of this administrative regulation.
(2) A person who intends to sell the raw fur of a river otter or bobcat to a licensed fur processor, fur buyer, or taxidermist or wishing to export a river otter or bobcat pelt outside the United States shall:
(a) Contact the department and request a Convention on International Trade of Endangered Species of Flora and Fauna (CITES) tag by providing:
1. A valid confirmation number as established in subsection (1) of this section; and
2. A street address where the tag is to be mailed; or
(b) Access the department's Web site at www.fw.ky.gov and complete and submit the CITES tag request form to the department.
(3) A person who intends to transfer to another person a river otter or bobcat that does not have an attached CITES tag shall attach to the carcass a handmade tag that contains the following:
(a) The confirmation number;
(b) The hunter or trapper's name; and
(c) The hunter or trapper's phone number.
(4) A person shall not provide false information while:
(a) Completing the hunter's log;
(b) Checking a river otter or bobcat; or
(c) Creating a handmade carcass tag.

(5) A CITES tag shall be attached to the raw fur, pelt, or unskinned carcass per the instructions provided by the department and remain with the pelt until it is processed or exported outside the United States.

(6) Possession of an unused CITES tag that is issued by the department shall be prohibited.

Section 11. Transporting and Processing a River Otter or Bobcat. (1) A person shall not sell the raw fur of a river otter or bobcat except to a licensed:

(a) Fur buyer;

(b) Fur processor; or

(c) Taxidermist.

(2) A taxidermist, fur buyer, or fur processor shall:

(a) Not accept a river otter or bobcat carcass or any part of a river otter or bobcat without a proper carcass tag or CITES tag established in Section 10 of this administrative regulation; and

(b) Keep the following information from a hunter or trapper:

1. Name;
2. Address;
3. Confirmation number or CITES tag number; and
4. Date received for each river otter or bobcat.

Section 12. Incorporation by Reference. (1) "Wildlife Identification Number for Trap Tags – Application", April 2014, is incorporated by reference.

(2) This material may be inspected, copied, or obtained, subject to applicable copyright law, at the Department of Fish and Wildlife Resources, #1 Sportsman's Lane, Frankfort, Kentucky 40601, Monday through Friday, 8 a.m. to 4:30 p.m. (20 Ky.R. 2928; Am. 3193; eff. 6-2-1994; 21 Ky.R. 1915; 2478; eff. 4-6-1995; 22 Ky.R. 1491; eff. 4-5-1996; 23 Ky.R. 3879; eff. 7-9-1997; 25 Ky.R. 1435; eff. 2-10-1999; 27 Ky.R. 214; 754; eff. 8-24-2000; 3340; 28 Ky.R. 363; eff. 8-15-2001; 2423; eff. 7-15-02; 29 Ky.R. 2139; eff. 4-11-03; 2964; eff. 8-13-2003; 31 Ky.R. 838; 1077; eff. 1-4-2005; 1717; eff. 6-8-2005; 32 Ky.R. 1765; eff. 6-2-2006; 33 Ky.R. 519; eff. 10-11-2006; 3426; 3604; eff. 6-13-2007; 35 Ky.R. 1008; 1743; eff. 3-6-2009; 36 Ky.R. 865; 1199; eff. 10-23-2009; 37 Ky.R. 797; eff. 11-4-2010; 38 Ky.R. 1661; 1948; eff. 6-7-2012; 39 Ky.R. 2397; 40 Ky.R. 542; eff. 9-5-2013; 2216; 2430; eff. 6-6-2014.)

## 150.105 Destruction or control of animals causing damage.

Notwithstanding any other provisions of this chapter, the commissioner may, with the approval of the commission, authorize conservation officers or any other persons to destroy or bring under control in such manner as he deems necessary any wild animal, fish or wild birds, protected or unprotected which are causing damage to persons, property or other animals, fish or birds or spreading diseases and which in his judgment should be eliminated or controlled to prevent further damage.

**Effective:** May 18, 1956

**History:** Amended 1956 Ky. Acts ch. 115, sec. 8, effective May 18, 1956. -- Amended 1952 Ky. Acts ch. 200, sec. 17. -- Created 1944 Ky. Acts ch. 6, sec. 1.

**150.275 Permit to take and transport wildlife for commercial nuisance wildlife control, scientific, or educational purposes -- Fees to be set by administrative regulation.**

(1) The commissioner may issue to any qualified person a permit to take and transport wildlife at any time for commercial nuisance wildlife control, scientific, or educational purposes; such permits shall be valid at the discretion of the commissioner and shall show upon their face the period of their validity.

(2) The Fish and Wildlife Commission may set fees, by administrative regulation pursuant to KRS Chapter 13A, for the issuance of permits authorized by subsection (1) of this section.

**Effective:** July 14, 1992

**History:** Amended 1992 Ky. Acts ch. 353, sec. 4, effective July 14, 1992. -- Amended 1986 Ky. Acts ch. 265, sec. 11, effective July 15, 1986. -- Amended 1978 Ky. Acts ch. 178, sec. 9, effective June 17, 1978. -- Amended 1952 Ky. Acts ch. 200, sec. 38, effective June 19, 1952. -- Created 1946 Ky. Acts ch. 84, sec. 10.

## 150.399 Traps illegally set or used -- Seizure or treatment as contraband.

Any trap set, used, or maintained in violation of the provisions of KRS 150.400 or 150.410 shall be subject to confiscation as contraband under the provisions of KRS 150.120, except that any trap set, used, or maintained without the tag required by subsection (1) of KRS 150.410 is hereby declared contraband and shall be so treated without any order of court so declaring.

**Effective:** July 14, 1992

**History:** Amended 1992 Ky. Acts ch. 353, sec. 6, effective July 14, 1992. -- Amended 1952 Ky. Acts ch. 200, sec. 53, effective June 19, 1952. - Created 1948 Ky. Acts ch. 52, sec. 3.

**150.400 Traps -- Approval -- Prohibition -- New design.**

(1) No person shall set, use or maintain, for the purpose of taking wildlife, any steel trap unless the size and type of the trap has been approved by the commissioner and the commission by regulation.

(2) The commissioner may approve, by regulation, any commercially manufactured trap which is designed to take wildlife alive and unhurt or to kill instantly.

(3) Subject to the provisions of KRS 150.410 it shall be lawful to use snares, deadfalls, wire cage or box traps, but no person shall set, use or maintain a snare large enough to take deer, elk or bear.

(4) Any manufacturer designing a new trap may send a sample to the commissioner for approval or disapproval.

**Effective:** July 15, 1986

**History:** Amended 1986 Ky. Acts ch. 265, sec. 19, effective July 15, 1986. -- Amended 1960 Ky. Acts ch. 126, sec. 1, effective June 16, 1960. -- Amended 1952 Ky. Acts ch. 200, sec. 54. -- Amended 1948 Ky. Acts ch. 52, sec. 1. -- Amended 1942 Ky. Acts ch. 68, sec. 41. -- Recodified 1942 Ky. Acts ch. 208, sec. 1, effective October 1, 1942, from Ky. Stat. secs. 1954d-62a to 1954d-62c.

**150.410 Tagging of traps -- Visiting trap line -- Protection of domestic animals.**

(1) No person shall set, use, or maintain a trap for the purpose of taking wildlife unless there is attached thereto a metal tag giving either the name and address of, or the wildlife identification number as prescribed in administrative regulation that corresponds to, the person setting, using, or maintaining the trap.

(2) Each person who sets a trap for the purpose of taking wildlife shall visit the same at least once every twenty-four (24) hours and remove any wildlife found therein.

(3) No person shall set a trap in such manner as unreasonably to endanger the life or safety of any domestic animal.

**Effective:** June 25, 2009

**History:** Amended 2009 Ky. Acts ch. 20, sec. 4, effective June 25, 2009. -- Amended 1992 Ky. Acts ch. 353, sec. 7, July 14, 1992. -- Amended 1988 Ky. Acts ch. 365, sec. 11, effective July 15, 1988. -- Amended 1986 Ky. Acts ch. 265, sec. 20, effective July 15, 1986. -- Amended 1952 Ky. Acts ch. 200, sec. 55, effective June 19, 1952 -- Amended 1948 Ky. Acts ch. 52, sec. 2. -- Amended 1942 Ky. Acts ch. 68, sec. 42. -- Recodified 1942 Ky. Acts ch. 208, sec. 1, effective October 1, 1942, from Ky. Stat. sec. 1954d-62.

FOR-13
MANAGING WILDLIFE DAMAGE PROBLEMS IN KENTUCKY: ASSISTANCE, PROCEDURES, POLICIES AND REGULATIONS
ISSUED: 9-83
REVISED: 6-91
Thomas G. Barnes, Extension Wildlife Specialist;
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Thomas Edwards, Kentucky Department of Fish & Wildlife Resources

Introduction
Most wildlife species (defined as undomesticated animals with a backbone, excluding man) are beneficial; however, they can cause problems when they are in the wrong place at the right time. As human populations continue to increase, wildlife-human conflicts are also likely to increase.
Every wildlife-human conflict does not necessarily require control. It is long-term sustained damage that reaches some economic or personal threshold that requires corrective action. Thus, the primary objective of a wildlife damage control program is to alleviate a problem, not destroy wildlife.
Wildlife damage control methods are essentially the opposite of techniques to improve wildfire habitat. Because all wildlife require food, shelter, water and space to survive, wildlife managers try to find out which requirement is in short supply or limiting population growth if they are trying to increase the population. Managers then apply appropriate techniques to provide the limiting requirement, thus increasing population size.
Wildlife damage control seeks to eliminate or make the environment "inhospitable" by moving one or more of the essential requirements, thus reducing the target wildlife population. If this is not possible or practical, alternative actions may be taken after thorough evaluation.
There is no "cookbook" approach to dealing with animal damage problems. Each individual situation must be examined based on a variety of factors, including:
- species of animal causing the damage,
- severity of damage,
- season and duration of damage,
- legal status of the animal,
- biological and ecological considerations and value,
- available types of prevention and control methods (non-lethal and lethal) and
- economic considerations.

When control is appropriate, specific management techniques should be applied at the time, point and place where the animal is most vulnerable.
The best type of program to solve wildlife damage problems is based on the following principles:
1.In most cases it is biologically impossible to control the entire population. In addition, most damage is caused by a relatively few individuals, not the entire population. One exception is when roosting or feeding activities of some bird species conflict with human interests. In these special cases, hundreds or thousands of individuals may be involved, and special control measures are necessary.
2.When the individual animal(s) causing the problem are removed, the damage will cease. However, damage may be caused by another individual if the habitat or original attractant remains.
3.The people who experience the problem are in the best position to locate the individual animal and reduce losses promptly. In some cases, especially those involving bird roosts with hundreds or thousands of birds, the problem may be beyond the scope of the individual to resolve, and professional assistance may be necessary to solve the problem.

The first step in solving a wildlife damage problem is correct identification of the species involved. This is important because any one technique is not appropriate for all wildlife species. For example, controlling coyote damage may require trapping or snaring, while a pesticide may be more appropriate



for commensal rodent (house mice, black rats, Norway rats) control or large bird roosts creating a public health hazard.

Preventive Measures
Many wildlife damage problems can be solved by applying preventive measures, such as habitat modification, barrier control or repellents. Preventive measures, the preferred methods in most cases, are most effective when damage can be predicted well in advance. Examples of preventive measures include erecting a fence to keep out coyotes or other predators or sealing off entrances into a building where hats, birds or snakes could enter.
After the initial damage assessment. the first step in managing a wildlife damage problem is to examine the food, shelter, water and space needs of the wildlife species causing the damage. Can the habitat be altered to make it less hospitable? Can the source of food, shelter or water be removed? Habitat modification generally produces long-lasting control.
If the habitat cannot be modified, can an effective barrier be placed to keep the animal from the site of damage? Effective barriers may include fences, hardware cloth, heavy sheet metal or individual tree guard tubes.
Other methods of keeping animals away from the site of damage may include using a visual, auditory or chemical repellent Visual repellents may include aluminum pie fins or foil hanging in the breeze, balloons or brightly colored plastic. Auditory repellents include any device which produces a loud noise, such as bird rockets, propane cannons or a radio playing loud music.
Chemical repellents are classified as area repellents if they produce a foul smell to keep animals away or contact repellents if the repellent produces a bad taste in the animal's mouth after chewing on the substance or produces an adverse behavioral reaction signaling other animals to move away.

Removal
The next step in managing a wildlife problem is to remove the offending animal using safe and effective methods. Various traps or snares are available which can catch animals safely and humanely. Shooting is effective in moving individual animals in rural areas. Remember, unless you are somehow exempt, you must have a valid Kentucky hunting license to shoot a firearm in the state during any season of the year.
If all else fails, a pesticide registered for that particular wildlife species can be used. Private individuals must be trained and certified in order to buy and use Restricted Use Pesticides. This training is available at your county Extension office.

Repair
After the problem has been remedied and the individual offending animal(s) removed, be sure to repair any damage to buildings or other structures. Seal all entrances where hats, birds or snakes could enter a building. These actions prevent further damage. If preventive techniques are not used, the features that attracted the animal still remain, with the possibility of another animal moving in and continuing to damage your property.

Sources of Assistance
A variety of programs and agencies provide assistance or information on managing wildlife damage problems.
**The Kentucky Cooperative Extension Service** provides a wide range of information on prevention and control of wildlife damage. County agents and specialists receive up-to-date training on handling a variety of wildlife damage situations.
Publications are available for many of Kentucky's wildlife problems, including coyotes, moles, deer, chipmunks, rabbits, native mice, bats, snakes and woodpeckers. These publications provide details on life histories and methods for recognizing, preventing and controlling damage. Contact your local Cooperative Extension Service office, located in every Kentucky county, for more information.

**The United States Department of Agriculture, Animal and Plant Health Inspection Service, Animal Damage Control (USDA / APHIS / ADC)** is the agency that provides most of the on-site assistance with bird damage control in Kentucky. APHIS is responsible for all major migratory bird problems, waterfowl including Canada geese and some resident nongame and non-furbearing animal problems. APHIS personnel also provide information and advice to people who have other wildlife damage problems.

Field representatives of APHIS responsible for Kentucky are located in Louisville. Other field representatives who may work in Kentucky are located in eastern, central and western Tennessee. People who have wildlife damage problems (including those from beaver) within a county which has a cooperative agreement may be eligible for on-site assistance from APHIS personnel. Contact the USDA/APHIS/ADC office in Louisville for more information.

The primary responsibility of the **Kentucky Department of Fish and Wildlife Resources (KDFWR)** is to manage and preserve wildlife and their habitat in the state. The KDFWR provides information and advice on managing wildlife populations and preventing damage from resident wildlife species, including white-tailed deer, coyote and beaver. The KDFWR also issues permits to kill nuisance animals when other appropriate control methods fail.

Some **commercial pest control operators** may assist people in urban areas with managing problem wildlife species. Many pest control operators will handle problems with Norway and black rats, house mice, pigeons, starlings, house sparrows, raccoons and squirrels for a fee. These companies are listed in your local telephone directory.

Commercial pest control operators must obtain a license from KDFWR for controlling vertebrate wildlife populations. This permit, along with appropriate certification and licensing through the Division of Pesticides in the Kentucky Department of Agriculture, allows the use of any chemical or device approved by the Environmental Protection Agency and the Kentucky Department of Agriculture for controlling wildlife damage.

**Other sources of information and assistance** include the Kentucky Department of Agriculture and the Health Department. The Kentucky Department of Agriculture is responsible for consultation and technical assistance with controlling late spring, summer and early fall small (one or two trees) residential blackbird and starling roosts.

Larger bird-roosting problems must be referred to the USDA/APHIS/ADC office in Louisville. The Health Department is responsible for problems associated with commensal rodents and situations involving public health nuisances.

Laws and Regulations

Wildlife is a public-owned resource protected by federal and state laws. Before beginning any wildfire damage control program, you should determine the legal status of the animal, because laws will influence which wildfire damage control techniques can be used. The KDFWR and the U.S. Fish and Wildfire Service are responsible for laws related to wildlife protection, management and animal damage control.

Federal Agency Regulations

The U.S. Fish and Wildlife Service is responsible for enforcing the Endangered Species Act of 1973 (as amended), the Fish and Wildlife Act of 1956 (as amended) and the Migratory Bird Treaty Act of 1918 (as amended). Because of these laws, it is illegal to kill, destroy or harm any endangered or threatened wildlife species or any migratory bird except the feral pigeon, European staffing and English sparrow. A federal permit must be obtained before any federally protected migratory species may be taken, possessed or transported. This includes whole birds, any bird part, eggs or nest. This permit is not required only when the following conditions are present under the provisions of the Migratory Bird Treaty Act:

"Yellow-headed, bi-colored and tri-colored, red-winged, rusty and Brewer's blackbirds, cowbirds, all grackles, crows and magpies when committing or about to commit depredation upon ornamental or



shade trees, agricultural crops, livestock or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance."

Federal permit application form requests and a $25.00 processing fee should be made to:
U.S. Fish and Wildlife Service
Law Enforcement Permit Office
P.O. Box 4839
Atlanta, GA 30302
Telephone (404) 331-3555

State Regulations

The following Kentucky Fish and Wildlife Statutes (or laws) are related to wildlife damage control:

**150.105. DESTRUCTION OR CONTROL OF ANIMALS CAUSING DAMAGE.**
Notwithstanding any other provisions of this chapter, the commissioner may, with the approval of the commission, authorize conservation officers or any other persons to destroy or bring under control in such mariner as he deems necessary any wild animals, fish or wild birds, protected and unprotected, which are causing damage to persons, property or other animals, fish or birds, or spreading diseases, and which in his judgment should be eliminated or controlled to prevent further damage.

**150.170 [illegible]. KILLING OF ANIMALS CAUSING DAMAGE.**
Resident landowners, their spouses or dependent children who kill or trap on their lands any wildlife causing damage to such lands or personal property situated thereon, shall not be required to have a hunting or trapping license. Tenants or their dependent children residing upon said lands shall also have the same privilege. Upon destruction of any wildlife by the above-specified individuals, such act must be reported to the department or the resident conservation officer for the proper disposition of the carcass.

**150.320. BIRDS NOT PROTECTED-NESTS AND EGGS.**
(1)No person shall take any wild bird except game birds or live raptors for which there is an open season, either under the laws of Kentucky and the regulations of the department or the laws of the United States, except those birds mentioned in subsection (2) of this section.
(2)This chapter does not protect or in any way limit the taking of the crow, the starling or the English sparrow, but any persons taking any of them must have a hunting license.
(3)No person shall take, disturb or destroy the nest or eggs of any wild birds except for raptors as prescribed by regulation.

**150.365. FIRE, EXPLOSIVES, ELECTRIC DEVICES, GAS, SMOKE TO TAKE WILDLIFE PROHIBITED.**
No wildlife may be taken as the result of a fire or any type of explosives or with the aid of any mechanical, electric or hand-operated sonic recording devices, except as specified by regulation. No persons shall use smoke or gas or in any other way molest or destroy the den, hole or nest of any wildlife, nor shall any person burn a field for the purpose of driving game, except employees or agents of the department in carrying out investational,research or improvement projects.

**150.400. TRAPS-APPROVAL-PROHIBITION-NEW DESIGN.**
(1)No person shall set, use, or maintain, for the purpose of taking wildlife, any steel trap unless the size and type of the trap hav been approved by the commissioner and the commission by regulation.
(2)The commissioner may approve, by regulation, any commerically manufactured trap which is designed to take wildlife alive and unhurt or to kill instantly.
(3)Subject to the provisions of KRS 150.410, it shall be lawful to use snares, deadfalls, wire cage or box traps, but no person shall set, use or maintain a snare large enough to take deer, elk, or bear.
(4)Any manufacturer designing a new trap may send a sample to the commissioner for approval or disapproval

**150.410. TAGGING OF TRAPS-VISITING TRAP LINE-PROTECTION OF DOMESTIC ANIMALS.**

(1)No persons shal set, use or maintain a trap for the purpose of taking wildlife unless there is attached thereto a metal tag giving the name and address o fthe person setting, using or maintaining trap. The commission may furnish a tag, at cost, to applicants therefor.

(2)Each person who sets a trap for the purpose of taking wildlife shall visit the same at least once every twenty-four (24) hours and remove any wildlife found therein.

(3)No person shall set a trap in such manner as unreasonably to endanger the life or safety of any domestic animal.

UK COOPERATIVE EXTENSION SERVICE
University of Kentucky -- College of Agriculture

# Wildlife Diseases

Last Updated: February 18, 2008

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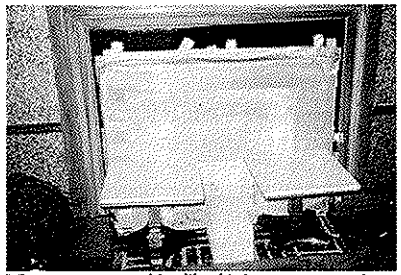
## Section four: What you need to know about wildlife diseases

### How do you catch them and how could you prevent them?

*"I was scratched on the wrist while banding a Canada goose. About a week later, another goose scratched off the scab. It took me a few hours to notice that the open wound was completely covered in goose poop. Our field station was a day's helicopter flight away from the nearest hospital, and I'd forgotten a first-aid kit. So I washed the wound as best I could with snow. The next morning, the entire area was swollen and tender and I had difficulty bending the wrist." [He cleansed the wound with whiskey and recovered fully.]*

*—Arthur Smith, wildlife biologist, SD*



When you see something like this in your customer's home, what crosses your mind? (After "good things they called me.") This exclusion attempt could mean that the nuisance animals entered the living spaces. Ask if any person or pet came into contact with the wild animal. If that's true, consult with the health department. You may need to submit a specimen for a rabies test. That might change your approach to capturing and removing the animal.

Wildlife diseases can be caused by bacteria, viruses, fungi, or parasites. The ones that can be transmitted to people are called "zoonotic diseases" or "zoonoses." There are several different ways you can become infected. Most often, this happens when an infected animal bites or scratches you. Disease agents may enter your body through wounds, or through your eyes, nose, or mouth.

You can also pick up diseases indirectly, when you're bitten by a mosquito, tick, or flea that fed on an infected animal. Mosquitoes spread West Nile virus, ticks spread Lyme disease, and fleas carry plague and typhus.



Some diseases are transmitted through the air, such as hantavirus or histoplasmosis. You can breathe them in, especially while stirring up dust in a confined space. Touching your mouth after you've touched something that's contaminated, or eating infected meat that hasn't been properly cooked, may also cause an infection. This is a significant problem for young children, especially when they're playing outdoors. Their sandboxes, play areas, or toys may become contaminated by the droppings or urine of wildlife. Kids may put soil, wood chips, or droppings into their mouths. Raccoon roundworm is spread this way; the parasite's eggs are found in contaminated soil.

### Prevention

**Hopeless? Helpless? No way.**

So how can you protect yourself, and make sure you don't bring diseases or parasites into your home? Practice good personal hygiene, wear protective gear such as disposable gloves, disinfect your equipment, maintain your rabies and tetanus vaccinations, and use safe animal capturing and handling techniques. Good hygiene and sanitation will also reduce the chance of developing allergies to animals.

Probably the single most important thing you can do to reduce your risk of catching a zoonotic disease is to wash your hands. Ordinary soap and water will do. Wash your hands the way your parents taught you to, thoroughly and often. And always wash your hands before you eat, drink, or smoke.

Another healthy habit is to avoid contact between your hands and your face, eyes, or mouth. Pay attention when you're eating, drinking, smoking, adjusting your glasses, applying cosmetics, taking medication, and when you sneeze.

Keep your gear clean, too. Many of the objects you handle are often fouled by blood, feces, urine, saliva, or body tissues. If your hands or gloves are dirty, it's easy to contaminate doorknobs, car doors, clipboards, telephones, computer keyboards, faucet handles, and many other objects. The nuisance animal may also have made quite a mess; if you don't offer clean-up services, you may want to tell your customers how to deal with it safely.

**After the job...**

At the end of the day, clean and disinfect all of the equipment you used with dilute bleach water (a 10% chlorine bleach solution, which is one part bleach to nine parts water) or a household or commercial disinfectant. Wipe down your truck's seat, steering wheel, and door handles. Some NWCOs keep a quart spray bottle of disinfectant in the truck's cab because bleach solutions don't keep long, so it's better to work with small batches. Just don't mix bleach and ammonia, or use bleach to clean up droppings, which contain ammonia. Use a household or commercial disinfectant instead. Antibacterial wipes may seem even more convenient but they weren't designed to kill parasites, fungi, or viruses. Those agents cause all but one of the diseases discussed later.

Consider the time you spend cleaning as marketing effort because some customers will interpret cleanliness as a sign of professionalism and competence.

**A few wildlife-related safety tips from the CDC that you may want to share with**

**customers:**

- Teach children never to handle unfamiliar animals, wild or domestic, even if they appear friendly. "Love your own, leave other animals alone."
- Enjoy wild animals from afar. Never adopt wild animals or bring them into your home. Do not handle, feed, or unintentionally attract wild animals to your home or yard (see below).
- Don't try to nurse sick animals to health. Do not "rescue" baby birds or other baby animals. They usually don't need it. (Direct questions to a wildlife rehabilitator or DEC Bureau of Wildlife staff.)
- Before traveling abroad, consult with a health care provider, travel clinic, or your health department about the risk of exposure to rabies. They can advise you about whether pre-exposure rabies vaccinations are sensible, and how you should handle an exposure in that country, should it arise.
- These CDC tips focus on disease prevention. As we mentioned earlier, you can take measures to prevent nuisance situations while leaving part of your landscape for wildlife. There are many things to consider when managing land for wildlife, including the risk of exposure to wildlife diseases.

### Medically important or just media hype? (Some health concerns that affect NWCOs)

Overturned trash cans are a nuisance, but is the situation dangerous? Depends on whether the culprit is a bear or a mouse. To use the best practices approach, you need to think like a detective. Imagine if you saw this scene after the bear left. A careless NWCO might blame the problem on a raccoon and suggest ways to make the cans raccoon-proof. Those measures might not slow down a bear. So the problem, and the safety risk, could continue.

Consider this an **introduction** to some health concerns that affect NWCOs. For example, you'll often be cautioned to "wear a proper respirator." That's shorthand to alert you to the need to protect yourself from breathing in microscopic disease agents.

How much do you need to know? You're not a doctor, after all. You don't have to be able to throw around words like "sapro-zoonoses," but you do need to know enough to protect yourself and others, and to answer your customers' questions.

Sometimes our fears about these wildlife diseases are much greater than our actual risks of catching them, or the likely results of an infection. Even for an ethical NWCO who's not trying to sell a job by frightening customers with an overblown assessment of the risk of catching a wildlife disease, it can still be tricky to share the necessary information in the right context.

It's also important to resist jumping to conclusions. For example, distemper can cause symptoms that look like rabies. The only way to be sure is to test.

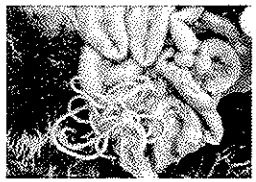
Some of these diseases are **potentially** fatal. That's something your customer will probably want to know—what's the worst case scenario? But the chance of catching most of these diseases is low, and even then, many of them are treatable.

The trick is to have good, complete, and credible information from a trusted source. One extremely valuable source for current and accurate information is the national Centers for Disease Control (CDC). Most of the pages on their website about wildlife-related health issues are written in simple language and get right to the point. The addresses of the websites that focus on each disease are included at the end of each description.



Other good sources for information about wildlife diseases include physicians; veterinarians; medical entomologists; the state's health, wildlife, and agriculture departments; trade magazines; professional organizations; wildlife conferences; books; fact sheets; videos; listserves; and websites. See the NWCO Resources

### Parasites



One last medically-related point: When you remove wildlife from people's homes, it's also important to plan for the parasites that may be left behind. Birds and mammals are host to a variety of parasites including fleas, ticks, mites, lice, and bed bugs. Although these parasites generally prefer their original host species, if you remove those animals, the hungry parasites may enter the home looking for a meal. Many of these parasites will bite people and they can be extremely annoying. (And itchy customers are generally not happy, which isn't good for business.)

These pests may fly or crawl into the home through windows, ventilators, cracks, and crevices. Droppings, feathers, fur, food, and carcasses can also attract other pests such as flies and carpet beetles. This can be a significant problem if animals have died in inaccessible locations, such as in the walls. That can happen when an animal is poisoned, and it's one of the risks of using that management method.

Effective clean-up should remove any parasites present in the home. If a site is badly infested, you should wear protective clothing before entering. Even if you don't offer clean-up services, know how to properly advise your clients. Most states have an "integrated pest management" or "IPM" program, usually associated with the land grant university. (In New York, for example, that's Cornell University's "New York State Integrated Pest Management Program.") These programs offer information about how to deal with many pests, inciuding the ones that fall off wildlife. IPM stresses a combination of practical, economical pest management methods that minimize the risks to people and the environment.

### Zoonotic Diseases

Now, on to the zoonoses. The zoonotic diseases that are potentially fatal for people are listed first. So, for example, we've listed hantavirus before mange, which a NWCO is far more likely to encounter, because hantavirus can become a much more serious health problem. At the tail end are two wildlife diseases that people generally encounter from contact with a "middleman," either a mosquito or tick.

There's a lot of information in this section. The next chart should help you remember the answers to three critical questions: who? what? how? Who's likely to transmit the disease to people. What disease. And how do people catch it.

## How do you protect yourself from wildlife diseases?

**Mammal bites or scratches**

**Precautions:**

- Get rabies pre-exposure vaccine and keep it current
- Wear animal handling gloves
- Use a restraining device such as a catchpole
- Capture animal in trap
- Avoid contact with animal mouth and saliva
- Shower soon after work, every day

**Mosquito or tick bites**

**Precautions:**

- Wear loose-fitting, light-colored clothing (harder to bite and makes it easier to see small ticks)
- Use repellent
- Tuck pant legs into socks (keeps ticks from crawling onto legs)
- Check yourself for ticks at lunchtime; remove any you find

**Breathe it in**

**Risks include:**

- Histoplasmosis
- Hantavirus
- Canine distemper? (not definitively established)

**Precautions:**

- Wear a proper respirator, disposable clothing, goggles, gloves, and hood
- Ventilate area, if possible
- Dampen contaminated materials, wipe up with wet sponge
- Spray contaminated area or dead animals with disinfectant
- If possible, schedule job for cool, damp weather

**Dirty* hands touch mouth, eyes, or nose**

**Risks include:**

- Raccoon roundworm (mouth)
- Toxoplasmosis (mouth)
- Rabies (infected saliva gets into mouth, eyes, or nose)
- Hantavirus (mouth, eyes, or nose)

**Precautions:**

- Wear a proper respirator, disposable clothing, rubber gloves
- Wash your hands thoroughly with soap and water, especially before eating, drinking, or smoking
- Avoid contact between your hands and your face. Pay attention when you sneeze, eat, drink, smoke, adjust glasses or put in contacts, or take medication.

Dirty means that the hand, glove, or object is contaminated with whatever causes that disease, such as a virus, bacterium, or a parasite's eggs. These agents are often microscopic.



**Disease gets into wound**

**Risks include:**

- Rabies
- Hantavirus

**Precautions:**

- Protect wounds with bandages, if practical
- Wear gloves or clothing that covers wound
- Check wounds and keep them clean

**Eat contaminated food or put dirty object into mouth**

**Risks include:**

- Raccoon roundworm (dirty object)
- Toxoplasmosis (contaminated meat or dirty object)
- Hantavirus (may be possible via contaminated food or water)

**Precautions:**

- Wash your hands thoroughly after outdoor activities and especially before eating, drinking, or smoking

See advice for customers on pgs. 4-19, 4-20, and 4-24

**Handle infected animal or contaminated equipment**

**Risks include:**

- Mange

**Precautions:**

- Wear gloves
- Minimize contact with mangy animal by using restraining devices
- Minimize contact with contaminated clothing, equipment
- Dry clothing at high heat to kill any mites on it

## Common Diseases Spread by Nuisance Wildlife

- Disease: Histoplasmosis
- Disease: Rabies
- Disease: Toxoplasmosis
- Disease: Hantavirus
- Disease: Mange
- Disease: Distemper
- Disease: West Nile Encephalitis
- Disease: Ancylostomiasis

- Disease: Aspergillosis
- Disease: Babesiosis
- Disease: Botulism
- Disease: Campylobacteriosis
- Disease: Cat scratch disease
- Disease: Cryptococcosis
- Disease: Cryptosporidiosis
- Disease: Dermatomycosis
- Disease: Encephalitis
- Disease: Ehrlichiosis
- Disease: Giardiasis
- Disease: Hantavirus Pulmonary Syndrome
- Disease: Leptospirosis
- Disease: Lyme Disease
- Disease: Lymphocytic-choriomeningitis
- Disease: Psittacosis
- Disease: Q (query) fever
- Disease: Raccoon Roundworm
- Disease: Rickettsial pox
- Disease: Salmonellosis
- Disease: Schistosomiasis
- Disease: Sporothrichosis
- Disease: Toxocariasis
- Disease: Tularemia
- Disease: Typhus

**Disease name**

- Agent (what causes disease)
- Vectors (animal carriers in the Northeast)
- Route (how people catch the disease)
- Symptoms in people

**Transmission routes (how people catch disease)**

- Fecal-oral: Person touches contaminant and then, with unwashed hands, touches mouth.
- Ingestion: Person eats or drinks contaminated product.
- Inhalation: Person breathes in disease agent.
- Wound/eye/nose/mouth: The contaminant invades a person's wound, eyes, nose, or mouth.

**Next Section Carcass Disposal**

## Handbook Contents





## Disclaimer

**This manual was written as a guide to train nuisance wildlife control operators in New York State. Laws and regulations may differ in your state. Always consult local and state laws before implementing wildlife damage management activities.**

## Contact Information

Contact your local Extension Office

## Resources

Internet Center for Wildlife Damage Management
National Wildlife Control Operator's Association
Wildlife Control

## Acknowledgments

We thank the New York State Department of Environmental Conservation for contributing this information.

Produced by the NYS Department of Environmental Conservation, Cornell Cooperative Extension, and the

NYS Integrated Pest Management Program.
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FOR-51
MANAGING MUSKRAT PROBLEMS IN KENTUCKY
ISSUED: 9-91
REVISED:
Thomas G. Barnes, Department of Forestry

People either love or hate muskrats. If you prize the muskrat's fur, you will probably love the animal. Muskrats are the most valuable furbearing animal in this country in terms of numbers harvested. Muskrats also hold a special place in the scientific and wildlife community because much of our early understanding of wild animal population dynamics was derived using the muskrat as an experimental animal.

Were it not for its name, the muskrat, or "marsh rabbit," would be excellent table fare. These semiaquatic furbearers are clean animals, and their flesh is highly palatable to humans and other wildlife, especially mink.

But if you are a pond owner, farmer or gardener plagued by their burrowing and feeding activities, you are likely to consider the muskrat a pest. The most serious conflicts between humans and muskrats occur when muskrats burrow into the banks of farm ponds, reservoirs and other earthen water-retaining structures. By tunneling into the dam, muskrats may cause a leak that is difficult to plug, resulting in pond drainage.

They can also become a nuisance to farmers and gardeners when they feed on crops or vegetables. Urban homeowners sometimes become terrified of muskrats because they mistake these clean, water-loving, plant-eating rodents for black or Norway rats. This is a common mistake because a muskrat, with its flattened, scaly, sparsely haired taft, resembles a large vole (to which it is closely related). This fear is unwarranted because muskrats are very clean animals and do not carry most of the diseases associated with rats and mice.

## Animal Facts and Biology

Muskrats (Ondatra zibethica) are one of the largest rodents in Kentucky. They are stocky animals with broad heads and short legs. Their pelts consist of soft, thick underfur with long, glossy, dark-red to dusky-brown guard hairs. Their front feet are not webbed. They have four sharp-clawed toes and a small thumb on each front foot. Their large hind feet are partially webbed, with stiff hairs along the toes. Adult muskrats measure 16 to 25 inches in length and weigh between 1 3/4 and 4 pounds. Their tails measure 7 to 11 inches long.

Muskrats get their name from the pair of musk glands located at the base of their tails. These glands are used during the breeding season when musk is secreted on logs or other areas around houses, bank dens or trails on the bank to mark the area.

Muskrats are found throughout Kentucky wherever appropriate habitat is found. Appropriate habitat for muskrats is almost anywhere they can find a year-round supply of food and water. Muskrats spend most of their lives in aquatic habitats, such as ditches, streams, marshes, lakes, beaver ponds, mine pits, farm ponds or any wetland area.

The key component of muskrat habitat is slow-moving or non-flowing water that allows the growth of aquatic vegetation. Ideally, the water should be two to three feet deep. Cattails, bulrush, sedges and arrowhead (excellent for food and construction of houses) should be present around the bank.

Muskrats are vegetarians and relish cattails, bulrush, smartweed, duck potato, horsetail, water lily, sedges, young willow sprouts and pickerel weed. Muskrats will eat almost any aquatic vegetation, including the bulbs, roots, tubers, stems and leaves of numerous wetland plants. They occasionally eat corn, soybeans, grain sorghum and small grains. Muskrats will sometimes eat animals, such as crayfish, mussels, turtles, frogs or fish, during periods of low food supply.

For shelter muskrats use bank burrows, "houses" built of aquatic plants and feeding huts.

Most muskrats in Kentucky live in burrows in the bank of a stream or pond. The entrance to the burrow is usually a four- to six-inch diameter hole located six to eight inches below the surface of the water.



This opens up to a lateral burrow which may be as long as 15 feet. At the end of the burrow is a raised, dry nest chamber.

Some muskrats in Kentucky live in cone-shaped "houses" that measure up to 2 3/4 yards in diameter The height of these houses varies, and each house will have one or two separate raised chambers. Feeding huts are platforms of marsh vegetation where the muskrat brings food to eat. These huts are usually circular and smaller than houses.

Muskrats are prolific breeders and can produce an entire generation in about 30 to 60 days under optimal conditions. In Kentucky, muskrats have three to four young per litter and may have three or more litters a year. Muskrats breed year round in more southerly latitudes, but the breeding season in Kentucky usually runs from March through October, peaking in March through June. Males will mate with as many females as possible, and copulation usually occurs underwater.

After a 28- to 29-day gestation period, 3 to 11 blind, naked and helpless muskrats are born. The young weigh about 3/4 ounces and measure four inches long. After one week, they are covered with a coarse gray-brown fur. Their eyes open when they are 14 to 16 days old.

The kits (young muskrats) are weaned by about the 24th day and fend for themselves by the end of their first month. The mother is ready to give birth again by this time. The first litter may stay in the nest; then the mother adds another nest chamber to accommodate the new litter.

Muskrats are mostly nocturnal and remain active all year. They are not great travellers, and the average home range is no larger than a 200-yard circle in optimal habitat. During the spring or fall and at times of crisis (flooding, drought, food shortages) muskrats can move considerable distances. It is during these crisis periods that muskrats are often seen on roads and travelling through urban subdivisions. At these times it is not uncommon to see a muskrat miles from the nearest source of water.

Muskrats are eaten by a host of predators, including hawks, owls, raccoons, mink, fox, coyote and even largemouth bass and snapping turtles. Muskrats also prey upon other muskrats. During periods of overcrowding, other muskrats may kill entire muskrat litters. During a drought year, when overcrowding problems are magnified, muskrats are particularly susceptible to being eaten by other muskrats and a variety of other wildlife species. Muskrats are also susceptible to such diseases as tularemia and hemorrhagic disease, which can devastate an entire population.

## Preventing & Controlling Muskrat Damage

Nonlethal methods of controlling muskrats exist, but they are expensive and may not be practical for many farm pond owners. If you are experiencing muskrat damage to the point where lethal control is necessary, consider using control methods during the winter. Muskrat pelts are in their best condition at this time of year, and the pelts may be sold to local furbuyers if you possess a valid Kentucky hunting and trapping permit.

Muskrats are considered furbearing animals in Kentucky. An open trapping season is established for the legal harvest of these animals, and they are subject to all applicable state laws and regulations. Consult the Kentucky Department of Fish and Wildlife Resources' trapping digest for information on removal of muskrats during the legal trapping season.

Landowners and tenants who live and work on the property are not required to have a Kentucky hunting and trapping license to remove muskrats that are causing damage to the property. After the animal has been destroyed, you must contact your local conservation officer for disposal of the carcass.

There are no repellents, fumigants or poisons registered for controlling muskrats in Kentucky. The most effective method of removing problem muskrats is trapping.

## Nonlethal Control

The best solution for preventing muskrats from burrowing into dams is to properly construct the dam. Good dam construction should include the following:

1.A dam with an inner face having a slope of 3:1, outer face 2:1, eight feet wide at the top, three feet of freeboard and good grass cover with no grazing by livestock.

2.A spillway to prevent water from rising more than six inches on the dam.

3.Bank stabilization using riprap (large rocks), a 6 -to 12-inch layer of sand or pea gravel or 1 x 2 inch mesh wire laid against the bank. Banks should be stabilized at least two feet above and three feet under the normal surface water level.

Earthen dams can be protected by cutting a narrow trench down the center of the dam and filling it with concrete. The trench should extend three feet below the water and should be filled with concrete to one foot above the normal high-water level. This barrier will prevent muskrats from burrowing completely through the dam and causing a leak.
Contact your local Soil Conservation Service, fish and wildlife district biologist or Extension aquaculture or wildlife specialist for more information on proper pond construction.
Another method of reducing muskrat problems is to remove their habitat or food supply (cattail, burreed, rushes, sedges and arrowhead). Unfortunately, this also decreases cover for a variety of desirable fish and wildlife species.

Lethal Control
The most practical solution to muskrat problems is to remove individual animals. Muskrats can be shot in the early morning or at dusk with a .22 caliber rifle. However, the most effective and practical method of removing problem animals is trapping. Muskrats are among the easiest furbearers to trap.
The most efficient traps used to catch muskrats are the #1 or 1 1/2 steel leg-hold or the size 110 Conibear trap. Conibear traps are recommended because they kill the animal almost instantly. The "quick kill" action of the Conibear trap allows it to be set in shallow or deep water runways. Leg-hold traps must be set near deeper water. This is necessary to prevent escape because muskrats instinctively dive into the water when alarmed. Upon diving, the animals quickly drown.
To find suitable trapping areas, find "runs" along the bank where the muskrats go in and out of the den or out of the water to feed (Figure 2a - 2b). These trails are usually easy to see if the water is clear, or you can feel them underwater with your hands. Place the Conibear or leg-hold trap underwater as close to the den entrance or feeding trail as possible without restricting trap function. Be sure to stake the trap securely. If you are using a leg-hold trap, place it in two to three inches of water and stake it in deep water; otherwise, traps should be placed along the bank if a "quick drown" device is used. When the muskrat is caught, it will dive into deep water. The weight of the trap probably will be enough to drown a muskrat. However, using a "quick drown" device ensures a swift, painless death.
To build a "quick drown" device, securely wrap a piece of strong wire several feet long around a brick. Attach the other end to a stake near the trap site. Toss the brick into the water so the wire is taut. Secure the trap to the wire with an L-shaped piece of iron. This will allow the trap to be pulled down the wire while preventing it from sliding back up (Figure 2c).
Another effective way to trap muskrats in deep water is to construct an artificial feeding station. Trappers have captured as many as three muskrats in a single night per station and as many as 30 in a week using this technique. Cut a piece of plywood into a three-foot square. Attach five pieces of thick styrofoam to the bottom of this platform (Figure 3a, 3b, 3c, 3d). Place a leg-hold trap on each side of the platform, and nail the traps to the underside of the raft close to the center. The raft can be anchored to the shoreline or to the bottom of the pond using a concrete block. Bait the set by nailing an apple, carrot or corn cob to the center of the raft. Be sure to check the traps at least once a day. When you first begin trapping, consider checking the traps twice a day to maximize trapping efficiency.
Remove muskrats only if they are causing a problem because they are a valuable fur resource and an integral part of aquatic ecosystems.

FOR-43
MANAGING RABBIT AND VOLE PROBLEMS IN KENTUCKY ORCHARDS
ISSUED: 5-90
REVISED:
Thomas G. Barnes, Extension Wildlife Specialist

Voles (Microtus spp.) and cottontail rabbits (Sylvilagus floridanus) may cause extensive damage to orchards by girdling seedling and mature trees. The amount and extent of damage will vary, and the best approach is a pest management system that integrates biological, mechanical, and chemical prevention and control techniques.

Animal Facts and Biology

**Voles.**

Often referred to as meadow or field mice, voles are small compact mammals with stocky bodies, small rounded ears, short legs, and a short tail. When fully grown, voles are 4 to 5 inches long. Their long, coarse hair can be blackish, grizzled, or reddish.

The three vole species that damage Kentucky orchard trees are pine voles (Microtus pinetorum), prairie voles (Microtus ochrogaster), and meadow voles (Microtus pennsylvanicus). Identification of individual species is essential because pine vole damage occurs below ground.

Voles eat a variety of grasses and broad-leaved weeds. They will also eat seeds, tubers, bulbs, and rhizomes. Prairie and meadow voles feed on tree bark primarily during the fall and winter. However, pine voles characteristically attack trees of all sizes during all seasons. Most pine vole damage occurs below ground where the animals feed on rootlets and the bark of larger roots.

Voles do not hibernate and are active all year long. They are most active during the day. Areas of activity are small (1/4 acre) and depend on population number, food supply, habitat, and season. A typical vole habitat consists of heavy, dense ground cover where the animals construct many burrows, tunnels, and runways. A single burrow system may contain several adults and young.

Voles breed from January through October in Kentucky and can produce an entirely new generation within about 60 days. Vole numbers fluctuate from year to year; under favorable conditions, populations can increase rapidly. Most orchard problems occur during these periods of rapid population growth. Although voles have a high reproductive rate, they are also a mainstay in the diet of hawks, owls, foxes, coyotes, and other meat-eating animals. In addition, the lifespan of a vole is short, ranging from 2 to 16 months. More than 80% of young voles die in their first month of life.

Rabbits.

Our most abundant and common rabbit is the eastern cottontail. The cottontail rabbit is often grouped with the rodents (mice, squirrels, rats) because of its large, prominent front teeth. However, rabbits have a second, smaller set of teeth directly behind the first set, a characteristic which places them in the group Lagomorphs.

Typical eastern cottontail rabbits weigh between 2 and 4 pounds and are 15 to 19 inches long. Cottontails appear gray to brownish gray with a short tail and big ears. The underside of the tail is white and looks like a cotton ball. Hence the name cottontail.

Rabbits will devour a wide variety of green vegetation. A rabbit's appetite varies considerably with season and locality. During the winter, rabbits appear to prefer the bark of apple trees, black and red raspberries, and blackberries. Clovers, grass, and broad-leaved weeds are a mainstay in summer diets. Cottontails usually prefer to feed at night although they are also active during daylight hours.

Rabbits tend to concentrate in favorable habitats around a brushy fencerow, brush or junk piles, upland thickets, or field edges. Their travels usually do not exceed 10 acres. Population levels are directly linked to the quantity and quality of habitat present.

The lifespan of a cottontail is short (12 to 15 months); however, cottontails have an extremely high reproductive potential. Kentucky cottontails may have 3 to 8 young per litter and up to 4 litters per year.



The first litter usually appears in March.

Fortunately, this high reproductive potential is not reached because cottontails also have a high death rate. Cottontails, like voles, are a mainstay in the diets of most meat-eating animals.

Predation, disease, weather, and encounters with humans contribute to the annual death rate. Up to 35% of the young die within the first month, and 65% of the remaining animals will die over winter.

Damage Identification

Most damage to orchard trees occurs during the winter when other preferred food supplies have dwindled and the animals resort to gnawing on tree bark. Because of the cottontail's high reproductive rate, control is sometimes necessary to reduce damage. However, complete eradication or extermination is not possible, necessary, or even desirable because of the cottontail's status as a preferred game species. Before attempting to prevent or control damage occurring to orchard trees, be sure to correctly identify the culprits responsible because control techniques vary by species. Correct identification is relatively easy based upon evidence at the site of damage.

Girdling and gnaw marks do not necessarily indicate vole damage because cottontail damage can look similar. However, the presence of tracks, droppings, and burrow systems should verify initial observations. Typical vole damage can be differentiated from rabbit damage by the lack of uniformity of gnawing marks and the area of tree damage. Gnawing marks from voles usually occur at or below the surface at various angles and in irregular patches. The gnawed patches are approximately 1/8 inch wide, 3/8 inch long, and 1/16 inch deep.

Rabbits, on the other hand, clip tender young shoots and terminal buds as well as gnawing on the trunk. The gnawing marks are larger and appear as clean, knife-like cuts at a 45-degree angle. Rabbit tracks and round droppings are also quite distinctive.

Prevention and Control

An orchard owner should pursue four general steps when developing a successful integrated pest management system. These include:

1.Correctly identifying the animal species causing the problem.
2.Modifying the habitat to make it less attractive to the problem animals.
3.Using environmentally sound prevention and control techniques appropriate for each individual situation.
4.Monitoring and evaluating the area for signs of reinfestation to determine if the control worked or if additional control is necessary.

The best approach to managing vole and rabbit damage in orchards is to use an integrated system with a variety of techniques. Not all techniques work in every situation, and orchard owners must be willing to use different approaches for their individual problem. Often a combination of techniques produces the best results. Control works best during the winter, reducing next year's breeding population. Habitat modification and exclusion provide the best long-term control for both voles and cottontails.

The various prevention and control techniques may be grouped as (1) biological, (2)mechanical, or (3) chemical. Each technique has advantages and disadvantages depending on management objectives, expense, location, and situation. The options for preventing and controlling voles and cottontails in orchards are discussed below.

Biological Control.

The three types of biological control are habitat modification, population reduction through hunting or trapping, and installation of raptor perches.

Habitat modification is particularly effective in deterring voles and rabbits. Dense, heavy vegetative cover, mulch, and weeds provide optimum habitat for voles and rabbits by providing food and protection from predators. If you remove this food and cover source, the area will provide less suitable habitat. If mulch is used in the orchard, it should be placed no closer than 3 feet to the trees. Vegetation remaining

between rows should be mowed regularly.
Soil tillage is particularly effective because it eliminates any cover, destroys existing burrow systems, and kills a percentage of the vole population. Brush piles, weed patches, junk dumps, and stone piles in or adjacent to the orchard should be removed, thereby eliminating places where rabbits live and hide. This method of control is one of the most effective, long-term solutions in reducing vole and rabbit damage to orchard trees. It has several advantages over other techniques because it is economical, does not place harmful chemicals into the environment, and is a long-term solution to the problem, not a quick fix.
Hunting rabbits in rural areas is a quick, easy, and effective method of control. Cottontails, avidly pursued by hunters, are legal game animals in the Commonwealth of Kentucky. A permit must be obtained from your county conservation officer to destroy cottontails anytime except during the legal hunting season. During hunting season you must have a valid Kentucky hunting license to shoot cottontails.
You must be persistent if hunting is your sole method of control. Removing rabbits in one year does not guarantee rabbit populations will remain low because of the rabbit's high reproductive potential. The best results can be achieved by hunting in the early morning or evening when the rabbits are most active. By permitting hunting, orchard owners provide public access to a public resource while reducing damage problems.
Trapping is not effective in reducing large vole or rabbit populations because time and labor costs are prohibitive. However, small populations can be controlled by trapping. Live trapping is the most effective way to remove cottontail rabbits. There are a variety of commercial live traps available at hardware, agricultural supply and feed stores, or sporting goods stores. Live traps are more effective if you cover them with canvas or some other dark material.
Rabbit traps can be baited with cob corn, oats, or dried apples during the fall and winter. Placing rabbit droppings inside the trap may make it more effective. Place the traps in areas where cottontails have been feeding or resting close to suitable cover. Bait the trap and wire the door open for several days. Once the bait is being taken regularly, remove the wire and set the trap. You must check the traps daily and remove captured animals. If the trap fails to catch any cottontails within a week, move the trap to a different location.
When vole populations are low or concentrated, trapping may be an effective control technique. The simple, wooden snap trap or Sherman live trap is commonly used. Bait the traps with a mixture of peanut butter and oatmeal or dried apples. Trap placement is crucial as voles rarely stray from their usual travel routes. Examine the area for nests, burrows, and runways in the grass or mulch. Place the traps perpendicular to the runway with the trigger end in the runway. Be sure to set enough traps (remember a vole's territory is about 1/4 acre). Fifty to 100 traps should be sufficient in many small orchards. Traps must be checked daily and dead animals removed.
One final biological method of reducing vole and rabbit populations is to install raptor perches. These structures provide hawks, owls, and other birds of prey an elevated "overlook" where they stand waiting to catch small animals. One perch per acre or two, located on higher ground, should be sufficient. While predators alone do not control vole or rabbit numbers, installation of raptor perches may help keep populations low once they have been reduced through alternative techniques.

Mechanical Control.
The most effective mechanical control methods are those which prevent animals from entering the general area (fencing) or preventing individual trees from being clipped. While fencing is the best way to eliminate animal damage, the cost of constructing effective fences is often prohibitive. Examine costs and benefits carefully before investing in this option. Even though fences may seem costly, with proper care they provide relief and protection from damage for many years.
Rabbit- and vole-proof fences are easily constructed of 1-inch mesh netting woven or poultry wire. The fence should stand 30 to 36 inches high. The bottom 6 inches should be turned outward and buried at least 6 inches under the surface. The lower 2 feet of the fence should be covered with a small (1/4 inch)



mesh wire or hardware cloth to prohibit voles from entering. Be sure to keep 6 inches of this below ground to prevent voles from burrowing under it. Inexpensive chicken wire fences can also be constructed to exclude rabbits; however, this fencing will require periodic replacement.
In most situations, protecting individual trees is more practical than excluding animals from the entire orchard. Plastic or 1/4 inch hardware cloth cylinders, 18-24 inches high and 4 inches under the surface, can be placed around individual trees. For adequate protection, these cylinders should be braced away from the trunk to prevent cottontails from pressing them against the tree and gnawing through them. There are a variety of commercial plastic, metal, or nylon tree guard tubes and wrappings available. Contact your local garden center or agricultural supply store for materials available in your area.

Chemical Control.
The two main groups of chemicals used to prevent or control rabbit and voles are repellents and toxicants. Repellents work well in reducing cottontail damage, however, their effectiveness in reducing vole damage has not been demonstrated. There are no toxicants (poisons) registered for use against rabbits, however, toxicants have been a mainstay in controlling vole damage.
Chemical repellents are classified as either contact or area. Contact repellents are applied directly to plants and repel by unpleasant taste, whereas area repellents are applied next to plants and repel by smell alone. Area repellents may be slightly less effective than contact repellents. It is important to recognize that repellents will not eliminate damage. They only reduce the severity of browsing.
Repellents should be applied before damage occurs and must be reapplied frequently after a rain, heavy dew, or new plant growth. Always follow label directions for the repellent you are using. Never apply repellents to any portion of a plant likely to be eaten by humans unless the label permits it.
There are a variety of commercially available chemical repellents on the market today. During the dormant season apply contact repellents when temperatures are above freezing.If you have rabbit problems during the growing season apply a contact repellent at about half the recommended concentration. Commercially available repellents can be found under a variety of trade names, and the active ingredient is usually bone tar oil, thiram, fermented egg solids, or ammonium soaps of fatty acids.

Be imaginative in your approach to using repellents. For example, placing several handfuls of human hair in a mesh bag and allowing it to blow in the breeze may be effective. Some people have successfully used hot pepper sauce to make trees distasteful to animals. You can make your own hot sauce repellent by mixing 1 tablespoon hot sauce in 1 gallon water. Add 2 tablespoons antidesiccant per gallon to allow the repellent to stick to the bark. Spray the foliage and bark when temperatures are above 40 degrees F.
A variety of toxicants is registered for use in controlling vole populations. When using toxicants, take extra precautions to ensure the safety of children, pets, and nontarget animals. Follow product label instructions carefully. Never use a pesticide in a manner inconsistent with its labeling. Failure to comply with directions provided may subject you to severe sanctions and penalties provided by state and/or federal laws.
Toxicants designed to kill voles and mice are called rodenticides. Rodenticides are classified as single-dose or multiple-dose depending on how long it takes the poison to act.
Single-dose (acute) rodenticides require only one feeding to be lethal. Multiple-dose (anticoagulant) rodenticides are slow acting because voles poisoned with anticoagulants die from internal bleeding. Thus, they must be consumed for several consecutive days to be effective. They are probably the safest and most preferred type of rodenticide.
Many types and brands of anticoagulant rodenticides are available on the market today. The most effective and potent contain cholecalciferol, brodifacoum, bromadiolone, chlorophacinone, and coumafuryl.
Because voles must feed on the bait for 3 to 5 days, the bait must be available for an extended period of time. Be sure to place the bait in runways or next to burrows so voles will find it during their normal travels.

One method of keeping bait available in good condition is to establish bait stations. You can purchase commercial bait stations or make your own from 2- to 3-inch diameter plastic pipe.

Many growers place shingles or boards in their orchards during September. They visit these stations during October and inspect them for vole runways beneath the covers. If runways are found, a rodenticide is placed under the boards. Some growers use machines which build artificial trails and dispense rodenticide in these trails.

Zinc phosphide is the most commonly used acute poison. It is a restricted use pesticide. Any person using this pesticide must be certified by EPA or work directly under the supervision of a certified person. Place the bait in runways or next to burrows where voles will find it. To increase the effectiveness of poison grain baits, prebait with good quality grain for 3 to 5 days. The best time to use grain baits is during the winter.

One problem with using zinc phosphide is "bait avoidance or shyness" which occurs when voles eat only enough to make them sick. If this happens, voles will not eat any bait for 6 months or more. To avoid this situation, do not use zinc phosphide more often than every 6 months and always follow label instructions. This rodenticide also comes as a tracking powder or in paraffin blocks.

Trade names are used for simplicity. No endorsement is intended, nor is criticism implied of similar products not named.

FOR-50
MANAGING BEAVER PROBLEMS IN KENTUCKY
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REVISED:
Thomas G. Barnes

Historically, the beaver (Castor canadensis) was North America's most important fur resource. During the 1800s, the unrelenting pursuit and uncontrolled harvest of beavers for their pelts led to extermination throughout much of the animal's range. However, in the early 1900s the beaver received protection. Because of this protection and resulting restoration efforts, including transplanting beaver and changing land management practices, the beaver made a remarkable comeback. Beaver numbers today are at, or exceed, their population levels before the arrival of white settlers in North America.
Beavers sometimes cause problems or become a nuisance when their feeding and dam-building activities conflict with man. This publication provides information on the identification, biology and natural history of beavers and how their feeding and dam-building activities can be prevented or controlled.

Identification
The beaver, fairly common throughout Kentucky, is North America's and Kentucky's largest rodent. It belongs to the family Castoridae. Adult beavers weigh between 35 and 60 pounds, with some reaching weights of 70 to 80 pounds. Adult beavers range in size from 25 to 31 inches from the tip of their nose to the base of their paddle-shaped tail. Beavers typically have large heads, indistinct necks, thick, stout bodies and small ears and eyes.
Perhaps their most recognized feature is a large, flat, hairless tail shaped like a paddle. This six- to eight-inch wide and 10- to 12-inch long tail is used for support when the beaver is on land and as a steering, swimming and communication device when it is in the water.
Beavers are uniquely adapted for life in the water. They have short, stout legs specialized for swimming and working. The large, fully webbed hind feet are adapted for swimming, whereas the small front feet are very dexterous, nimble and not webbed. Beavers use their front feet for digging as well as for holding and manipulating small twigs while they peel the bark off with their teeth.
Other adaptations for an aquatic lifestyle include ears and nostrils with valves that close when the beaver is submerged, eyes that are set high on the head to allow the beaver to see above water when swimming and lips located behind the front teeth that close when a beaver is submerged, allowing it to use its teeth under water.
Like many other rodent species, beavers have a pair of continually growing, large, orange front teeth (incisors). The beaver must keep the incisors worn back by using them daily.
Beaver fur, which was highly sought after and is somewhat in demand today, is comprised of a gray, soft, dense undercoat protected by long, coarse reddish-brown guard hairs. Color can vary from blond to almost pure black. Beavers carefully groom and comb their fur with oil from various glands, using the second claw on each hind foot, which is split lengthwise. Grooming with oil helps keep the beaver from becoming wet at the skin's surface. The beaver also has a pair of scent glands called "castor sacs." These glands produce a substance called castoreum which is used as a chemical signal to other beavers. It is almost impossible to tell the difference between male and female beavers unless the female is lactating and has swollen mammary glands.

Beaver Facts and Biology
The beaver is one of a few mammals, other than man, capable of modifying its habitat to suit its needs. When beavers move into an area, they quickly begin building dams to modify the habitat more to their liking. Once the dam has been built from surrounding timber, the subsequent flooding causes growing timber to die, and other aquatic vegetation begins growing. Often, the new plants growing around the edge of the pond (willows, sweetgum and blackgum) are preferred beaver foods. Thus, good beaver



habitat can be almost anywhere there is a year-round source of water. Appropriate habitat can include streams, rivers, ponds, lakes, large reservoirs, swamps, wetlands and drainage ditches.
Beavers are incredible, highly skilled engineers. They build dams on fast- and slow-moving streams to create a pond with a stable water level. They show unusual skill in selecting dam locations. The dam is usually constructed of sticks, mud and stones and provides the water impoundment for the main lodge.
Home to a beaver is its lodge or bank den, depending on the situation. Lodges are dome-shaped structures built of sticks and mud with a large interior chamber above the water line. Lodges vary in size from 6 to 40 feet, depending on the number of beavers in the colony. Beavers sometimes dig burrows into the banks of ponds, rivers and drainage ditches instead of building a lodge. All lodge and bank den entrances, normally two or more, are located underwater.
Beavers live in family units called colonies, which range in size from two to eight beavers (the average colony size is five to six). A colony consists of the adult pair, the current year's offspring (kits), the previous year's offspring (yearlings) and occasionally a 21/2 year old offspring. Beavers are highly territorial animals, and they actively defend the colony's territory against outsiders by using scent marking. When beavers become sexually mature around age two, they leave their home colony to form a colony of their own.
Beavers mate in January or February. Two to four one-pound kits (similar in appearance to the parents) are born in March or April. Kits grow rapidly, nursing for approximately 60 days, and by six months of age they weigh between eight and ten pounds. Beavers have a relatively long life span for a wild animal. Most beavers do not live beyond ten years of age, although some may live 20 years or more.
"Busy as a beaver" appropriately describes beaver behavior. Primarily a nocturnal animal, beavers are active for approximately 12 hours each night, feeding and working on the dam. It is not uncommon to see beavers during daylight hours, particularly in large reservoirs. Most daily movements are centered around the pond and lodge. Individual movements vary greatly.
The female parent in the colony is relatively sedentary, occupied with caring for young during the spring and summer. Two-year-old beavers may travel five to six miles in search of appropriate habitat conditions necessary for establishing a new territory. Other travels by individual beavers include wanderings by yearlings and adults who have lost their mates.
Beavers feed on the cambium layer (just under the bark) of woody plants and a variety of aquatic and upland vegetation. Preferred woody foods include willow, birch, maple, alder, cherry and poplar, although they can and will feed on the leaves, twigs and bark of most species of woody plants. During the summer beavers will also eat water lilies, pond weeds and cattails. Sometimes beavers will travel substantial distances from the pond or stream to get to corn or soybean fields, where they cut the plant off at ground level and drag it back to the water. What they do not eat, they use for construction material in dams and lodges.

Benefits of Beavers
Beavers are generally considered beneficial in situations where they do not compete with people for the use of the land, water or timber. Harvest of beaver pelts may be a source of income. While fur prices vary from year to year based on fashion trends, a recent survey done by the Kentucky Department of Fish and Wildlife Resources reported that more than 1,500 beaver pelts, valued at more than $20,000, were sold during the 1986-87 trapping season. Beaver ponds also attract a wide variety of other furbearing animals including mink, muskrat and raccoon. The value of these pelts, based on the same survey, was in excess of $1.4 million.
The unique dam- and pond-building attributes of beavers create favorable habitat for a variety of wildlife species, including fish, ducks, shorebirds, amphibians and reptiles. The variety of wildlife attracted to these ponds can be used for recreational, scientific or aesthetic purposes.
Ponds created in beaver dams help stabilize water tables, reduce rapid runoff from heavy rainfall and reduce soil erosion by depositing silt in the pools. Beaver castoreum is used in numerous trapper's lures, perfumes and cosmetics. Finally, beaver meat is excellent table fare if properly prepared.

Damage Assessment

Most beaver damage is relatively easy to identify. Much of tiffs damage is associated with or is a result of dam building, bank burrowing, tree cutting or flooding. Spring and fall are the periods when landowners experience the most severe damage from beavers.

Damage in urban areas includes cutting or girdling of ornamental and shade trees or shrubs. Because beavers are rodents with large sharp incisors, damage to trees appears as clean, knife-like cuts at a 45-degree angle.

In rural areas, beavers may dam drainage ditches and small streams and plug drain pipes or culverts. This can lead to localized flooding of roads, timber lands or agricultural cropland.

A hazard associated with beavers is giardiasis, a disease caused by a protozoan (Giardia lamblia). This pathogenic intestinal parasite can be carried by beavers and transmitted to humans through the local water system. The extent of giardiasis is unknown in Kentucky, although some beavers with the parasite have been found in the state.

Prevention and Control of Beaver Problems

Beavers are classified as furbearing animals in the state of Kentucky. An open trapping season is established for the legal harvesting of these animals, and they are subject to all applicable state laws and regulations. Consult the Kentucky Department of Fish and Wildlife's trapping digest for more information on removal of beavers during the legal trapping season.

If a beaver is damaging your property, you can kill the animal at times other than the legal trapping season. After the animal has been destroyed, you must contact your local conservation officer for disposal of the carcass.

If the beaver pond has been in existence for a considerable period of time (even if it is flooded cropland), the area may be officially classified as a wetland. Under the provisions of the 1985 Food Security Act, Conservation Reserve Provision, it may be illegal to destroy the dam and drain the wetland. Contact the U.S. Army Corps of Engineers in Louisville or your local Agricultural and Soil Conservation Service, Soil Conservation Service or Kentucky Department of Fish and Wildlife Resources office for an on-site visit and recommendation.

Nonlethal Prevention and Control

Individual high-value shade or ornamental trees can be protected from beavers by wrapping them with 1/4- or 1/2-inch hardware cloth to a height of four feet. Small areas around culverts, drains and ponds in urban areas can be fenced using netwire with small mesh wire.

Another method of discouraging beavers is to install a device to manipulate the water level of a pond. This can be accomplished by installing a three-log drain (Figure 3) or wire mesh culvert that the beavers cannot plug. Lowering the water level in the summer encourages wild or planted foods to grow, providing excellent habitat and food for waterfowl.

For more information on constructing water control structures to discourage beavers and enhance waterfowl habitat, contact a Kentucky Department of Fish and Wildlife Resources District biologist or the Cooperative Extension Service.

One innovative way to discourage beavers is the use of a high tensile electric fence (Figure 4). Stake a portable battery or solar-powered charging unit some distance from a run (slide) or a hole knocked into the dam. If you are placing the wire across a slide, mow or trim the vegetation very close to the ground. Finally, string a single strand of wire three inches above the ground or water's surface so the beavers will strike it as they pass through the slide or attempt to repair the hole in the dam. This electric shock acts to repel the animals; if they are shocked enough, they will move to another area.

Daily tearing out dams and removing dam construction materials with dynamite may cause a colony or individual beaver to move. This is very dangerous and not recommended. Even if this procedure is effective, the beavers may move into a new area and become even more troublesome.

Lethal Control



There are no chemical repellents or toxicants (poisons) registered for controlling beavers in Kentucky. The only control method that works well is trapping. The most effective trap is a number 330 Conibear (instant-kill-type) trap. This trap is designed to be placed underwater near a break in the dam, at the lodge entrance, near a slide or on a beaver run (Figure 5a), (Figure 5b), (Figure 5c), (Figure 5d).Trapping should be done by an experienced trapper because these traps exert a tremendous pressure and impact when tripped. Therefore, appropriate care must be taken when setting and placing the trap. The Kentucky Department of Fish and Wildlife Resources, #1 Game Farm Road, Frankfort, KY 40601 provides technical guidance to landowners experiencing beaver problems. If the beaver problem is large in scope or particularly severe, contact USDA-APHIS-ADC, 3231 Ruckriegel Parkway, Louisville, KY 40299 for assistance.

It is against the law in Kentucky to destroy or harm a beaver lodge or den. Contact the Kentucky Department of Fish and Wildlife Resources or USDA-APHIS-ADC in Louisville for technical guidance before destroying dams.

FOR-45
MANAGING TREE SQUIRREL PROBLEMS IN KENTUCKY
ISSUED: 10-90
REVISED:
Thomas G. Barnes

Kentucky has three species of tree squirrels: eastern gray (Sciurus carolinensis), northern fox (Sciurus niger), and flying (Glaucomys volans). Gray and fox squirrels are game species, whereas flying squirrels are not a game species. Because flying squirrels seldom cause problems for homeowners, they are not discussed in this publication.
Fox and gray squirrels often come into conflict with humans when they take up residence in an attic, eaves or walls of a house. Squirrels sometimes cause damage by gnawing and removing bark or fruits from valuable fruit and nut producing trees, ornamental trees and shrubbery or by feeding on corn, tomatoes, strawberries and other seeds or mature fruits in the garden.
Tree squirrels are the number one game animals pursued by Kentucky sportsmen, but they are protected by Kentucky law. You must contact your local conservation officer before attempting any control measures.

## Identification

The eastern gray squirrel is the most common tree squirrel found in Kentucky. These medium-sized rodents have a bushy tail. They are 16 to 20 inches long and weigh 1 to 2 pounds. Gray squirrels vary in color from gray to brownish gray with a white belly. Completely black (melanistic) and white (albino) forms are also encountered occasionally.
The northern fox squirrel is Kentucky's largest tree squirrel. Fox squirrels measure 18 to 27 inches, including their bushy tail, and weigh 1 3/4 to 2 1/4 pounds. Fox squirrels are typically grizzled gray with a touch of yellow or orange upper parts and pale yellow to bright orange underparts. The fox squirrel's tail usually has numerous yellow-tipped hairs, while gray squirrels have white-tipped tail hairs.

## Animal Biology and Facts

Both fox and gray squirrels are common in Kentucky. The favorite haunts of gray squirrels are largely forested habitats dominated by oak and hickory trees and city parks or suburban yards. Fox squirrels like relatively open country with oak, hickory and walnut trees scattered along fence rows or occurring in small groves.
Squirrels require large old trees which produce their favorite foods: acorns, hickory nuts, walnuts and Osage orange fruits. During the spring and summer when nuts are scarce, squirrels eat tree buds, fruits, berries and succulent green plant material. In the fall they are very busy collecting nuts and storing them for future use. Old mature trees are also necessary for nesting because squirrels prefer nesting in tree cavities, leaf-nests high in a tree or man-made den boxes.
Squirrels are active during the day. Most activity occurs in the early morning and late afternoon to early evening. Squirrels do not hibernate and are active year round. During late December through January and June through July, squirrels become very active and noisy as they prepare to mate.
Squirrels typically breed when they are one year old. Three to four blind and naked young are born in March/April and September after a 42- to 45-day gestation period. Newborn squirrels weigh about one-half ounce and open their eyes after about 32 days. Young begin exploring outside the nest when they are weaned at 10 to 12 weeks of age.
Home range and movements of squirrels vary widely. Most activity is concentrated within several acres although squirrels have been reported to range from 1 to 100 acres. One study reported squirrels traveled 50 miles during the fall in search of suitable habitat.
Squirrel populations periodically rise and fall and are intricately linked to the quantity and quality of available habitat. Like most small game species, squirrels have high reproductive and death rates. Normally more than 50% of the squirrels in a population die each year. Squirrels are a favorite food of



many predators, including hawks, owls, snakes, foxes, house cats and dogs. Squirrels are also susceptible to a variety of parasites and diseases, including ticks, mange mites, fleas and internal parasites. Most squirrels in the wild never reach four years old.

## Preventing and Controlling Tree Squirrel Damage

The best long-term solution to managing squirrel problems in the home is to exclude or "build them out" of a building or attic. Because squirrels are rodents and have large front teeth, you must use 1/4 or 1/2-inch hardware cloth or 26 gauge metal when excluding squirrels from buildings. Do not use steel wool or window screening; the squirrels can chew through it.
The best way to eliminate squirrels that have entered a building is to find all their entrances and travel routes. Be sure to look for eave openings, attic vents, loose flashing around chimneys and pipes and openings around cables. Plug all entrances except one, and set a trap at the open entrance (see section on trapping below). Once the squirrels have been eliminated from the building, be sure to repair any damage they caused. Then use the preventive measures outlined below.
To prevent further damage, trim all trees which have limbs within eight feet of the building. Squirrels can be discouraged from climbing trees if you put a band of two-foot-wide sheet metal six feet away from the bottom of the tree. Remove any branches less than six feet from the ground to prevent squirrels from jumping onto them. If the squirrels are gaining access via telephone or electrical wires, put a two-foot section of lightweight 2- to 3-inch diameter plastic pipe over the wire by slitting the pipe lengthwise and placing it over the wire. Be careful not to touch the wire. The pipe will rotate on the wire causing squirrels to tumble.
Squirrels may temporarily vacate an attic and give you enough time to seal entrances if you place mothballs correctly throughout the attic. Use one pound of mothballs per 100 square feet of attic space. Because the mothball vapors are heavier than air, they must be suspended in baseball-size clumps close to the damaged area. Using old pantyhose is an inexpensive, effective way to do this.
One method of controlling and preventing squirrel damage is to reduce the population through shooting or trapping. In rural areas squirrel populations can be reduced effectively by hunting. You must have a valid Kentucky hunting license to shoot squirrels. If you hunt at times other than normal Kentucky hunting seasons, you must contact your local conservation officer before killing any squirrels. Because squirrels are most active during the morning and evening, concentrate your hunting activities during these periods. Many types of firearms are capable of taking squirrels, but a shotgun loaded with #6 shot shells or a .22 caliber rifle is most effective.
A variety of traps can be used to catch squirrels. If you know the squirrels' entry point and you can easily reach it without endangering yourself, place a #110 conibear trap directly over the open entrance. As the animal passes through the opening, it will be killed instantly.
Squirrels can also be captured with live cage traps (Figure 1 ). To be effective, these traps must be pre-baited and wired open for several days before trapping. A variety of baits works well, including peanut butter, walnuts, pecans, apple or orange slices, corn and sunflower seeds. To prevent squirrels from returning, take trapped squirrels at least 5 to 10 miles from the capture site before releasing them. If squirrels are entering an attic where there is space to set a live trap, place the trap immediately behind the opening and catch the squirrel as it enters the building. Do not remove squirrels when young are present.
One box-type of trap has been effective in California. This trap, shown in Figure 2a, Figure 2b and Figure 2c is placed in adjacent trees. A final method of trapping gray squirrels is to use rat-snap traps nailed to a tree or house 15 to 20 feet above ground. The traps should be baited with peanut butter or sweet corn.
No poisons or fumigants are registered for controlling tree squirrels in Kentucky. One method of keeping squirrels from browsing on trees and gnawing on wood is to use a chemical repellent. Repellents do not stop gnawing damage but do reduce the severity of damage. The best repellent is one containing Thiram. Always follow label instructions for using any chemical substance.
Old reports found in the literature suggest repellents containing polybutenes can be used to repel

squirrels. The substance burns the squirrels' feet. The following substances can be sprayed on wood to repel squirrels: ( 1 ) One pound of copper napthenate mixed in 2 1/2 quarts of mineral spirits. (2 ) Three pounds asphalt emulsion and 2 pounds copper carbonate mixed in 2 quarts of water. (3) One teaspoon of Lysol® or 3 ounces epsom salts mixed in 1 gallon of water. Several of these solutions may discolor wood; treat a small area hidden from view first to determine the amount of discoloration.
Be patient and persistent. Wildlife damage problems are rarely solved quickly. Once the squirrel problem has been eliminated, be sure to repair any damage to remove the attractive feature and prevent further damage.

About the Author
Tom Barnes has worked at the University of Kentucky's Department of Forestry for two years as an Extension specialist in wildlife. After working on his master's degree at South Dakota State University, he worked in the state Game, Fish and Wildlife department and at the U.S. Fish and Wildlife Service. He also gained experience in the field while working at U.S.D.A. Animal Damage Control. He has published information on mice, rabbit and vole damage to trees. His Ph.D. from Texas A&M is in wildlife management.

FOR-49

COOPERATIVE EXTENSION SERVICE
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# Managing Skunk Problems in Kentucky

*Thomas G. Barnes*
*Extension Wildlife Specialist*

Because skunks are found almost everywhere throughout Kentucky—in agricultural areas, woodlots, towns and cities—we are all familiar with the unmistakable odor they discharge when provoked. This obnoxious odor causes humans to fear and dislike skunks.

Despite our dislike for them, skunks are, for the most part, beneficial to us because they feed on insect and rodent pests. Occasionally, skunks can cause problems or become a nuisance when their digging activities or feeding habits conflict with humans, or they release their odorous musk in self-defense.

**This publication provides information on:**
- the identification, biology, and natural history of skunks,
- preventing unwanted encounters with these smelly carnivores, and
- controlling individual skunk problems when they occur.

## Identification

Two species of skunks live in Kentucky. The striped skunk (*Mephitis mephitis*) can be found in every county. The spotted skunk (*Spilogale putorius*) is rare and can be found only in the southeastern corner of the state.

Skunks are often referred to as polecats, civet cats, hydrophoby cats, or big striped skunks. The spotted skunk is incorrectly called a civet cat because of its similarity to Old World civets. Skunks are not closely related to either true civets or to cats.

Skunks are members of the weasel family (*Mustelidae*). All members of this family (skunks, river otters, long-tailed weasels, least weasels, and mink) have characteristic musk glands.

Striped skunks are short, stocky mammals about the size of a domestic house cat. They typically have a triangular-shaped head tapering to a blunt nose, a large bushy tail, and large feet equipped with well-developed claws.

Their color pattern is typically characterized by two prominent white stripes down the back in a coat of jet black fur. The amount of white on the back varies tremendously, from just a patch on the head to stripes covering the entire back.

Spotted skunks are about one-half the size of striped skunks and are much more weasel-like. They are readily distinguishable by white spots in front of each ear and on the forehead and four to six broken white stripes on the back. These animals are much more nervous than striped skunks and are better climbers.

Because many of the habits of the two species are similar, skunk biology and natural history will be combined in this publication.

## Skunk Facts and Biology

Skunks can be found in a variety of habitats throughout Kentucky. Favored haunts include rolling hayfields, fencerows, brushland, woodland edges, weedy fields, rocky outcrops, wooded ravines, stone walls, and drainage ditches. Home to a skunk is an underground den that may be found in vacant buildings; under house porches, culverts, brush piles, tree stumps, lumber piles; or in abandoned fox or woodchuck burrows.

The dens are lined with leaves, hay, or grasses. Skunks use a variety of dens for loafing during the day, for giving birth and raising young, and for periods of inactivity during the winter. During the day, skunks usually sleep in the den, although during the warmer months, they may bed in vegetation along fencerows, hayfields, or pastures.

During the winter months, skunks may remain inactive in the den for a period of days or weeks. Skunks do not hibernate but become inactive during cold weather, relying on stored body fat to get them through the winter. Several skunks may share the same den during winter to conserve body heat.

Skunks are nocturnal, becoming active from sunset to slightly after sunrise. Female skunks are not great travelers, whereas male skunks may travel up to four or five miles a night during breeding season. Skunk home ranges normally vary from one to one and a half miles in diameter.



During the breeding season, males move slowly, become active during the day, and are reluctant to flee when endangered. This is the time when skunks are often struck by cars.

The breeding season for skunks in Kentucky begins in late January when males begin searching for females near winter dens. Skunks mate in February, and the blind, wrinkled, thinly furred young are born in May and June. Usually five to nine young kits are born in a litter, but there can be as many as 18 or as few as two.

Young skunks are weaned when they are about two months old. Families break up during August and September when the young leave to find their own homes.

Skunks are opportunistic feeders, feeding on both plant and animal material. Favorite skunk foods are grasshoppers, crickets, beetles, wasps, cutworms, and other insect larvae.

When insects are not available, skunks will eat mice, rats, shrews, moles, chipmunks, and other small mammals. Skunks will also eat reptiles, amphibians, fish, fruits, and garbage. They will occasionally feed on poultry and the eggs of ground-nesting birds.

Most of a skunk's diet consists of small mammals and insects considered injurious to man. Thus, when skunks are not causing a problem, many people believe they should be left alone because, on the whole, they do more good than harm.

## Damage Assessment

Skunks become a problem when they dig under foundations; take up residence under a house, porch, or building; dig in lawns, golf courses, and gardens for insect larvae or roots; disturb refuse and garbage cans; or kill and eat poultry eggs or fowl. Skunk diggings normally appear as 3- to 4-inch cone-shaped holes or patches of upturned earth. Be cautious, as many other animals, including domestic dogs, also dig in lawns. Skunks can also damage beehives as they feed on adult and larval bees.

Most skunk problems are related to the animal's ability to discharge a very obnoxious odor when provoked. The scent, produced by two internal glands located at the base of the tail, is usually released for self-defense. Before spraying the thick, volatile, oily, sulfur-containing compound, skunks usually stamp their front feet rapidly and growl or hiss.

Skunks generally walk a short distance on their front feet and raise their tail as a warning before releasing any scent. The fluid is released in a fine spray directed accurately up to 10 feet and less accurately for 20 feet. Skunks can discharge the spray several times within a short period. The fluid is painful if it gets in a person's eyes and may cause temporary blindness for up to 15 minutes.

## Rabies

Skunks are very susceptible to rabies. Because they can become locally abundant and transmit rabies to other mammals, skunks cause concern for human health and livestock safety. Rabies is a serious viral disease that infects many types of warm-blooded animals. It is generally spread by direct contact with an infected individual, usually by biting.

When a skunk becomes infected with the rabies virus, it may go unnoticed for a period of time. Symptoms may not appear for weeks or months. During this time, the infected animal may transmit the virus to other animals it contacts. In the final stages of the disease, skunks may seem tame or listless, show signs of excessive salivation, become unusually aggressive or nervous, wander about during the daytime, and show little fear of humans.

Skunks are usually docile, slow-moving animals, and their main period of activity is from sunset to sunrise. If you notice a skunk acting strangely (aggressive or nervous, wandering in the daytime, or tame and listless), do not approach it. Parents should warn children never to approach or pet a skunk or any other wild animal. If you live in an area where there is a large skunk population, all pet dogs and cats and important livestock should be vaccinated for rabies.

Do not keep skunks or other wild animals as pets because they cannot be effectively immunized against the disease. Furthermore, they may have contracted rabies at an early age and be infected, yet fail to exhibit symptoms for some time.

If you are bitten by a skunk or other wild animal, capture and cage the animal if at all possible. Do not shoot the skunk in the head because the health department will require the head to determine if the animal was rabid. After you have been bitten, scrub the wound with warm soapy water for at least 20 minutes. Immediately after cleansing the wound, seek medical attention.

Submit the head of the animal to the state public health department for testing. Your local public health authorities, physician, or veterinarian can provide additional information on rabies. Animals suspected of being rabid should be submitted for diagnosis to your public health officials.

## Skunk Odor Control

People often find the smell of skunk musk nauseating. Skunk odor can be effectively reduced by using a variety of commercial and home remedies. Neutroleum alpha is a commercial deodorant that effectively masks skunk musk. You can purchase it from USDA-APHIS-Animal Damage Control, 3231 Ruckriegel Parkway, Louisville, KY 40299.

When used properly, this compound can be used to bathe pets or humans or scrub basements, garages, floors, walls, etc. It can also be sprayed in a room or onto contaminated soil from an aerosol sprayer. Other commercial-strength deodorants available from janitorial supply houses may also be effective. Commercial odor deodorants or neutralizers such as Skunk Off, Skunk Stuff, Nil' Odor, and Ecosorb are available from trapping supply houses or mail-order companies.

Home remedies that may help to reduce the intensity of the smell include tomato juice, vinegar, and diluted chlorine bleach or ammonia. Be careful when using any of these materials because they may cause color changes on certain materials, and they may be caustic to humans and pets. Note cautions on product labels before using them.

## Prevention and Control of Skunk Problems

### Prevention

The best long-term solution to managing skunk problems is to prevent them from happening. Lawns and farmyards that are kept clean are less attractive to skunks. Remove all sources of debris from the yard where skunks could find shelter or food (insects or small rodents). These include old boards lying on the ground, rocks, junk, and stacked lumber or trash piles.

You can also reduce the opportunity for an encounter with one of these smelly creatures by placing garbage or other food materials in sealed trash cans (not garbage bags). If you feed pets outside, clean up all dog and cat food after each feeding, and store the feed in a steel trash can so it is unavailable to insect or rodent pests.

Many farmsteads have grain storage areas that attract mice and rats and possibly skunks in search of an easy meal. Unless the rodent problem is solved, this source of food will create a continual skunk problem. A good integrated rodent control program will eliminate this attraction. To summarize, modify the environment by removing sources of shelter and situations that create rodent or insect problems.

Most skunks can be prevented from digging and denning under foundations, porches, or buildings by sealing off all openings. With sturdy mesh wire (1/4- or 1/2-inch hardware cloth or similar material), tightly seal holes in foundations, under porches, or vents near ground level or other areas where a skunk could enter. If the skunk could gain access by digging, the mesh wire should be buried 12 to 18 inches underground. The bottom 6 inches should be bent outward in an "L" shape to discourage skunks from digging under it.

Aboveground fences can be constructed of 3-foot wide, 1-inch poultry netting with the bottom 12 inches buried underground as mentioned previously. Fencing will also keep skunks out of landscaped areas, gardens, window wells, or other pits.

If you know skunks are living under a house, porch, barn, or other structure, you can exclude them from reentering. Wait until after dark when the skunk has left to seek food. Examine the dirt at the den entrance. Fresh tracks indicate the skunk has left for the evening. If you do not see tracks easily, sprinkle fine sand, dust, or flour at the entrance as a visual aid.

If you think more than one skunk is living under the building, attach a piece of 1/2-inch hardware cloth to the opening. This wire should be larger than the entire entrance, be hinged at the top, and remain loose on the other three sides. This simple device will allow skunks to push open the gate and leave, but not reenter. Once the skunks are gone, seal the entrance and any other entrances completely. Be sure to follow the instructions on exclusion mentioned previously.

### Control

There are no chemical repellents or toxicants (poisons) registered for controlling skunks in Kentucky. Other than habitat modification and exclusion mentioned above, the only methods available for controlling skunks are trapping and shooting.

Skunks are considered fur-bearing animals and receive protection under Kentucky law. However, if a skunk is damaging your property, you can legally kill or destroy the animal. You must then notify your local conservation officer to dispose of the carcass.

#### Shooting

If you live in a rural area, you can shoot skunks with a .22 caliber rifle or shotgun. You must be in a position so that when the skunk's odor is released, it will travel downwind from the house or other buildings. To lessen the chance of odor release, shoot the skunk just in front of the hind legs, followed immediately by another shot through the brain. If the head is to be examined for rabies, do not shoot the animal through the head. You must have a valid Kentucky hunting license to shoot skunks. In all other cases, shooting is not recommended because it often results in the release of odor.

#### Trapping

The preferred and most recommended solution to removing and disposing of problem skunks is trapping. Skunks can easily be trapped. A variety of live traps for catching skunks is available from hardware, agricultural supply and feed stores, or sporting goods stores (Figure 1). Select a size approximately 10 x 10 x 30 inches. Before setting the trap, cover it with heavy canvas to reduce the chances of a skunk releasing its scent (Figure 2). Be sure to leave each end open.

Bait the trap with canned or fresh fish, fish-flavored cat food, sardines, chicken entrails, or peanut butter. If you know the location of den's entrance, place the trap directly in front of it so the skunk will enter the trap as it leaves the den.

Skunks are easy to catch and can be transported without releasing their scent if done carefully. If you did not cover the trap with canvas, tarp, or thick burlap when it was set, slowly approach the animal, and gently cover the trap with the material. This creates a dark, secure environment, and the skunk will be less fearful and less likely to release its scent. Carefully pick up the covered trap, and gently place it in the back of a pickup truck for transportation. You must work quietly and slowly and avoid sudden jarring movements or loud noises.

Because of the potential for spreading rabies, skunks should not be released back into the environment but should be humanely disposed of.

If the skunk will be destroyed after it has been captured, steel leg-hold and killer-type traps can be used. If you use either of these types of traps, the likelihood a skunk will release its scent is greatly increased. **Never use these traps where pets could be captured.** Use a number 1 or 11/2 steel leg-hold trap or a 120 or 150 instant-killer-type trap.



Contact your local Kentucky Fish and Wildlife Resources biologist, Cooperative Extension Office, or USDA-APHIS-Animal Damage Control Officer for more information on using these types of traps.

*Remember, skunks are an important part of the natural world. They are highly beneficial to farmers, gardeners, and landowners because they eat agricultural and garden pests that can cause health problems. The best approach in managing skunk problems, where possible, is to leave these animals alone.*

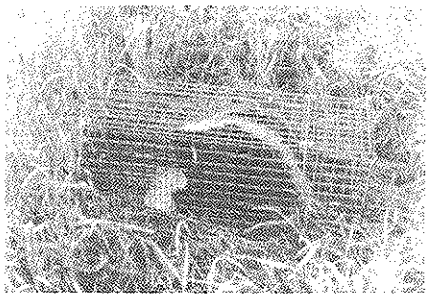

*Figure 1. Skunk in a live trap.*

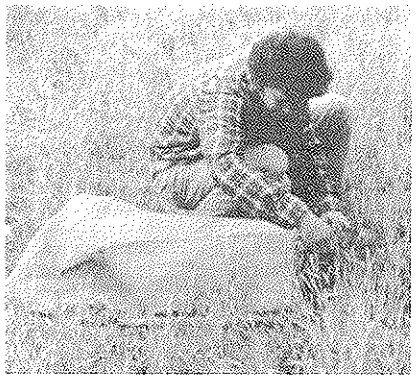

*Figure 2. Skunk trap covered with canvas.*



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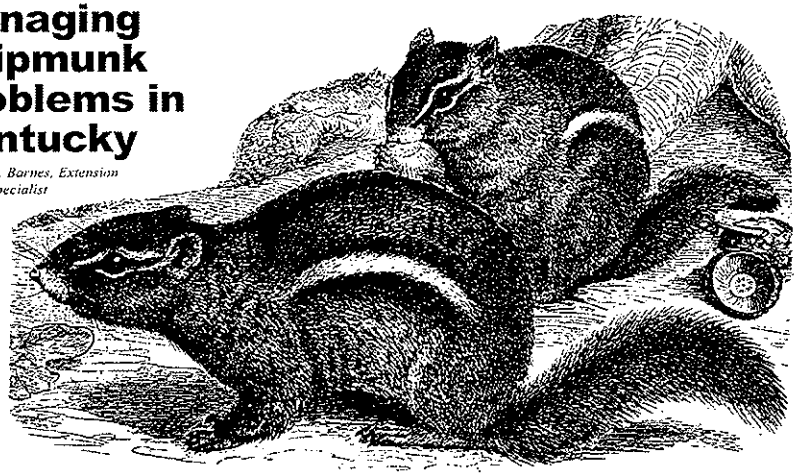
COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

# Managing Chipmunk Problems in Kentucky

*Thomas G. Barnes, Extension Wildlife Specialist*



Chuck-chuck-chuck, heard ringing throughout Kentucky during warm weather, is the sound of the eastern chipmunk (*Tamias striatus*), Kentucky's only striped squirrel. Common throughout the state, it is often called a ground squirrel. It should not be confused with the thirteen-lined or Franklin's ground squirrel which does not live in Kentucky but can be found in bordering states. Chipmunks often come into conflict with humans when they burrow around sidewalks and destroy valuable vegetables, flowers, or seeds.

## Chipmunk Facts and Biology

Chipmunks are small squirrels (family: *Sciuridae*). A fully grown chipmunk stretches 8 to 10 inches, tail included. Adults weigh 2 to 5 ounces. They are easily recognized by dark chocolate or russet fur with five dark stripes and two light stripes on the back (Figure 1). Close examination reveals several facial stripes and prominent internal cheek pouches used for collecting and carrying seeds. They have a flattened, well-haired (bushy) tail which they hold straight up in the air when they scurry across a lawn.

Chipmunks can be found in a variety of habitats, including woodlands, lawns, gardens, parks, and brushy areas. They seem to like areas with varied terrain, including rocks, fallen logs, and woodpiles. Often seen in trees, chipmunks are agile climbers but prefer to spend most of their time on the ground close to their burrows.

Chipmunks live in underground burrows that can be up to 6 feet long and 2 to 3 feet deep. Burrow entrances are often overlooked and difficult to find because no soil is piled up and the entrance can be concealed with leaves and other debris. A burrow system usually has more than one entrance and usually includes a nest chamber (up to 12 inches in diameter) lined with leaves and a food-storage chamber that can hold 9 gallons of food.

Primarily solitary animals, chipmunks come together to breed in March and April and again in July and August. After a gestation period of one month, two to eight young are born in the underground nest chamber. The young are born naked and helpless. The young emerge from the nest when they are about two-thirds grown, and they can breed the first year.

Chipmunks are territorial and have small ranges (typically less than 100 yards ). Numbers usually do not exceed two to four per acre. They can live three to four years in the wild and up to eight years in captivity.

Chipmunks eat the seeds and fruits of oaks, maples, hickories, beeches, elms, and many other trees, shrubs, grasses, and flowers. They also relish bulbs, dried grain, raspberries, and blackberries. While primarily herbivorous, chipmunks also eat insects, small reptiles, and amphibians, and even an occasional bird egg.

Chipmunks become very active collecting and storing food as cold weather approaches. At this time, they stuff seeds in cheek pouches using their forefeet. Then they carry these seeds to a food-storage area. Although they are true hibernating animals, relying on the stored food as an energy source, they do not get overly fat in the fall like other hibernating animals. Every couple of days they awaken during the winter to feed. During warm, sunny winter days, they may be seen scurrying above ground.

The chipmunk often chooses a raised spot (stump, rock, log) to feed, which enables it to look out for potential predators. If disturbed, it scurries for the burrow, tail raised, emitting a series of high-pitched calls. Chipmunks are popular food items for hawks, weasels, rat snakes, and, in particular, house cats and dogs.

## Preventing and Controlling Chipmunk Damage

Chipmunks can become pests by burrowing in gardens and lawns, digging up newly planted seeds, eating fresh garden or flower stems and fruits, and gnawing on tree bark and buds. Homes in heavily wooded areas or landowners feeding birds during the summer may experience more problems because chipmunks may be attracted to these areas. A clear, well-kept yard will probably have fewer chipmunk problems.

Before deciding on a control measure, ask yourself these questions:

1) Can I keep the chipmunk from digging in the garden by erecting a fence or other exclusion device?
2) If I can't erect an effective barrier, can I repel them from the site? Often visual, sound, or chemical repellents are available.
3) Can I move the animal safely and effectively? Often trapping is effective in removing problem animals.

The most effective types of chipmunk control are exclusion, trapping, and shooting. Each method has advantages and disadvantages, and homeowners must decide which method will work for their particular problem. Be patient. Animal damage problems are rarely solved quickly.

### Exclusion

In wooded areas where chipmunks are abundant, the best long-term solution is to exclude them from important areas. In these situations, trapping becomes never-ending, and exclusion is cheaper and less time consuming.

Hardware cloth is one of the best exclusion materials available. Use 1/4-inch material and be sure to bury it 6 inches to 8 inches deep to keep chipmunks from digging under sidewalks and around gardens or other important areas.

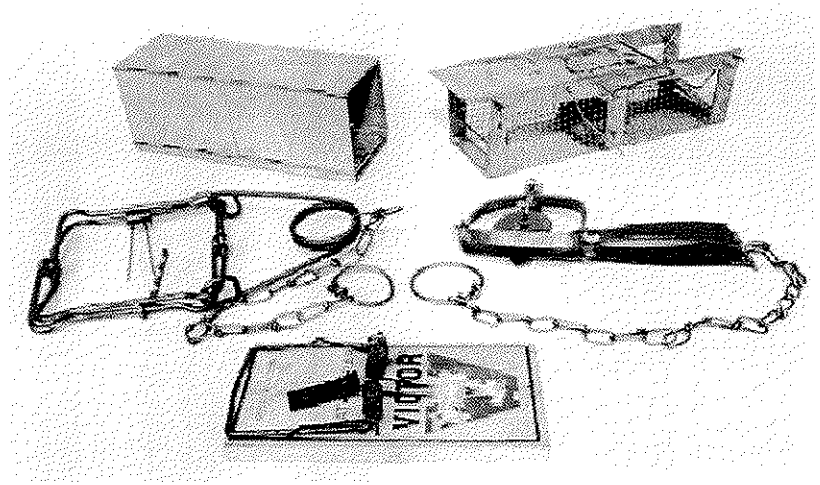


*Figure 2. Clockwise from the bottom: a rat snap-trap, a body-grip trap (in set position), a Sherman live-trap, a cage trap (in set position), and a leg-hold trap.*

## Trapping

Chipmunks can be easily trapped using steel leg-hold traps, live-traps, or rat snap-traps Figure 2). Your chances of catching several chipmunks in a short period are increased if you place bait on or in an unset trap for three to four days before setting the traps. Good baits include a mixture of peanut butter and oatmeal, sweet corn and high-quality grains, including wheat, barley, oats, or peanuts.

A simple burrow-entrance live-trap can be constructed out of hardware cloth (Figure 3). Use a 12 x 20-inch piece of 1/4- or 1/2-inch hardware cloth. Bend it three consecutive times to form a rectangle (3 x 3 x 20 inches). Crimp the edges together using hog rings. Close one end of the box with a 3-inch piece of hardware cloth. Construct a door of hardware cloth (2 3/4 x 8 inches) and attach one end to the top of the trap so that it can move freely. Bend the opposite end so that when the door is closed, approximately 2 inches comes in contact with the floor.

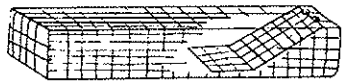


*Figure 3. A burrow-entrance live trap can easily be constructed from either rigid welded wire mesh or hardware cloth.*

For best results, set the trap in a burrow where chipmunks have been seen entering. Wedge the door end firmly into the entrance and prop the trap into position with a block of wood. Gravity will hold the door closed until the chipmunk enters as it leaves the burrow and traps itself.

Other live-traps can also be effective. Prebait these traps and block open the door. Place the trap close to the burrow entrance in a runway. You can increase your trapping success by covering wire live-traps with canvas, cardboard, or some other dark material.

Steel leg-hold or jaw traps can also be used effectively. Use a number 0 or 1 trap. Near the burrow entrance, excavate a small area in a runway just large enough to place the trap (Figure 4). Set the trap with the pan slightly below the soil surface so that when covered with soil it will be flush with the surrounding area. Put a piece of waxed paper over the trap pan and under the jaws. Cover the trap with very fine soil and conceal it so it does not look unnatural. No bait is necessary.

## Shooting

In rural areas, chipmunks can be easily controlled by shooting with a .22 caliber rifle or pellet gun. They are active during the day, and a patient homeowner can be very effective in controlling small populations of them. Remember you must contact your local conservation officer before you begin shooting, and you must have a valid Kentucky hunting license to shoot any wild animal.

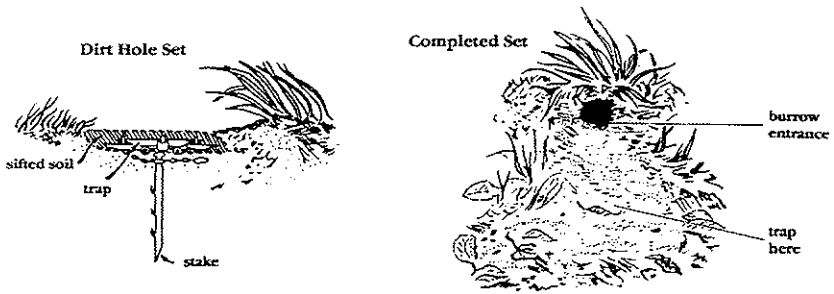



*Figure 4. Near the burrow entrance, excavate a small area in a runway just large enough to place the trap.*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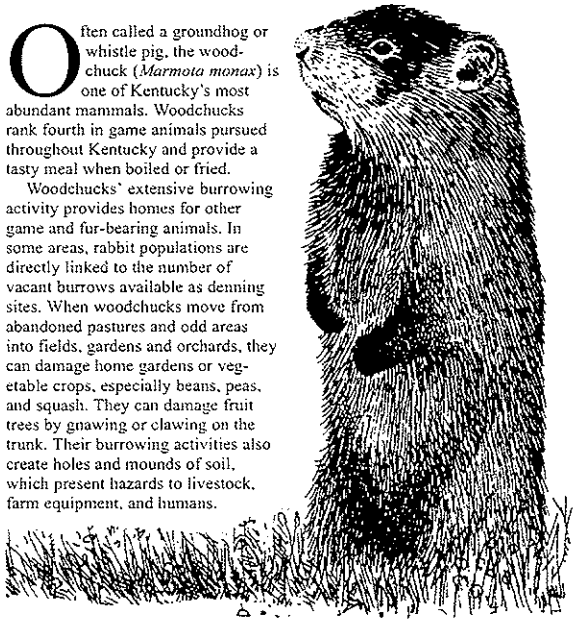
UNIVERSITY OF KENTUCKY · COLLEGE OF AGRICULTURE

# Managing Woodchuck Problems in Kentucky

*Thomas G. Barnes, Extension Wildlife Specialist*

Often called a groundhog or whistle pig, the woodchuck (*Marmota monax*) is one of Kentucky's most abundant mammals. Woodchucks rank fourth in game animals pursued throughout Kentucky and provide a tasty meal when boiled or fried.

Woodchucks' extensive burrowing activity provides homes for other game and fur-bearing animals. In some areas, rabbit populations are directly linked to the number of vacant burrows available as denning sites. When woodchucks move from abandoned pastures and odd areas into fields, gardens and orchards, they can damage home gardens or vegetable crops, especially beans, peas, and squash. They can damage fruit trees by gnawing or clawing on the trunk. Their burrowing activities also create holes and mounds of soil, which present hazards to livestock, farm equipment, and humans.



Good woodchuck habitat can be found throughout Kentucky. Woodchucks prefer a mixture of open farmland, woods, fencerows, and roadsides. They live in burrows usually located in fields, along roadsides or stone fences, at the base of trees, and around building foundations. Main entrances to burrows are easily identified by mounds of excavated dirt adjacent to a 10- to 12-inch diameter hole. Burrow systems are extensive and each system has at least two entrances. Some secondary entrances may be hard to identify because they are dug from below ground and do not have mounds of dirt beside them (Figure 1). These entrances often serve as escape holes.

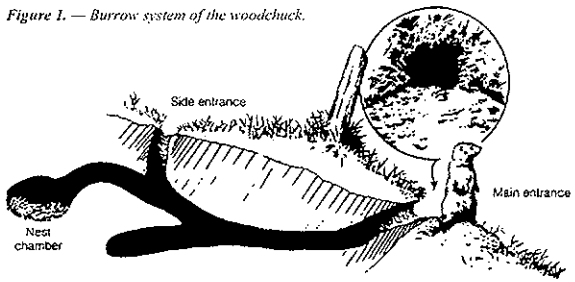
Woodchucks use burrows for mating, hiding from predators, and hibernation. One branch of the burrow system leads to a nest chamber containing dried grass. This dead-end nest chamber is sealed with soil during the winter and serves as a hibernation chamber.

Woodchucks are most active during early morning and late afternoon when they are feeding. They are vegetarians

## Animal Facts and Biology

Woodchucks are members of the squirrel family. When these heavy-bodied rodents are surprised, they emit a loud, shrill whistle and dive into a burrow; hence the name whistle pig. The woodchuck is easily distinguished by its well-furred, compact, chunky 20- to 27-inch body; short legs and toes with long, curved, well-developed claws; short tail; and grizzled or frosted, brownish-gray appearance. Adult woodchucks weigh between 5 and 10 pounds. Like other rodents, they have a pair of large, chisel-like front teeth.

*Figure 1. — Burrow system of the woodchuck.*




and eat a variety of broadleafed weeds, including dandelions and plantain. Woodchucks are particularly fond of legumes, including alfalfa and vetch, clover, peas, and beans. When not actively feeding, woodchucks can be seen basking or dozing on rocks, stone fences, and logs during the warmest part of the day.

In late August and September, woodchucks have voracious appetites as they prepare to hibernate. This deep sleep, when body temperatures drop and heart rate slows to four beats a minute, usually begins in October and continues through February. After hibernation, males usually emerge first and may travel some distance in search of a mate. Once a mate has been located, breeding occurs during March. In April, four to five young are born. The young woodchucks remain in the den for about two months.

Woodchucks are not great travellers. They usually do not range more than 50 to 100 feet from the den, although their home range may exceed 40 acres. Most activity is concentrated around the burrows. Burrow systems may be 5 feet deep and 25 to 30 feet in total length.

## Preventing and Controlling Woodchuck Damage

Control is most effective in the spring, when active burrows are easily located, young woodchucks have not yet scattered, and there is less likelihood of damage to other wildlife. In late summer, fall, and winter, other game animals may use the burrows for protection.

The most effective types of woodchuck control are shooting, trapping, and fumigation. Fencing may help reduce woodchuck damage; however, woodchucks are excellent climbers and can easily crawl over fences. No poisons are registered for controlling woodchucks in Kentucky.

### Shooting

In rural areas, woodchucks can be easily controlled by shooting them with a rifle. Shooting provides sport for hunters as well as a source of edible meat. Woodchucks are considered a varmint and may be legally shot anytime of the year if they are damaging your property. You must have a valid Kentucky hunting license to shoot any wild animal.

When you see a woodchuck at its burrow entrance, walk casually in its general direction (not directly toward it). When the woodchuck dives into its burrow, run quietly within about 25 yards of the burrow entrance and prepare to shoot. The woodchuck will usually pop its head up to have another look and can then be shot. If you use a large caliber rifle with a telescopic sight, woodchucks can be shot from a considerable distance.

### Trapping

Live traps, Conibear traps and steel leg hold traps (Figure 2) are effective in capturing woodchucks. Trapping is the best method to use near buildings or where fumigation may create a poison or fire hazard. Place live traps covered with dark canvas and baited with apples or carrots near the burrow entrance. Block the trap door open for several days to allow the animals to take the bait regularly. Once this has happened, set the trap.

The No. 220 Conibear trap is particularly effective in controlling woodchucks. This trap kills the animal quickly, so take care to avoid capturing dogs, cats, and other domestic animals. Place the trap in a burrow entrance so the woodchuck will pass through it, tripping the trigger (Figure 3). No bait is required for this type of trap. If children or pets are present, place the trap at the burrow opening so it is flush with ground level and then cover the entrance with a cardboard box to prevent capture of other species.

Woodchucks are strong animals; thus a No. 2 steel leg hold trap is required to hold them. Near the burrow entrance, excavate a small area just large enough to place the trap (Figure 4). Set the trap with the pan slightly below the soil surface so it will be flush at ground level when covered with soil. Place a piece of wax paper over the trap pan and under the jaws. Sift very fine soil over the trap to conceal it so it does not look unnatural. No bait is necessary. Be sure to check traps twice daily and treat captured animals humanely.

*Figure 2. — Traps (clockwise from bottom): snap trap, Conibear trap, Sherman trap, cage trap, leg hold trap.*

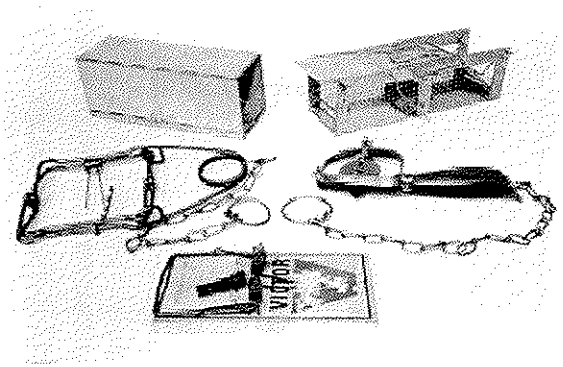


*Figure 3. — Placement of Conibear trap.*

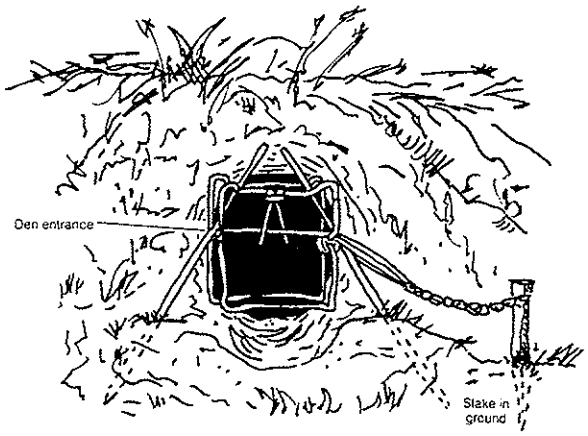
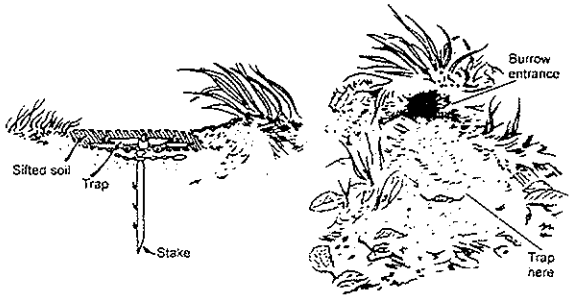



*Figure 4. — Placement of leg hold trap.*
Near the burrow entrance, excavate a small area in a runway just large enough to place the trap.




**Fumigation**

Gas cartridges that produce poisonous gas (killing by suffocation) are one of the most common methods of woodchuck control. These cardboard cylinders must be ignited and placed in the burrow system. **Because of potential fire hazard and gas accumulation in homes, never use a gas cartridge in burrows under homes, tobacco sheds, buildings, dry grass, or near other combustible materials.** Gas cartridges may be purchased from your local county agricultural Extension agent, U.S. Department of Agriculture, APHIS-ADC, 3231 Ruckriegel Parkway, Suite 107, Louisville, KY 40299 or the Kentucky Department of Fish and Wildlife Resources, #1 Game Farm Road, Frankfort, KY 40601.

Fumigation is most effective February through April when the soil is moist because:

1. the burrow can be tightly sealed so little gas escapes through small cracks in the soil, and
2. woodchuck reproduction has not yet occurred. Other factors determining the success of fumigation include the length and configuration of the burrow system, absorption of gas into soil cracks, and inadequate plugging of all burrow entrances.

Gas cartridges are safe if the user takes a few precautions. **Never use a fumigant in a manner inconsistent with its labeling. Failure to comply with directions may subject you to severe federal or state penalties.** Gas cartridges must be ignited by lighting a fuse. They are not bombs and will not explode if properly prepared and used. Follow these precautions before using a gas cartridge: Before lighting the fuse, ensure that the cartridge will pass easily into the burrow entrance. Always light the end of the fuse, never the cartridge directly. *Do not* hold a burning cartridge in your hand. Once the fuse has been lit, work quickly because burn time may be less than five seconds. Place the fuse-end of the cartridge into the burrow first. Avoid prolonged breathing of smoke, and handle cartridges carefully because ignited gas cartridges can cause severe burns.

For successful control, treat burrows in the following manner:

1. Locate *all* entrances surrounding active burrows.
2. With a shovel, cut clumps of sod slightly larger than each burrow entrance. Place a piece of sod over each entrance except the main entrance. Next to the main entrance, place a piece of sod precut to the size of the burrow entrance.
3. Follow the written label instructions on the cartridge for ignition and placement.
4. Kneel at the main burrow entrance, light the fuse, and immediately place the cartridge as far down the hole as possible. Use a shovel handle or stick to push the cartridge farther down the burrow without causing large amounts of loose soil to fall into the burrow, because this may smother the cartridge.
5. Immediately seal the burrow by placing the piece of precut sod over the opening and tramping it down slightly.
6. Wait three to four minutes and watch nearby holes. If you see smoke escaping from these holes, reseal them.
7. Repeat steps 1 through 4 until all burrows are closed.
8. Within two to three days, check to see if the burrow is reopened and retreat the area if necessary.

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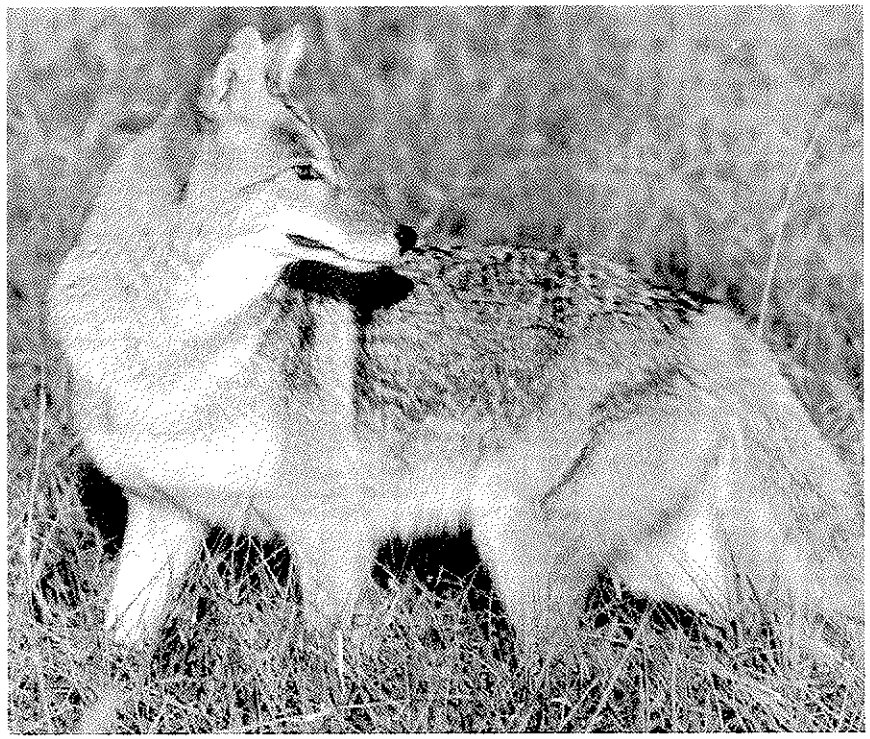
# Coyote

## Managing Coyote Problems in Kentucky



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Coyote
Managing Coyote Problems in Kentucky

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*Bernice U. Constantin, District Supervisor, U.S. Department of Agriculture, APHIS—Animal Damage Control*

### Contents



### Acknowledgments

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Photo credits: Robert Henderson (cover, Figure 1, Figure 2, adapted), Jay Lorenz (Figure 3), Guy Connelly (Figures 4 and 5).

The text and figures on trapping were adapted from publications of the New York Department of Environmental Conservation and are used with that agency's permission.

In the last 30 years the coyote (*Canis latrans*) has gradually spread throughout the eastern United States from its historic range in the plains and mountains of western North America. Except for the eastern mountains, the coyote is now common in all parts of Kentucky.

Although the bulk of their diet consists of small wild mammals, carrion, fruits, and vegetable matter, some coyotes will kill livestock if given the opportunity. Coyotes' most common prey is lambs (less often adult sheep), calves, swine, and poultry. Not all coyotes live by killing livestock, however. Livestock losses often are due to individual "problem" coyotes that have learned to kill livestock or that have been afforded an easy opportunity by the farmer. Free-ranging dogs also kill and injure livestock. For example, in Kansas dogs account for an estimated 25 percent of the livestock predation losses.

Fortunately, ranchers, Extension personnel, animal damage control specialists, and wildlife biologists in western states have a wealth of experience with coyotes and with coyote/livestock problems. This publication is based largely on that experience. Although range conditions and livestock management differ between western states and Kentucky, the coyote behaves basically the same everywhere, and many predation management practices used in the West are applicable to Kentucky. Kentucky producers should take full advantage of their western counterparts' knowledge.

## Approach to Managing Coyote Problems

The management of coyote problems has five parts:

- Understanding the coyote,
- Employing preventive livestock management when feasible,
- Learning how to identify coyote kills when they occur,
- Learning how to control problem coyotes, and
- Developing a plan of action before a problem occurs.

Understanding the coyote is necessary so that you will know why the different preventive and control techniques are effective and how to successfully apply them. Coyote depredation on livestock can be reduced in two ways: (1) keep predators and livestock apart or (2) remove depredating coyotes. All of the methods discussed in this publication fall into one category or the other. Preventive livestock management may not be possible in every situation, but most producers can take some steps to reduce the risk of predation. Good management not only reduces livestock losses, but it also reduces the amount of time and effort spent eliminating problem coyotes.

The time to decide how you are going to deal with a livestock kill by coyotes is before it happens. If you wait until after you have a problem to make requests for information or assistance, the problem could get worse or the ideal control opportunity may be lost. Learning how to manage coyote problems and planning a course of action beforehand is the best approach.

## Legal Status of Coyotes in Kentucky

Coyotes are not protected in Kentucky and may be taken year-round by hunting or with traps or non-locking snares during the furbearer trapping season. Coyotes may be hunted during daylight hours only. Hunters may use hand- or mouth-operated, mechanical, or electronically operated calling or attracting devices to aid in taking coyotes. Coyote trappers are restricted to non-locking snares and number 2 or smaller foothold traps. More information on trap requirements, hunting and trapping license requirements, and trapping season dates is available in the *Kentucky Hunting Digest* and *Kentucky Trappers Guide* or from your local conservation officer.

Kentucky law allows individuals whose property is being damaged by coyotes to kill such animals at any time of the year, but only by means allowed during the hunting and trapping seasons. Landowners must, however, report any destruction of coyotes outside the trapping season to a Kentucky Department of Fish and Wildlife Resources' local conservation officer for carcass disposal.

In certain instances, the Commissioner of the Kentucky Department of Fish and Wildlife Resources may allow persons other than the landowners, tenants, or their dependents to assist in trapping coyotes outside the trapping season on property where a problem is known to exist. Persons assisting landowners in removing problem coyotes during the closed trapping season must obtain written approval of the Commissioner by contacting the local conservation officer. This does not in any way limit individuals possessing a valid Kentucky trapping license from volunteering or contracting their services to assist landowners in removing problem coyotes during the legal trapping season.



## Understanding the Coyote

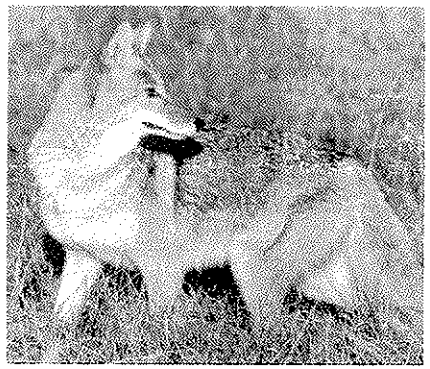


*Figure 1.*

**Physical Description.** A typical adult coyote weighs 29 to 33 pounds; adult weights, however, can range from 20 to 42 pounds, with males usually larger than females. Coyotes have a slender snout, erect ears, and a bottle-shaped tail carried at a downward angle (Figure 1). A light gray coat with lighter colored underparts and legs is most common. However, the coat may vary considerably from buff yellow to reddish yellow or black. The long, coarse guard hairs on the back and tail are typically black-tipped.

**Coydogs.** Coyotes occasionally breed with dogs, producing the "coydog" hybrid. Research, however, has shown that hybrids are seldom found in the southeast United States and are likely rare in Kentucky.

**Reproduction.** Coyotes mate in late February or early March; 60 to 63 days later the female gives birth to three to seven pups in an underground or brushpile den. Litter size and pup survival can vary greatly in relation to the food supply. Most female coyotes do not breed until their second year, unless food is abundant or the coyote population density is low. Coyotes breed only once a year and are monogamous, meaning males and females have only one mate in a single year. The male helps care for the young, which begin to travel with adults at about eight weeks of age.

**Diet.** The coyote is an opportunist and will eat whatever is easiest to obtain and consistently present. Rodents, rabbits, and similarly sized mammals and carrion (dead animals) make up the bulk of their diet during the winter. In the summer, coyotes eat substantial amounts of vegetable matter, fruits, and insects. Where deer are abundant, coyotes may prey on fawns in late spring. Livestock also are taken most frequently in the spring because it is then that young livestock usually are most abundant and adult coyotes have to hunt more often to feed pups. Predation, however, can be common any time of the year that young livestock are available.

**Density.** Where coyotes are present, one adult coyote per 1 to 2 square miles is an average population density over a large area. However, population levels often vary considerably between areas or from year to year. The low point in the annual coyote population cycle occurs in the spring just before pups are born (whelping); the high point occurs just after whelping.

**Social Behavior.** Coyotes are basically solitary and do not travel in packs like wolves, although family groups (up to six to eight animals) may be seen. Coyote pairs or family groups live in distinct, nonoverlapping territories. A family group usually includes a mated pair, nonbreeding offspring from the previous year, and pups from the current year. Family groups do not always travel together, so it is more common to see single coyotes or pairs.

Territory boundaries are maintained by scent marking, rarely by fighting. A small percentage of coyotes are nomads and do not respect territorial boundaries. In fall, many young coyotes disperse from their natal territories in search of a place to settle. Dispersal movements often cover 10 to 50 miles. Unpaired adults also may roam in late winter in search of mates.

**Home Range and Movements.** The size of a coyote's home range may vary from 5 to 13 square miles or more, but daily activity is usually confined to smaller areas. Coyotes are most active at night and at dawn, often traveling 3 to 8 miles each night within their home range. During the daytime, coyotes usually rest or "bed" in different locations each day (except when adults are caring for pups at a den). In one Texas study, bedding locations were an average of a half mile to one mile apart on successive days.

**Mortality.** Human activity is a major cause of coyote mortality in many areas. Coyotes also are susceptible to a number of canine diseases including distemper, hepatitis, mange, parvovirus, and rabies. Average annual mortality rates of 30 to 40 percent for adults and up to 70 percent for juveniles are typical.

## Preventing Livestock Losses

The key to preventing livestock losses to coyotes and dogs is to use livestock management practices that keep farm animals and predators apart, that do not encourage coyotes to congregate near farms, and that do not teach coyotes to associate livestock with food. Below is a summary of preventive management practices for sheep, swine, cattle, and poultry.

### Sheep

Because most sheep losses occur in pastures, **corralling sheep at night** can reduce or eliminate predation by coyotes. Sheep can be trained to return to a corral every evening. Corrals should be located near buildings and human activity. Outdoor lights further discourage coyote activity near security corrals. If necessary, construct corrals using "canine-proof" fence designs, several of which are discussed below.

**Confined lambing** can reduce losses of highly susceptible newborn lambs. **Lambing in late fall** (possible for some breeds only), when coyotes are not hunting to feed growing pups, also reduces the potential for predation losses.

**Minimizing the use of high-risk pastures** by lambs during problem periods of the year may help reduce losses. Pastures highly interspersed with wooded and brushy areas, ravines, and streams that provide daytime resting sites for coyotes and concealed approaches to sheep are where losses are more common.

Sheep producers who **remove or bury dead livestock** tend to have fewer coyote problems. For example, one western study found that sheep producers who hauled away or buried sheep carcasses had only 40 to 50 percent of the sheep losses of producers who left carcasses in pastures. Leaving livestock carcasses in pastures or open pits not only encourages coyotes to associate livestock with food, but also causes coyotes to congregate near farms.

Sheep losses to coyotes and dogs are sometimes severe enough that **specialized fences** designed to exclude coyotes or hinder their movements are economically feasible. No practical fence is completely coyote-proof, but some designs are effective. Specialized fencing can be used on a small scale for security corrals or small pastures. High tensile electric fences (Figure 2) will keep most coyotes out of corrals or pastures and are relatively inexpensive. Adding electric strands to the outside of existing fences also can be effective. Net wire fences 5 1/2 feet high with a top strand of barbed wire will exclude many coyotes and hinder the movement of others. You can improve the effectiveness of net wire fences by adding a 24-inch apron turned outward at ground level and by slanting the top 18 inches of the fence outward. Coyotes prefer to go under or through a fence, not over it. Therefore, well-maintained net wire fences help reduce the number of

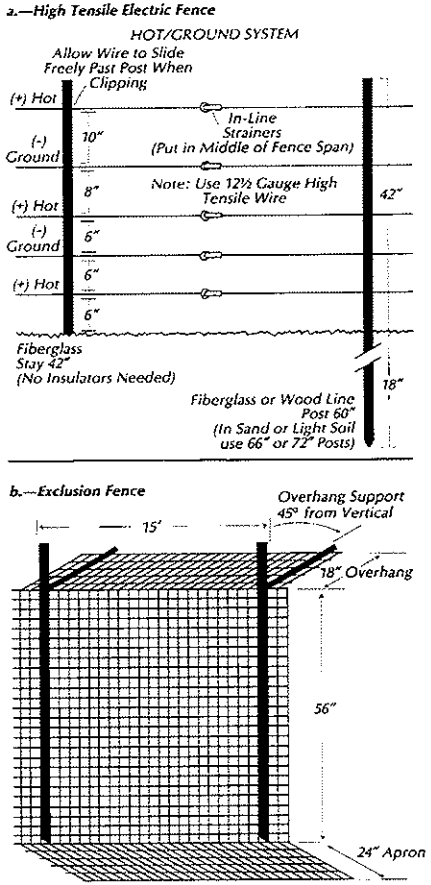



*Figure 2.—Two fence designs that can be used to exclude or hinder coyote movements. (a) High-tensile electric fencing is the most effective and is relatively inexpensive. (b) The effectiveness of this net wire fence was improved by adding a 24-inch apron turned outward at ground level and by slanting the top 18 inches of the fence outward.*



entry points into pastures, which makes it easier to trap a problem coyote. When fencing new pastures or replacing old fences, consider designs that will exclude coyotes and dogs.

**Guardian dogs** are becoming popular with sheep producers in Kentucky. The most popular breeds are the Great Pyrenees, Komondor, Akbash, and Anatolian (Figure 3). These large breeds have been selectively developed to protect livestock, but the dog must be handled and trained properly to be effective.

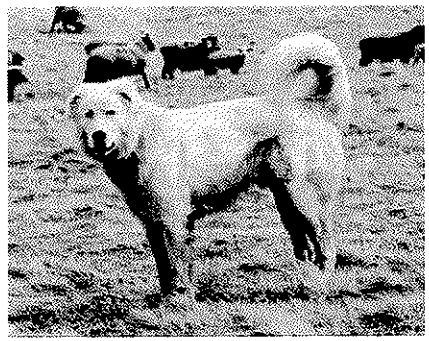


*Figure 3.—Guardian dogs are proven effective for protecting sheep from coyotes.*

A guardian dog is best acquired as a puppy and raised with sheep. As it grows to adulthood, it develops an "attachment" to or bond with the flock. This bonding and their natural aggression to intruders make these dogs effective guardians. Although keeping and training any dog takes much effort and can be expensive, many livestock producers feel that guardian dogs are cost effective in preventing losses to coyotes. Not every guardian dog performs well, however, nor are these dogs suitable for all situations. Guardian dogs are not a substitute for livestock management that discourages coyote predation.

**Frightening devices** such as propane gas exploders, flashing lights, sirens, and transistor radios may temporarily discourage coyote attacks. These devices are only useful, however, as a stop-gap measure while you are deciding on a better long-term solution. Moving these devices to different locations every one to two days will make them more effective.

### Swine

An Illinois study on the relationship between husbandry practices and coyote predation found that swine losses to coyotes were most common for operations that: (1) farrowed in March and had large numbers of small pigs at that time, (2) had escaping swine, and (3) disposed of swine carcasses in areas accessible to coyotes.

Apparently, a large number of small pigs in the spring attracts coyotes and probably dogs as well. Recognizing this, **greater vigilance** during the spring and effectively confining piglets reduce swine losses to predators and other causes. As noted above with sheep, improper **carcass disposal** may encourage predation. In the Illinois study, 12 of 46 swine producers who did not properly dispose of dead swine had coyote problems, compared to only one of 34 producers who removed or buried dead animals—a ninefold difference.

### Cattle

Most calves killed by coyotes are less than one week old, and many are killed immediately after birth. Cows left to calve in large pastures often seek secluded locations where the newborn calves are more likely to attract coyotes, thus contributing to the problem. **Keeping cows about to calf and young calves in smaller pastures near buildings** can reduce losses to coyotes. Scheduling calving to occur in several distinct intervals during the calving season minimizes the problem of holding cows in a smaller pasture. **Minimizing the use of high-risk pastures** until young calves have gained weight and strength may also help reduce losses. If a predation problem is severe enough, producers should consider installing high tensile electric fence around selected pastures to use during peak problem periods. Portable electric fences are another option.

As with sheep and swine, **proper disposal** of dead cattle may help avoid coyote problems. On a related note, cattle producers have observed coyotes eating afterbirth in pastures. The availability of afterbirth may attract coyotes to calving pastures, thereby increasing the risk of predation. This is another argument for restricting calving to easily monitored pastures.

### Poultry

**Confining** free-roaming poultry is the most effective prevention. If complete confinement is not practical, confining poultry at dusk may reduce losses.

## Management Option Summary

**Sheep**
- Corralling at night
- Confined lambing
- Lambing in fall
- Pasture selection
- Proper disposal of dead livestock
- Specialized fences
- Guardian dogs
- Frightening devices

**Swine**
- Confinement
- Proper disposal of dead livestock
- Specialized fences
- Frightening devices

**Cattle**
- Pasture selection for calving and for young calves
- Proper disposal of dead livestock
- Specialized fences
- Frightening devices

**Poultry**
- Complete or partial confinement

## Investigating Livestock Deaths

When you find livestock carcasses, do not assume that a partially eaten carcass is the result of a coyote or dog kill. Careful examination will usually reveal whether the animal was killed by a predator or died of other causes. Some common causes of livestock loss other than predators are starvation, exposure to severe weather, diseases, bloat, suffocation, poisonous plants, lightning, snake bite, and theft. If the animal was killed, the responsible predator species usually can be identified from wounds, tracks, and other evidence. The following steps will help determine if predation occurred.

1. Look around the carcass to see if it died where you found it. If it appears to have died in a different location, it may have been dragged away from the site of death by predators or scavengers.

2. Look for signs of a struggle. Blood, hair and hide, broken vegetation, and displaced soil and rocks indicate a struggle and are usually good evidence of predation.

3. Look for predator signs around the carcass, such as tracks, droppings, and hair. When looking for predator signs, avoid unnecessary driving and walking over the area and inadvertently destroying useful evidence.

4. Note the position of the carcass. Animals killed by predators are usually found on their sides with limbs extended. Livestock lying with legs folded under them are more likely to have died of other causes.

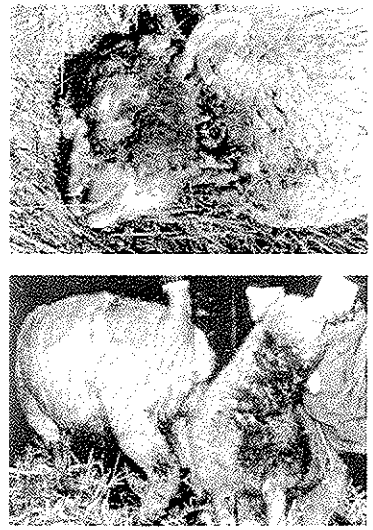
5. Examine the carcass for signs of hemorrhaging (bleeding) and general damage. Evidence of hemorrhage is the most important factor in determining whether an animal was killed by predators. Bleeding can occur before and for only a brief time after death. Therefore, hemorrhaging will occur (around bite marks) in livestock that are actually killed by a predator. Livestock that died of other causes (e.g., sickness) before the coyote began feeding will not hemorrhage. If there are no external signs of blood, the carcass should be skinned (especially around the head and neck) to look for hemorrhaging under the skin since blood may not have penneated the hair or wool around a wound (Figure 4).

*Figure 4.—Hemorrhaging (bleeding) is the most important evidence of predation. If there are no external signs of blood, the carcass should be skinned to look for evidence of bleeding.*

6. Distinguish between feeding on stillborn livestock and predation on newborn livestock. When a newborn lamb or calf is found dead and fed upon, it is sometimes difficult to determine if it was born healthy and preyed upon or stillborn and eaten as carrion. Several characteristics can help you determine this. If the animal was born alive, the exposed end of the umbilical artery will show a distinct blood clot; stillborn animals will not have a clot. The lungs of a live-born animal will be light pink; the lungs of a stillborn will be a dark scarlet color. Milk in the stomach indicates that the animal nursed before it died. Also, the membrane covering the soles of the hoof wears away when a newborn lamb or calf starts to walk. Dirt on the hooves is evidence of live birth.



7. Distinguish between coyote and dog kills. Dog and coyote kills can usually but not always be distinguished by evidence at the site. Coyotes typically kill sheep by biting them on the throat just behind the jaw and below the ear (Figure 5). Death usually occurs from suffocation. Very young lambs may be bitten in the head, neck, or on the back from above.



*a.*

*b.*

*Figure 5.—(a) A single bite on the throat just behind the jaw and below the ear is strong evidence of a coyote kill. (b) Note the more extensive injuries on the neck and flanks of the dog-injured animal.*

Dogs usually attack indiscriminately and mutilate their prey, although large, experienced dogs may attack the throat of the prey, just as coyotes do. Livestock attacked by dogs may have intestines pulled out, hams and shoulders skinned and chewed, and noses or faces lacerated. However, inexperienced coyotes may chase their prey and bite at the sides and rear of the animal, much like dogs. This most often happens in the fall when young coyotes are learning to hunt, but it is not restricted to that time of year, as some coyotes habitually kill in this way. Dog packs also harass livestock and frequently chase animals for several hours. Careful searching where this occurs often reveals numerous attack sites with tracks, hair or wool, and pieces of skin widely scattered. Finding tracks also may help determine whether the prey was attacked by coyotes or dogs. Coyote and dog tracks are similar, but coyote tracks are generally longer and narrower than dog tracks (Figure 6).

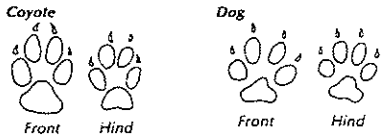



*Figure 6.—Coyote tracks are generally longer and narrower than dog tracks.*

Although dog and coyote feeding behavior differs at kill sites, it is difficult to distinguish between coyote and dog kills solely on this behavior. Domestic dogs consume their prey less often than do coyotes. Coyotes normally feed in the flank area or just behind the ribs. The internal organs (liver, heart, lungs, etc.) are usually eaten first, as are the milk-filled stomachs of young animals. Feeding on the hindquarters is also common, especially on calves. Small animals may be entirely consumed or carried away.

## Removing Problem Coyotes

Livestock losses to coyotes can be reduced or eliminated by removing problem coyotes. In Kentucky, trapping is the most common method of removing coyotes, but predator calling and hunting and killing coyotes at den sites can work in some situations.

### Coyote Trap and Snare Sets

Detailed publications showing how to trap coyotes are available (see the section on "Who Can Help"). The summary provided below is only intended to familiarize you with the basic techniques of coyote trapping.

Problem coyotes often follow predictable routes to get to livestock. The successful trapper identifies areas coyotes frequent by finding tracks, fur, scats, and remains of kills or by actually observing the coyote. Because most coyotes rarely enter cage or box traps, foothold traps and snares are most often used. Foothold traps should be set in the open on level ground where the coyote will likely stop to investigate. In typical Kentucky farm country, three to five sets per 100 acres will be sufficient. Examples of good locations for trap and snare sets are shown in Figure 7. Depredating coyotes are often easier to trap away from the pastures where damage occurs.

Three basic trap sets are commonly used for coyotes: dirt-hole, scent post, and blind (snare) sets. These trap sets exploit the coyotes' normal hunting and territorial

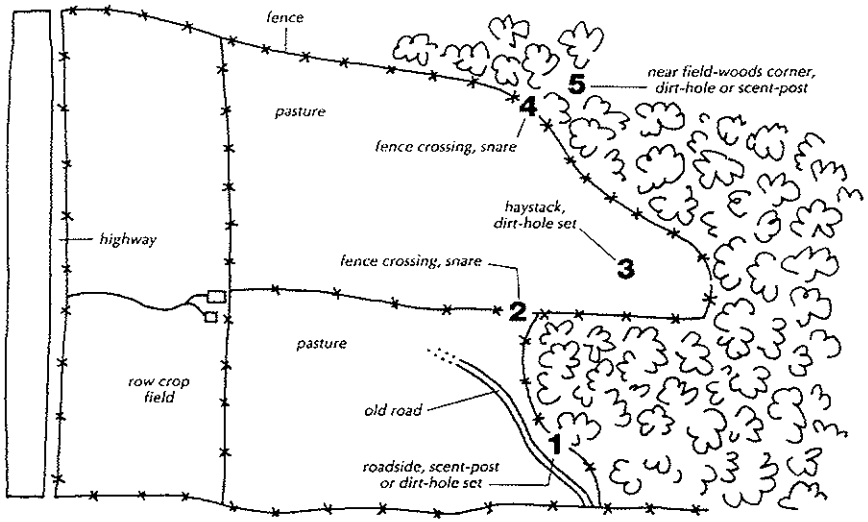



*Figure 7.—Good locations for coyote traps and snare sets. Note these locations are set along fence lines and near woods, not in the open field.*

marking behaviors. Equipment necessary to make foothold trap sets includes traps (sizes 1 3/4 to 2), stakes, trowel or small shovel, hammer to drive stakes into ground, soil sifter, trap pan covers, clean cotton or rubber gloves, and coyote lure and/or urine (both are commercially available). Great care should be taken to keep equipment and trap set locations free of human or unnatural odors. Adjusting or modifying traps so that 1 to 2 pounds of pressure is needed to set them off will reduce the number of opossums, skunks, etc. caught. Traps and trapping supplies can be purchased at local hardware stores, farm supply stores, or by mail order.

**Dirt-Hole Sets.** A completed dirt-hole set (Figure 8) appears as a small hole in the ground where mice or other rodents live or where a predator has attempted to dig to reach prey. Bait or lure is placed in the hole to attract the coyote to the set and into the hidden trap. Site selection is very important. The set should be made in a relatively open spot where visibility is good on all sides.

The bait hole should be dug in front of a clump of weeds, a rock, a small stump, or some similar object used as a backstop. The hole should be about 2 1/2 to 4 inches in diameter, 6 to 8 inches deep, sloping back under the backstop. All dirt removed should be placed in the sifter.

Next, remove a triangle of sod about 10 inches on each side in front of the hole. The point of the triangle should touch the hole, giving it the appearance of a small hole dug by a fox or coyote. Remove soil from the triangle until it is deep enough for the trap to sit below the surface. Some trappers offset the trap slightly to the right or left of center to help assure a front foot catch.

Stake the trap so that the stake and chain will be directly under it. Only about 8 inches of chain should be used, and the chain should have a swivel. Cover the stake and excess chain with a smooth layer of earth and position the trap carefully so it will not rock or shift position. In wet or freezing weather, the trap should be bedded in dry sand, anthill soil, or dry dirt mixed with ground hay or grain hulls. Trapping antifreezes also are available.

Place a cover over the trap pan and under the jaws before covering the trap with shifted soil. This prevents soil from obstructing the trap pan. The pan cover can be a piece of clean cloth, a small plastic bag, nylon window screen, or waxed paper.

The soil should be level, and the trap should be buried no more than one-half inch below the surface.



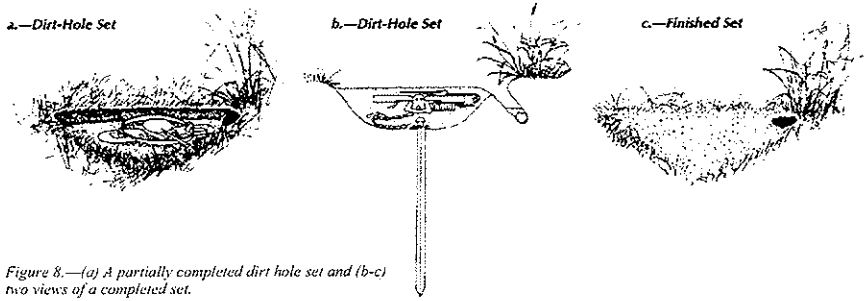



*Figure 8.—(a) A partially completed dirt hole set and (b-c) two views of a completed set.*

Finally, place a commercially made bait or lure in the bait hole, and sprinkle a few drops of coyote urine on the backstop.

**Scent Post Set.** Like domestic dogs, coyotes urinate on prominent objects along their lines of travel. Trappers can take advantage of this habit to catch coyotes. A small prominent object, like a protruding stone, grass tuft, or stick, serves as the post for this set. Place a liberal amount of coyote or fox urine and a few drops of gland lure on the post. Coyotes, believing another coyote has moved into the area, will re-mark the scent post in defense of their territory. The trap should be carefully bedded and concealed 9 to 18 inches away from the post on the downhill side or on the side which is least obstructed so that the animal will step on it while urinating. Stake and cover the traps as described for the dirt-hole set (Figure 8).

**Snare Sets.** Snares may be set where coyotes crawl under or through fences or in trails (Figure 9). Scents

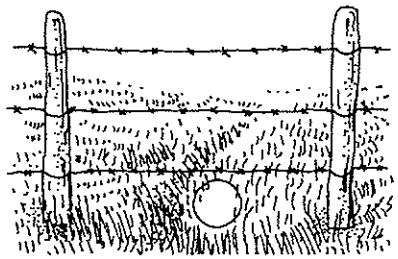


*Figure 9.—Snares are most effective when placed in travel routes such as well-worn fence crossings.*

should not be used at these sets, but snares can be used effectively along paths leading into a baited area (e.g., remains of a livestock kill). Snare loop size is not as important as snare position. The bottom of the snare loop should be about 10 inches from the ground (except in crawl spaces under fences, where it should be 2 inches above the ground). The loop should be centered in the trail and wide enough to cover the width of the trail. If the trail is too wide, find a constricted location or use a few small weeds or sticks to narrow the path. Snares must be adequately anchored to trap stakes, trees, strong fence wire, or fenceposts with a good swivel. If wire is used to attach snares and swivel, at least two strands of 14-gauge wire wound together are needed.

## Predator Calling

Coyote hunting using a predator call can be an effective method of taking coyotes, but considerable experience and skill are needed to be successful. Predator calling involves the use of mouth-operated or electronic calls that emit sounds to attract predators. Coyotes responding to predator calls can be shot with a 12-gauge shotgun loaded with BBs or number 4 buckshot up to distances of 35 yards, or with an accurate rifle at longer distances.

## Den Removal

If you can locate the den site of coyotes that are causing damage, removing all coyote pups will usually stop depredation, even if the adults are not killed. However, the problem will likely recur next year unless the adults are also removed.

## Methods Not Recommended for Kentucky

**Bounty.** The bounty system has been used in the United States for more than 300 years with little success. Experience has shown that bounty payments are ineffective in controlling predation on livestock. Coyotes compensate for losses in their population by breeding at a younger age or having larger litters and by increased pup survival. To be effective, control measures (trapping and shooting) should be aimed at eliminating the individual coyotes that have become predators of livestock, not the entire population. Bounties are costly, and they promote the illegal trafficking of skins for bounty collection. When confronted with the suggestion of a bounty, stockmen and citizens should ask how effective this method of control has been in the past and what the costs were.

**Toxicants and Repellents.** There are no toxicants registered for use on coyotes in Kentucky, and there are no repellents registered for use or proven effective for coyote damage control.

## Planning Your Response to the Problem

If you are sharing a farm with coyotes, decide how you are going to react to a coyote or dog kill before it happens. First, plan on spending the time needed to identify the actual causes of livestock deaths. Do not assume that every lost or partially eaten animal is a coyote kill. Trapping is a lot of work, and you would not want to waste your time trapping coyotes when there is another cause of your livestock losses.

If you do have a coyote kill, trapping should begin immediately to increase the opportunity of catching the offending animal before it can do more damage. If you intend to trap problem coyotes yourself, you will need to have the equipment on hand and know how to use it. If you plan to use the help of a local trapper, you need to make contacts in advance.

Decide in advance what options you have or can develop for protecting livestock or lessening the chance of additional kills while trapping a problem coyote. As discussed earlier, some possibilities are corralling sheep at night, confining pigs, moving calves to pastures near buildings, and using frightening devices. Coordinate your efforts with neighbors who also have vulnerable livestock.

## Who Can Help

District wildlife biologists from the Kentucky Department of Fish and Wildlife Resources are available to investigate livestock losses to coyotes. Suspected coyote depredations should be reported immediately to the local conservation officer. With a trapping season and a year-round hunting season on coyotes, trappers and hunters are a potential source of help for livestock producers with problem coyotes. The department keeps a listing of private trappers who are willing to help landowners alleviate coyote problems. These trappers are not employed by the Department of Fish and Wildlife Resources and do not represent the department. The Kentucky Department of Agriculture is authorized to pay for livestock losses due to coyotes. Claims must be reported to the local county dog warden within 72 hours after the loss or damage incident.

Extension personnel, both county agents and state specialists, can help producers acquire information on coyotes and on how to solve coyote problems. The USDA Animal Damage Control Office can also provide information.

A number of publications and videotapes on coyote trapping, snaring, and calling; guardian dogs; and other methods of preventing coyote problems are available for distribution or loan from the Kentucky Department of Fish and Wildlife Resources, the U.S. Department of Agriculture Animal Damage Control office in Louisville, or the Cooperative Extension Service, University of Kentucky.

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Chief, Bird Control Research Section
Denver Wildlife Research Center
USDA-APHIS-ADC
Denver, Colorado 80225

# RIVER OTTERS

Fig. 1. The North American river otter, *Lutra canadensis*

## Damage Prevention and Control Methods

### Exclusion

Fence small raceways, tanks, or ponds with 3 x 3-inch (7.6 x 7.6-cm) mesh wire.

### Repellents

None are registered.

### Toxicants

None are registered.

### Fumigants

None are registered.

### Trapping

Use Conibear® traps (Nos. 220 and 330), foothold traps (No. 2), and snares to control river otters in damage situations.

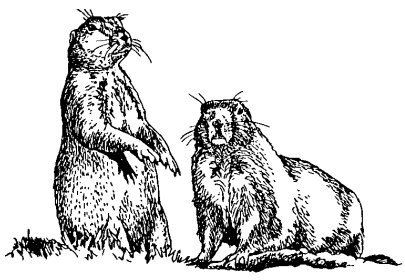
For restocking purposes, river otters can be caught in live traps, modified No. 1 1/2 soft-catch traps, and No. 11 longspring traps.

### Shooting

If nonlethal approaches cannot be employed, shooting with shotgun or small-caliber rifle can be effective in damage situations that involve only one or two otters.

## Identification

River otters (*Lutra canadensis*, Fig. 1) are best known for their continuous and playful behavior, their aesthetic value, and the value of their durable, high-quality fur. They have long, streamlined bodies, short legs, and a robust, tapered tail, all of which are well adapted to their mostly aquatic habitat. They have prominent whiskers just behind and below the nose, thick muscular necks and shoulders, and feet that are webbed between the toes. Their short but thick, soft fur is brown to almost black except on the chin, throat, cheeks, chest, and occasionally



**PREVENTION AND CONTROL OF WILDLIFE DAMAGE — 1994**

**Cooperative Extension Division**
**Institute of Agriculture and Natural Resources**
**University of Nebraska - Lincoln**

**United States Department of Agriculture**
**Animal and Plant Health Inspection Service**
**Animal Damage Control**

**Great Plains Agricultural Council**
**Wildlife Committee**

**C-109**

Fig. 2. Distribution of the river otter in North America.

the belly, where it is usually lighter, varying from brown to almost beige.

Adult males usually attain lengths of nearly 48 inches (122 cm) and weights of about 25 pounds (11.3 kg), but may reach 54 inches (137 cm) and 33 pounds (15 kg). Their sex can be readily distinguished by the presence of a baculum (penile bone). Females have 4 mammae on the upper chest and are slightly smaller than males. Female adults measure about 44 inches (112 cm) and weigh 19 pounds (8.6 kg). The mean weights and sizes of river otters in southern latitudes tend to be lower than those in latitudes farther north.

## Range and Habitat

River otters occur throughout North America except the arctic slopes, the arid portions of the Southwest, and the intensive agricultural and industrialized areas of the midwestern United States (Fig. 2). Their precolonial range apparently included all of North America except the arid Southwest and the northernmost portions of Alaska and Canada. Otter populations are confined to water courses, lakes, and wetlands, and therefore, population densities are lower than those of terrestrial species. Their extirpation from many areas is believed to have been related more to poisoning by pesticides bio-magnified in fishes, and to the indirect adverse effects of water pollution on fish, their main food, than to excessive harvest. The loss of ponds and other wetland habitat that resulted from the extirpation of beaver in the late 1800s may have adversely affected continental populations of river otters more than any other factor. Increases in the range and numbers of river otters in response to the return of beaver has been dramatic, particularly in the southeastern United States. Recent releases totaling more than 1,000 otters have been made in Arizona, Colorado, Iowa, Kansas, Kentucky, Missouri, Nebraska, Oklahoma, Pennsylvania, Tennessee, and West Virginia in efforts to reestablish local populations.

River otters are almost invariably associated with water (fresh, brackish, and salt water), although they may travel overland for considerable distances. They inhabit lakes, rivers, streams, bays, estuaries, and associated riparian habitats. They occur at much higher densities in regions of the Great Lakes, in brackish marshes and inlets, and in other coastal habitats than farther inland. In colder climates, otters frequent rapids and waterfall areas that remain ice-free. Vegetative cover and altitude do not appear to influence the river otter's distribution as much as do good or adequate water quality, the availability of forage fish, and suitable denning sites.

## Food Habits

The diet of the river otter throughout its range is primarily fish. Numerous species and varieties of fresh and anadromous fishes are eaten, but shellfish, crayfish, amphibians, and reptiles are also frequently eaten, as are several species of crabs in coastal marshes. Mammals and birds are rarely eaten. Consumption of game fishes in comparison to nongame (rough) fishes is generally in proportion to the difficulty, or ease, with which they can be caught. Because of the availability of abundant alternate food species in warm water, losses of the warm water sport fishes are believed minor compared to losses river otters can inflict on cold water species such as trout and salmon.

## General Biology, Reproduction, and Behavior

The reproductive biology of river otters and all other weasels is complex because of a characteristic known as delayed implantation. Following breeding and fertilization in spring, eggs (blastocysts) exist in a free-floating state until the following winter or early spring. Once they implant, fetal growth lasts 60 to 65 days until the kits are born, usually in spring (March through May) in most areas. In the southern portion of the range the dates of birth occur earlier, mostly in January and February, implying implantation in November and December. Litters usually contain 2 to 4 kits, and the female alone cares for the young. They usually remain together as a family group though the fall and into the winter months. Sexual maturity in young is believed to occur at about 2 years of age in females, but later in males.

River otters are chiefly nocturnal, but they frequently are active during daylight hours in undisturbed areas. Socially, the basic group is the female and her offspring. They spend much of their time feeding and at what appears to be group play, repeatedly sliding down steep banks of mud or snow. They habitually use specific sites (toilets) for defecation. Their vocalizations include chirps, grunts, and loud piercing screams. They are powerful swimmers and are continuously active, alert, and quick—characteristics that give them immense aesthetic and recreational value. Their webbed feet, streamlined bodies, and long, tapered tails enable them to move through water with agility, grace, and speed. Seasonally, they may travel distances of 50 to 60 miles (80 to 96 km) along streams or lake shores, and their home ranges may be as large as 60 square miles (155 $km^2$). Males have been recorded to travel up to 10 miles (16 km) in 1 night.

River otters use a variety of denning sites that seem to be selected based on availability and convenience. Hollow

logs, rock crevices, nutria houses, and abandoned beaver lodges and bank dens are used. They will also frequent unused or abandoned human structures or shelters. Natal dens tend to be located on small headwater branches or streams leading to major drainages or lakes.

## Damage and Damage Identification

The presence of river otter(s) around or in a fish hatchery, aquaculture, or fish culture facility is a good indication that a damage problem is imminent. Otter scats or toilets that contain scales, exoskeletons, and other body parts of the species being produced is additional evidence that damage is ongoing. Uneaten parts of fish in shallow water and along the shore is evidence that fish are being taken. Otters usually eat all of a small catfish except for the head and major spines, whereas small trout, salmon, and many of the scaled fishes may be totally eaten. Uneaten carcasses with large puncture holes are likely attributable to herons. River otters can occasionally cause substantial damage to concentrations of fishes in marine aquaculture facilities. Often the damage involves learned feeding behavior by one or a family of otters.

## Legal Status

The river otter is listed in Appendix II of the Convention on International Trade in Endangered Species of Flora and Fauna (CITES). Its inclusion in this appendix subjects it to international restrictions and state/province export quotas because of its resemblance to the European Otter. Moreover, the river otter is totally protected in 17 states. Twenty-seven states have trapping seasons, and four states and two provinces have hunting seasons.

## Damage Prevention and Control Methods

Because river otter damage has been minor compared to that of other species, and because of its legal status under the CITES Agreement, little control research and experimentation has been done. Registration of repellents, toxicants, or fumigants for river otter control has not been sought. Alternate aquacultural practices and species, predator avoidance behavior, and use of protective habitat have not been fully explored. Careful assessment should be made of reported damage to determine if nonlethal preventative measures can be employed, and to ensure that if any lethal corrective measures are employed, they do not violate state or federal laws. Damage problems should then be approached on an individual basis. Cultural methods and habitat modification are normally not applicable. Opportunities to use repellents, toxicants, fumigants, and frightening devices are infrequent, yet the development of any of these or other effective nonlethal approaches would be preferable to lethal control measures.

### Exclusion

Fencing with 3 x 3-inch (7.6 x 7.6-cm) or smaller mesh wire can be an economically effective method of preventing damage at aquacultural sites that are relatively small, or where fish or aquaculture activities are concentrated. Fencing is more economical for protection of small areas where research, experimental, or propagation facilities such as raceways, tanks, ponds, or other facilities hold concentrations of fish. Hog wire-type fences have also been used effectively, but these should be checked occasionally to ensure that the lower meshes have not been spread apart or raised to allow otters to enter.

Electric fences have also been used, but they require frequent inspection and maintenance, and like other fencing, are usually impractical for protecting individual small ponds, raceways, or tanks in a series. They are of greater utility as a supplement to perimeter fences surrounding an aquaculture facility.

### Trapping

Traps that have been used effectively for river otters include the Conibear® (sizes 220 and 330) or other similar body-gripping traps and leghold traps (modified No. 1 1/2 soft-catch and No. 11 double longspring). The latter two are usually employed to capture river otters for restocking purposes. In water, body-gripping traps are usually placed beneath the water surface or partially submerged where runs become narrow or restricted (Fig. 3). They are effective when partially submerged at dam crossings, the main runs in beaver ponds, or other locations where otters frequently leave the water. Body-gripping traps are also effective in otter trails that connect pools of water or that cross small peninsulas. In these sets, the trap should

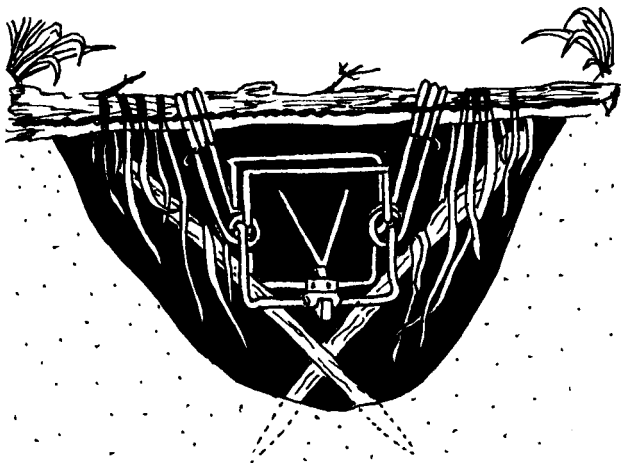


Fig. 3. Body-gripping trap suspended with a pole through the spring loops in a channel set to capture a river otter.

be placed at a height to blend with the surrounding vegetation to catch an otter that is running or sliding. After ice forms on the surface of streams and lakes, some trappers bait the triggers of body-gripping traps with whole fish. River otter trapping is prohibited in 21 states and one Canadian province. Check local regulations before trapping.

Most of the wild otters used for restocking in recent years were caught with No. 11 longspring traps in coastal Louisiana. These animals were usually caught in sets for nutria, in traps that were set in narrow trails and pullouts where shallow water necessitated that otters walk rather than swim. Leghold traps are also effective when placed in shallow edges of trails leading to otter toilets or other areas they frequent. Leghold traps set in out-of-water trails and peninsula crossings should be covered with damp leaves or other suitable covering.

With the depression of fur prices, nuisance beaver problems and efforts to control them have increased substantially throughout the United States. The killing of otters during beaver control trapping can be minimized by using snares, but they do occasionally sustain moderate injuries. In most situations, snared river otters can be released unharmed. Accordingly, snares are neither the most effective, nor the most convenient devices for capturing river otters or removing them from an area, and therefore are not recommended for either.

### Shooting

Shooting the offending otters that cause damage problems will often effectively prevent continued losses. Although otters are shy, they are inquisitive and will often swim within close range of a small rifle or shotgun. Extreme caution should be taken to avoid ricochet when shooting a rifle at objects surrounded by water.

Shooting river otters for fur harvest is legal in four states and one Canadian province. Check your local, state, and federal laws and permits governing shooting, the use of lights after dark, the seasons, and the possession of otter carcasses or parts, to ensure that planned activities are legal.

## Economics of Damage and Control

Although individual incidences of river otter damage and predation on fish can cause substantial losses to pond owners and to fresh water and marine aquacultural interests, their total effects are believed to be insignificant. Given the otter's aesthetic and recreational value, and its current legal status, consideration of broad control programs are unwarranted and undesirable.

## Acknowledgments

Figure 1 from Schwartz and Schwartz (1981).

Figure 2 from Toweill and Tabor (1982), adapted by Dave Thornhill, University of Nebraska-Lincoln.

Figure 3 by Clint Chapman, University of Nebraska-Lincoln.

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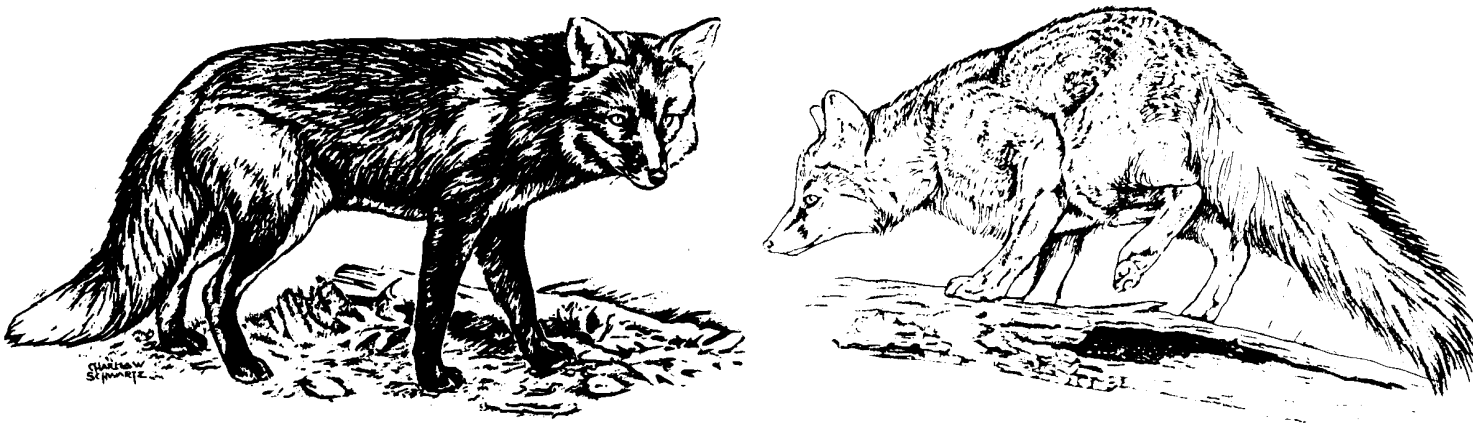
# FOXES

Fig. 1. Red fox, *Vulpes vulpes* (left) and gray fox, *Urocyon cinereoargenteus* (right).



## Damage Prevention and Control Methods

### Exclusion

Net wire fence.

Electric fence.

### Cultural Methods

Protect livestock and poultry during most vulnerable periods (for example, shed lambing, farrowing pigs in protective enclosures).

### Frightening

Flashing lights and exploders may provide temporary protection.

Well-trained livestock guarding dogs may be effective in some situations.

### Repellents

None are registered for livestock protection.

### Toxicants

M-44® sodium cyanide mechanical ejection device, in states where registered.

### Fumigants

Gas cartridges for den fumigation, where registered.

### Trapping

Steel leghold traps.

Cage or box traps.

Snares.

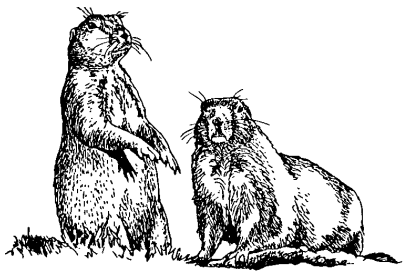
### Shooting

Predator calling techniques.

Aerial hunting.

### Other Methods

Den hunting. Remove young foxes from dens to reduce predation by adults.



**PREVENTION AND CONTROL OF WILDLIFE DAMAGE — 1994**

**Cooperative Extension Division**
**Institute of Agriculture and Natural Resources**
**University of Nebraska - Lincoln**

**United States Department of Agriculture**
**Animal and Plant Health Inspection Service**
**Animal Damage Control**

**Great Plains Agricultural Council**
**Wildlife Committee**

## Identification

The red fox (*Vulpes vulpes*) is the most common of the foxes native to North America. Most depredation problems are associated with red foxes, although in some areas gray foxes (*Urocyon cinereoargenteus*) can cause problems. Few damage complaints have been associated with the swift fox (*V. velox*), kit fox (*V. macrotis*), or Arctic fox (*Alopex lagopus*).

The red fox is dog-like in appearance, with an elongated pointed muzzle and large pointed ears that are usually erect and forward. It has moderately long legs and long, thick, soft body fur with a heavily furred, bushy tail (Fig. 1). Typically, red foxes are colored with a light orange-red coat, black legs, lighter-colored underfur and a white-tipped tail. Silver and cross foxes are color phases of the red fox. In North America the red fox weighs about 7.7 to 15.4 pounds (3.5 to 7.0 kg), with males on average 2.2 pounds (1 kg) heavier than females.

Gray foxes weigh 7 to 13 pounds (3.2 to 5.9 kg) and measure 32 to 45 inches (81 to 114 cm) from the nose to the tip of the tail (Fig. 1). The color pattern is generally salt-and-pepper gray with buffy underfur. The sides of the neck, back of the ears, legs, and feet are rusty yellow. The tail is long and bushy with a black tip.

Other species of foxes present in North America are the Arctic fox, swift fox, and kit fox. These animals are not usually associated with livestock and poultry depredation because they typically eat small rodents and lead a secretive life in remote habitats away from people, although they may cause site-specific damage problems.

## Range

Red foxes occur over most of North America, north and east from southern California, Arizona, and central Texas. They are found throughout most of the United States with the exception of a few isolated areas (Fig. 2).

Gray foxes are found throughout the eastern, north central, and southwestern United States They are found throughout Mexico and most of the southwestern United States from California northward through western Oregon (Fig. 3).

Kit foxes are residents of arid habitats. They are found from extreme southern Oregon and Idaho south along the Baja Peninsula and eastward through southwestern Texas and northern Mexico (Fig. 4).

The present range of swift foxes is restricted to the central high plains. They are found in Kansas, the Oklahoma panhandle, New Mexico, Texas, Nebraska, South Dakota, Wyoming, and Colorado (Fig. 4).

As its name indicates, the Arctic fox occurs in the arctic regions of North America and was introduced on a number of islands in the Aleutian chain.

## Habitat

The red fox is adaptable to most habitats within its range, but usually prefers open country with moderate cover. Some of the highest fox densities reported are in the north-central United States, where woodlands are interspersed with farmlands. The range of the red fox has expanded in recent years to fill habitats formerly occupied by coyotes (*Canis latrans*). The reduction of coyote numbers in many sagebrush/grassland areas of Montana and Wyoming has resulted in increased fox numbers. Red foxes have also demonstrated their adaptability by establishing breeding populations in many urban areas of the United States, Canada, and Europe. Gray foxes prefer more dense cover such as thickets, riparian areas, swamp land, or rocky pinyon-cedar ridges. In eastern North America, this species is closely associated with edges of deciduous forests. Gray foxes can also be found in urban areas where suitable habitat exists.

Fig. 2. Range of the red fox in North America.

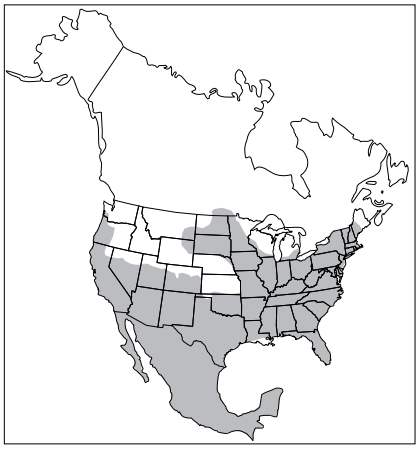


Fig. 3. Range of the gray fox in North America.

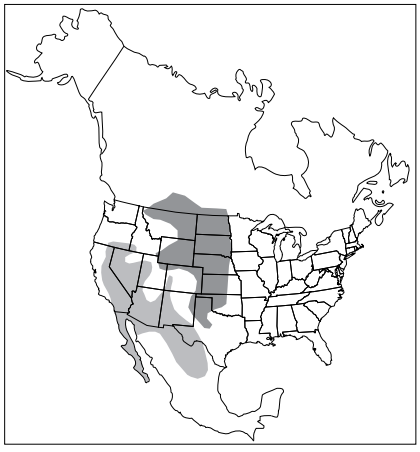


Fig 4. Range of the swift fox (dark) and the kit fox (light) in North America..

## Food Habits

Foxes are opportunists, feeding mostly on rabbits, mice, bird eggs, insects, and native fruits. Foxes usually kill animals smaller than a rabbit, although fawns, pigs, kids, lambs, and poultry are sometimes taken. The fox's keen hearing, vision, and sense of smell aid in detecting prey. Foxes stalk even the smallest mice with skill and patience. The stalk usually ends with a sudden pounce onto the prey. Red foxes sometimes kill more than they can eat and bury food in caches for later use. All foxes feed on carrion (animal carcasses) at times.

## General Biology, Reproduction, and Behavior

Foxes are crepuscular animals, being most active during the early hours of darkness and very early morning hours. They do move about during the day, however, especially when it is dark and overcast.

Foxes are solitary animals except from the winter breeding season through midsummer, when mates and their young associate closely. Foxes have a wide variety of calls. They may bark, scream, howl, yap, growl, or make sounds similar to a hiccup. During winter a male will often give a yelling bark, "wo-wo-wo," that seems to be important in warning other male foxes not to intrude on its territory. Red foxes may dig their own dens or use abandoned burrows of a woodchuck or badger. The same dens may be used for several generations. Gray foxes commonly use wood piles, rocky outcrops, hollow trees, or brush piles as den sites. Foxes use their urine and feces to mark their territories.

Mating in red foxes normally occurs from mid-January to early February. At higher latitudes (in the Arctic) mating occurs from late February to early March. Estrus in the vixen lasts 1 to 6 days, followed by a 51- to 53-day gestation period. Fox pups can be born from March in southern areas to May in the arctic zones. Red foxes generally produce 4 to 9 pups. Gray foxes usually have 3 to 7 pups per litter. Arctic foxes may have from 1 to 14 pups, but usually have 5 or 6. Foxes disperse from denning areas during the fall months and establish breeding areas in vacant territories, sometimes dispersing considerable distances.

## Damage and Damage Identification

Foxes may cause serious problems for poultry producers. Turkeys raised in large range pens are subject to damage by foxes. Losses may be heavy in small farm flocks of chickens, ducks, and geese. Young pigs, lambs, and small pets are also killed by foxes. Damage can be difficult to detect because the prey is usually carried from the kill site to a den site, or uneaten parts are buried. Foxes usually attack the throat of young livestock, but some kill by inflicting multiple bites to the neck and back. Foxes do not have the size or strength to hold adult livestock or to crush the skull and large bones of their prey. They generally prefer the viscera and often begin feeding through an entry behind the ribs. Foxes will also scavenge carcasses, making the actual cause of death difficult to determine.

Pheasants, waterfowl, other game birds, and small game mammals are also preyed upon by foxes. At times, fox predation may be a significant mortality factor for upland and wetland birds, including some endangered species.

Rabies outbreaks are most prevalent among red foxes in southeastern Canada and occasionally in the eastern United States. The incidence of rabies in foxes has declined substantially since the mid-1960s for unexplained reasons. In 1990, there were only 197 reported cases of fox rabies in the United States as compared to 1,821 for raccoons and 1,579 for skunks. Rabid foxes are a threat to humans, domestic animals, and wildlife.

## Legal Status

Foxes in the United States are listed as furbearers or given some status as game animals by most state governments. Most states allow for the taking of foxes to protect private property. Check with your state wildlife agency for regulations before undertaking fox control measures.

## Damage Prevention and Control Methods

### Exclusion

Construct net wire fences with openings of 3 inches (8 cm) or less to exclude red foxes. Bury the bottom of the fence 1 to 2 feet (0.3 m to 0.9 m) with an apron of net wire extending at least 12 inches (30 cm) outward from the bottom. A top or roof of net wire may also be necessary to exclude all foxes, since some will readily climb a fence.

A 3-wire electric fence with wires spaced 6 inches, 12 inches, and 18 inches (15 cm, 31 cm, and 46 cm) above the ground can repel red foxes. Combination fences that incorporate net and electric wires are also effective.

### Cultural Methods

The protection of livestock and poultry from fox depredation is most important during the spring denning period when adults are actively acquiring prey for their young. Watch for signs of depredation during the spring, especially if there is a history of fox depredation. Foxes, like other wild canids, will often return to established denning areas year after year. Foxes frequently den in close proximity to human habitation. Dens may be located close to farm buildings, under haystacks or patches of cover, or even inside hog lots or small pastures used for lambing. Because of the elusive habits of foxes, dens in these locations may not be noticed until excessive depredations have occurred.

The practice of shed lambing and farrowing in protected enclosures can be useful in preventing fox depredation on young livestock. Also, removal of

livestock carcasses from production areas can make these areas less attractive to predators.

**Frightening**

Foxes readily adapt to noise-making devices such as propane exploders, timed tape recordings, amplifiers, or radios, but such devices may temporarily reduce activity in an area.

Flashing lights, such as a rotating beacon or strobe light, may also provide temporary protection in relatively small areas or in livestock or poultry enclosures. Combinations of frightening devices used at irregular intervals should provide better protection than use of a single device because animals may have more difficulty in adapting to these disturbances.

When properly trained, some breeds of dog, such as Great Pyrenees and Akbash dogs, have been useful in preventing predation on sheep. The effectiveness of dogs, even the "guard dog" breeds, seems to depend entirely on training and the individual disposition of the dog.

**Toxicants**

The M-44®, a sodium cyanide mechanical ejection device, is registered for control of red and gray foxes nationwide by USDA-APHIS-ADC personnel, and in some states by certified pesticide applicators. Information on the safe, effective use of sodium cyanide is available from the appropriate state agency charged with the registration of pesticides. M-44s are generally set along trails and at crossings regularly used by foxes.

**Fumigants**

Gas cartridges made by USDA-APHIS-ADC are registered for fumigating the dens of coyotes, pocket gophers, ground squirrels, and other burrowing rodents. Special Local Needs permits 24(c) are available in North and South Dakota and Nebraska for gas cartridge fumigation of fox dens. State and local regulations should be consulted before using den fumigants.

**Trapping**

Trapping is a very effective and selective control method. A great deal of expertise is required to effectively trap foxes. Trapping by inexperienced people may serve to educate foxes, making them very difficult to catch, even by experienced trappers. Traps suitable for foxes are the Nos. 1 1/2, 1 3/4, and 2 double coilspring trap and the Nos. 2 and 3 double longspring trap. Traps with offset and padded jaws cause less injury to confined animals and facilitate the release of nontarget captures. State and provincial wildlife agencies regulate the traps and sets that can be used for trapping. Consult your local agency personnel for restrictions that pertain to your area.

Proper set location is important when trapping foxes. Sets made along trails, at entrances to fields, and near carcasses are often most productive (Fig. 5). Many different sets are successful, and can minimize the risk of nontarget capture. One of the best is the dirt-hole set (Fig. 6). Dig a hole about 6 inches (15 cm) deep and 3 inches (8 cm) in diameter at a downward angle just behind the spot where the trap is to be placed. Four to five drops of scent should be placed in the back of the hole. Move back from the bait hole and dig a hole 2 inches (5 cm) deep that is large enough to accommodate the trap and chain. Fasten the trap chain to a trap stake with a chain swivel and drive the stake directly under the place where the trap is set. Fold and place the chain under or beside the trap. Set the trap about 1/2 inch (1.3 cm) below the ground. Adjust the tension device on the trap to eliminate the capture of lighter animals. When the set is completed, the pan of the trap should be approximately 5 inches (13 cm) from the entrance of the hole with the pan slightly offset from the center of the hole (Fig. 6). Cover

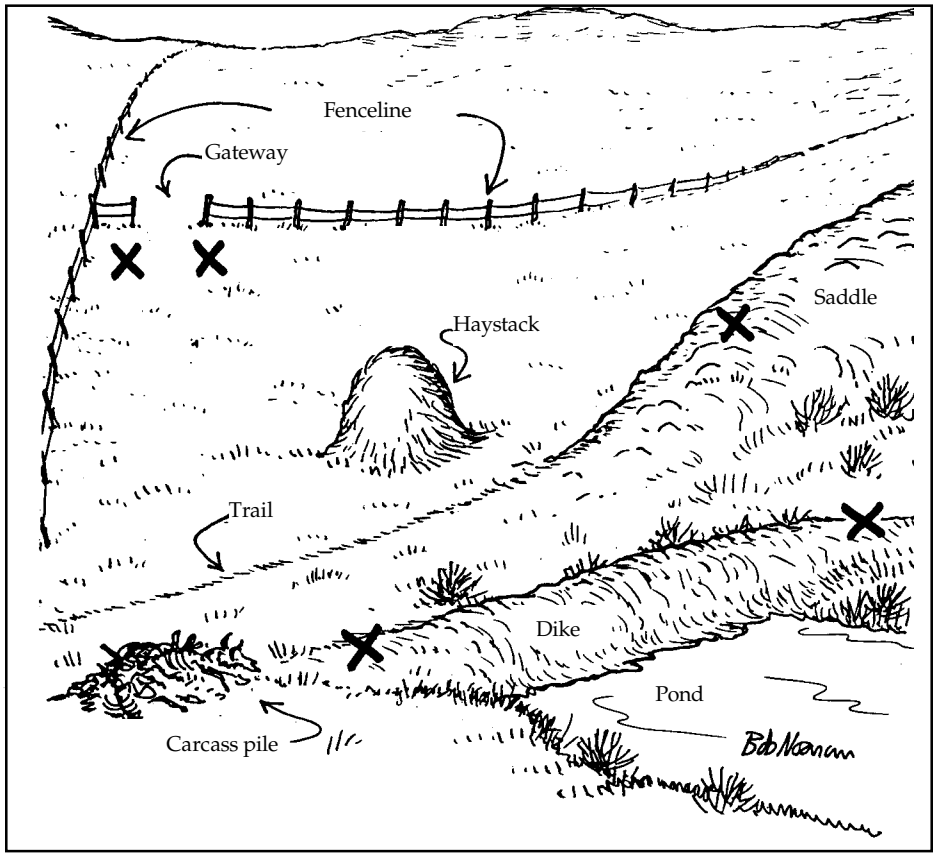



Fig. 5. Good locations for setting leghold traps for foxes.

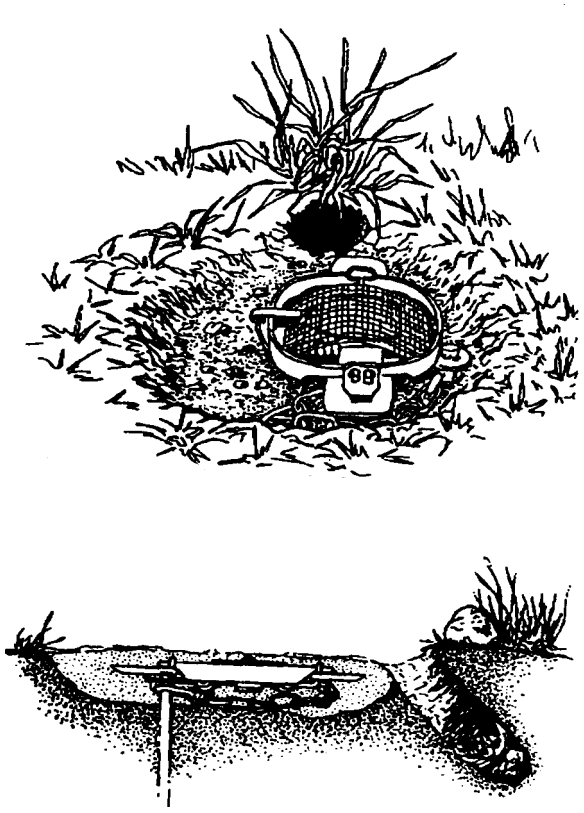


Fig. 6. A dirt-hole set showing proper trap placement.

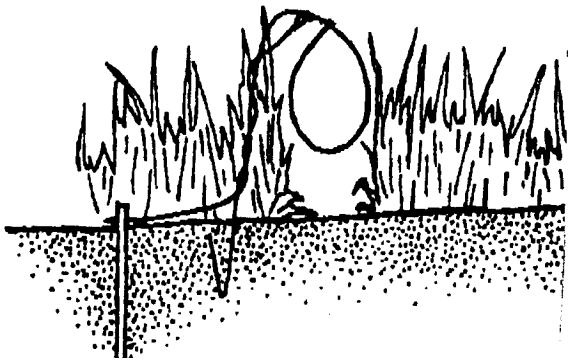


Fig. 7. Properly set neck snare for foxes.

the area between the jaws and over the trap pan with a piece of waxed paper, light canvas, or light screen wire. The trap must be firmly placed so that it does not move or wobble. The entire trap should be covered lightly with sifted soil up to the original ground level.

Fox scents and lures can be homemade, but this requires some knowledge of scent making as described in various trapping books. Commercial trap scents can be purchased from most trapping suppliers (see **Supplies and Materials**). Experiment with various baits and scents to discover the combination of odors that will be most appropriate for your area.

Equipment needed for trapping foxes includes traps, a sifter with a 3/16- or 1/2-inch screen (0.5 or 1.3 cm), trap stakes, trowel, gloves (which should be used only for trapping), a 16- to 20-ounce (448- to 560-g) carpenter's hammer with straight claws, and a bottle of scent. Remove the factory oil finish on the traps by boiling the traps in water and vinegar or by burying the traps in moist soil for one to two weeks until lightly rusted. The traps should then be dyed with commercially available trap dye to prevent further corrosion. Do not allow the traps and other trapping equipment to come in contact with gasoline, oil, or other strong-smelling and contaminating materials. Cleanliness of equipment is absolutely necessary for consistent trapping success.

Cage traps are sometimes effective for capturing juvenile red foxes living in urban areas. It is uncommon to trap an adult red fox in a cage or a box trap; however, kit and swift foxes can be readily captured using this method.

Snares made from 1/16-inch, 5/64-inch, and 3/32-inch (0.15 cm, 0.2 cm, and 0.25 cm) cable can be very effective for capturing both red and gray foxes. Snares are generally set in trails or in crawl holes (under fences) that are frequented by foxes. The standard loop size for foxes is about 6 inches (15 cm) with the bottom of the loop about 10 to 12 inches (25 to 30 cm) above ground level (Fig. 7). Trails leading to

and from den sites and to carcasses being fed on by foxes make excellent locations for snares.

### Shooting

Harvest of foxes by sport hunters and fur trappers is another method of reducing fox populations in areas where damage is occurring. Livestock and poultry producers who have predation problems during the late fall and winter can sometimes find private fur trappers willing to hunt or trap foxes around loss sites. Depredations are usually most severe, however, during the spring when furs are not saleable, and it is difficult to interest private trappers at that time.

Artificial rabbit distress calls can be used to decoy foxes to within rifle or shotgun range. Select a spot that faces into the wind, at the edge of a clearing or under a bush on a slight rise where visibility is good. Blow the call at 1/2- to 1-minute intervals, with each call lasting 5 to 10 seconds. If a fox appears, remain motionless and do not move the rifle or shotgun until ready to shoot. If a fox does not appear in about 20 minutes, move to a new spot and call again.

Aerial hunting can be used in some western states to remove problem foxes. This activity is closely regulated and is usually limited to USDA-APHIS-ADC personnel or individuals with special permits from the state regulatory agency.

### Den Hunting

Fox depredations often increase during the spring whelping season. Damage may be reduced or even eliminated by locating and removing the young foxes from the den. Locate fox dens by observing signs of fox activity and by careful observation during the early and late hours of the day when adult foxes are moving about in search of food. Preferred denning sites are usually on a low rise facing a southerly direction. When fox pups are several weeks old, they will spend time outside the den in the early morning and evening hours. They leave abundant signs of their presence, such as matted vegetation and remnants of food, including bits of bone, feathers, and hair. Frequently used den sites have a distinctive odor.

Fox pups may be removed by trapping or by fumigating the den with gas cartridges if they are registered for your area. In some situations it may be desirable to remove the pups without killing them. The mechanical wire ferret has proved to be effective in chasing the pups from the den without harming them. This device consists of a long piece of smooth spring steel wire with a spring and wooden plug at one end and a handle at the other. This wire is twisted through the den passageways, chasing foxes out of other den openings where they can be captured by hand or with dip nets. Small dogs are sometimes trained to retrieve pups unharmed from dens. Wire-cage box traps placed in the entrance of the den can also be useful for capturing young foxes.

## Acknowledgments

We thank Norman C. Johnson, whose chapter "Foxes" in the 1983 edition of this manual provided much of the information used in this section. F. Sherman Blom, Ronald A. Thompson, and Judy Loven (USDA-APHIS-ADC) provided useful comments.

Figure 1 from Schwartz and Schwartz (1981) adapted by Jill Sack Johnson.

Figures 2, 3, and 4 courtesy of Pam Tinnin.

Figure 5 courtesy of Bob Noonan.

Figures 6 and 7 courtesy of Tom Krause.

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# OPOSSUMS

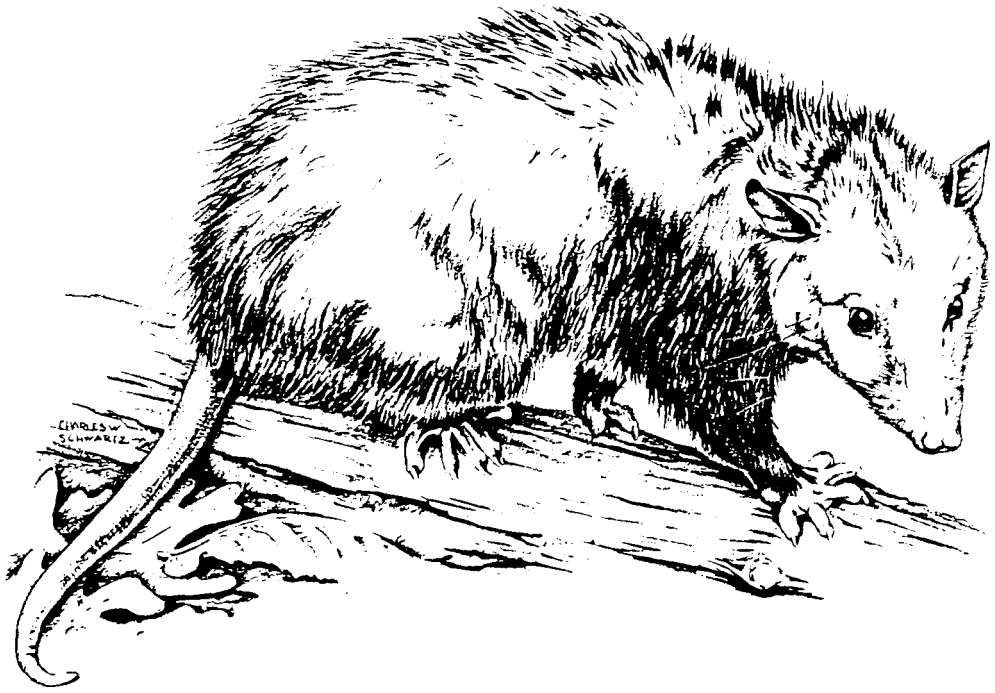


Fig. 1. Opossum, *Didelphis virginiana*

## Damage Prevention and Control Methods

**Exclusion**

Practical where opossums are entering structures.

**Habitat Modification**

Remove cover and plug burrows to reduce frequency of visits by opossums.

**Frightening**

Generally not practical.

**Repellents**

None are registered.

**Toxicants**

None are registered.

**Fumigants**

None are registered.

**Trapping**

Leghold traps.

Box traps.

Cage traps.

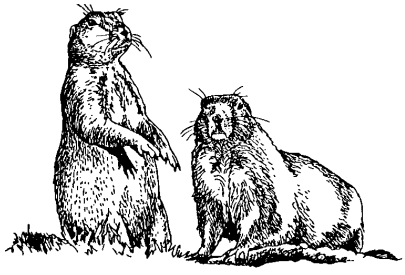
Body-gripping (kill) traps.

**Shooting**

Effective where firearms are permitted. Use a shotgun with No. 6 shot or a .22-caliber rifle.

## Identification

An opossum *(Didelphis virginiana)* is a whitish or grayish mammal about the size of a house cat (Fig. 1). Underfur is dense with sparse guard hairs. Its face is long and pointed, its ears rounded and hairless. Maximum length is 40 inches (102 cm); the ratlike tail is slightly less than half the total length. The tail may be unusually short in northern opossums due to loss by frostbite. Opossums may weigh as much as 14 pounds (6.3 kg); males average 6 to 7 pounds (2.7 to 3.2 kg) and females average 4 pounds (6.3 kg). The skull is usually 3 to 4 inches (8 to 10 cm) long and contains 50 teeth — more than are found in any other North



**PREVENTION AND CONTROL OF WILDLIFE DAMAGE — 1994**

**Cooperative Extension Division**
**Institute of Agriculture and Natural Resources**
**University of Nebraska - Lincoln**

**United States Department of Agriculture**
**Animal and Plant Health Inspection Service**
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**Great Plains Agricultural Council**
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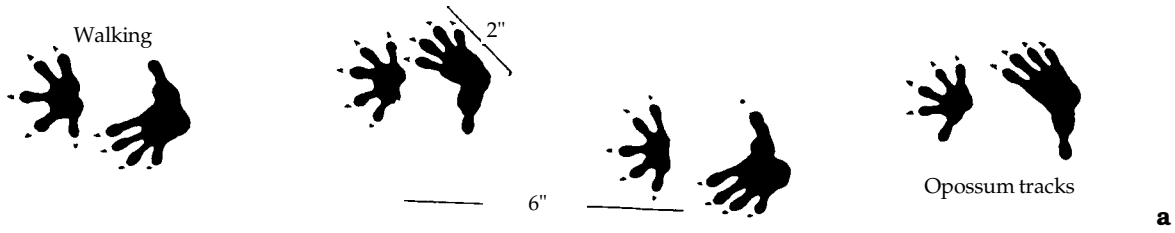




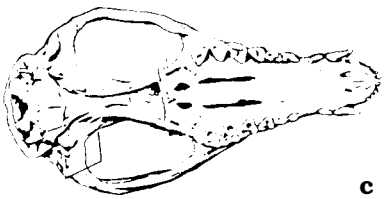



Fig. 2. Opossum sign and characteristics: (a) tracks, (b) droppings, and (c) skull.

American mammal. Canine teeth (fangs) are prominent. Tracks of both front and hind feet look as if they were made by little hands with widely spread fingers (Fig. 2). They may be distinguished from raccoon tracks, in which hind prints appear to be made by little feet. The hind foot of an opossum looks like a distorted hand.

## Range

Opossums are found in eastern, central, and west coast states. Since 1900 they have expanded their range northward in the eastern United States. They are absent from the Rockies, most western plains states, and parts of the northern United States (Fig. 3).

## Habitat

Habitats are diverse, ranging from arid to moist, wooded to open fields. Opossums prefer environments near streams or swamps. They take shelter in burrows of other animals, tree cavities, brush piles, and other cover. They sometimes den in attics and garages where they may make a messy nest.

## Food Habits

Foods preferred by opossums are animal matter, mainly insects or carrion. Opossums also eat considerable amounts of vegetable matter, especially fruits and grains. Opossums living near people may visit compost piles, garbage cans, or food dishes intended for dogs, cats, and other pets.

## General Biology, Reproduction, and Behavior

Opossums usually live alone, having a home range of 10 to 50 acres (4 to 20 ha). Young appear to roam randomly until they find a suitable home range. Usually they are active only at night. The mating season is January to July in warmer parts of the range but may start a month later and end a month earlier in northern areas. Opossums may raise 2, rarely 3, litters per year. The opossum is the only marsupial in North America. Like other marsupials, the blind, helpless young develop in a pouch. They are born 13 days after mating. The young, only 1/2 inch (1.3 cm) long, find their way into the female's pouch where they each attach to one of 13 teats. An average of 7 young are born. They remain in the pouch for 7 to 8 weeks. The young remain with the mother another 6 to 7 weeks until weaned.

Most young die during their first year. Those surviving until spring will breed in that first year. The maximum age in the wild is about 7 years.

Although opossums have a top running speed of only 7 miles per hour (11.3 km/hr), they are well equipped to escape enemies. They readily enter burrows and climb trees. When threatened, an opossum may bare its teeth, growl, hiss, bite, screech, and exude a smelly, greenish fluid from its anal glands. If these defenses are not successful, an opossum may play dead.

When captured or surprised during daylight, opossums appear stupid and inhibited. They are surprisingly

Fig. 3. Range of the opossum in North America.

intelligent, however. They rank above dogs in some learning and discrimination tests.

## Damage

Although opossums may be considered desirable as game animals, certain individuals may be a nuisance near homes where they may get into garbage, bird feeders, or pet food. They may also destroy poultry, game birds, and their nests.

## Legal Status

Laws protecting opossums vary from state to state. Usually there are open seasons for hunting or trapping opossums. It is advisable to contact local wildlife authorities before removing nuisance animals.

## Damage Prevention and Control Methods

### Exclusion

Prevent nuisance animals from entering structures by closing openings to cages and pens that house poultry. Opossums can be prevented from climbing over wire mesh fences by installing a tightly stretched electric fence wire near the top of the fence 3 inches (8 cm) out from the mesh. Fasten garbage can lids with a rubber strap.

### Traps

Opossums are not wary of traps and may be easily caught with suitable-sized box or cage traps (Fig. 4). No. 1 or 1 1/2 leghold traps also are effective. Set traps along fences or trailways. Dirt hole sets or cubby sets are effective (Fig. 5). A dirt hole is about 3 inches (8 cm) in diameter and 8 inches (20 cm) deep. It extends into the earth at a 45° angle. The trap should be set at the entrance to the hole. A cubby is a small enclosure made of rocks, logs, or a box. The trap is set at the entrance to the cubby. The purpose of the dirt hole or cubby is to position the animal so

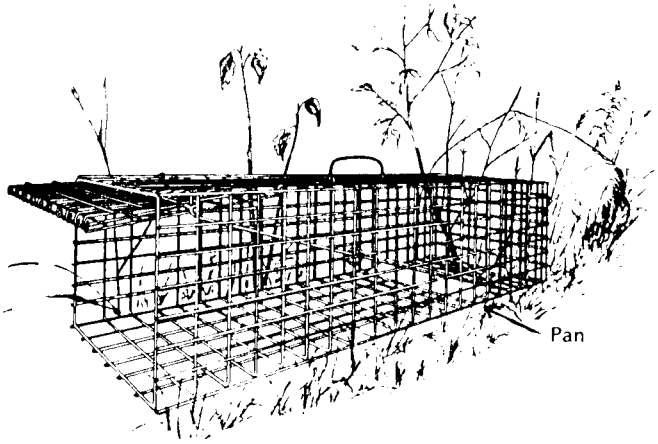
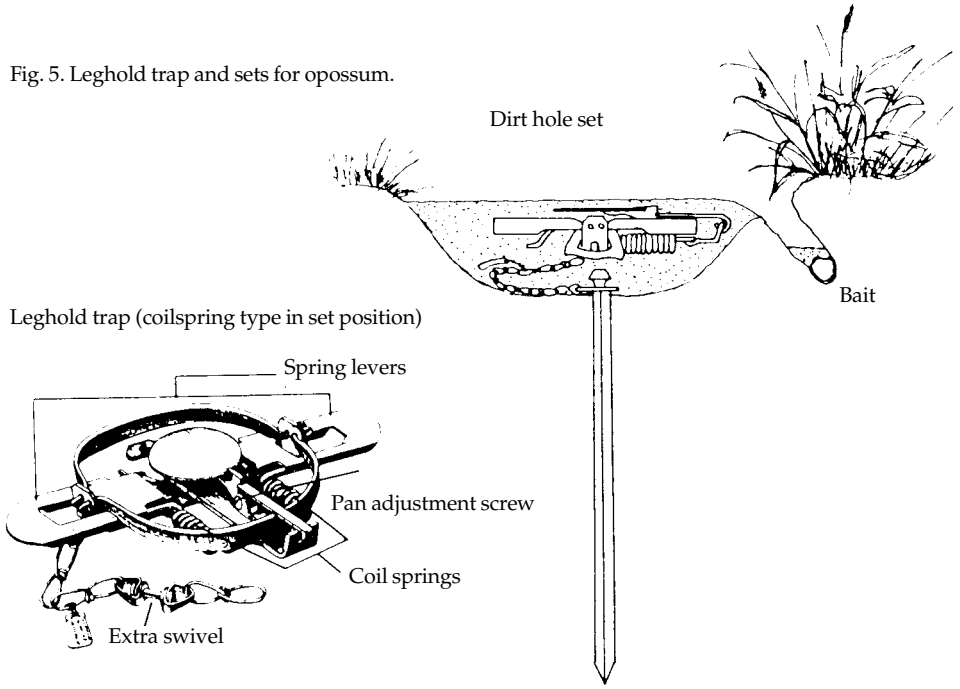
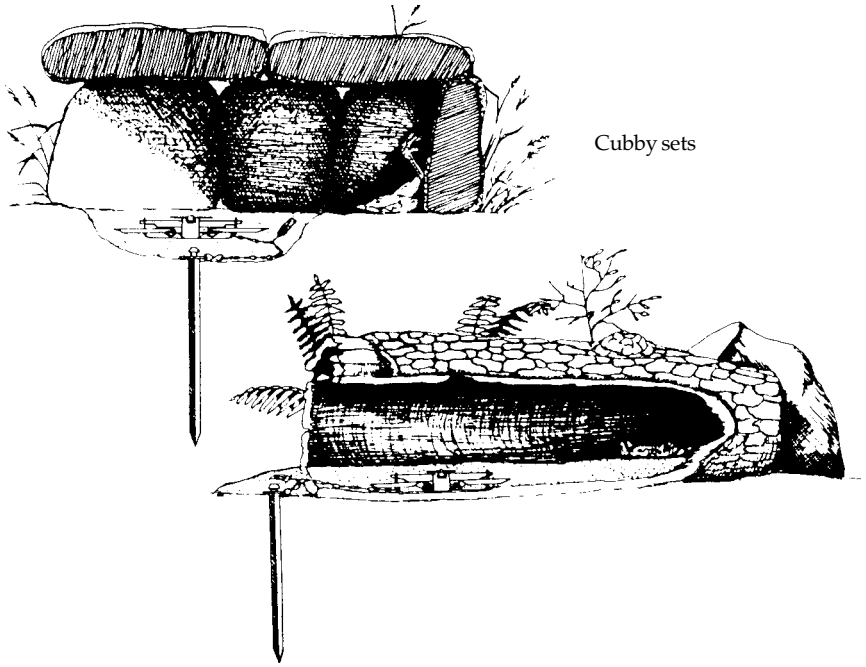



Fig. 4. Cage trap (set position).

Fig. 5. Leghold trap and sets for opossum.

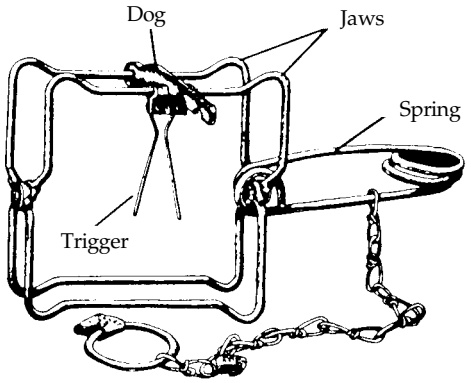


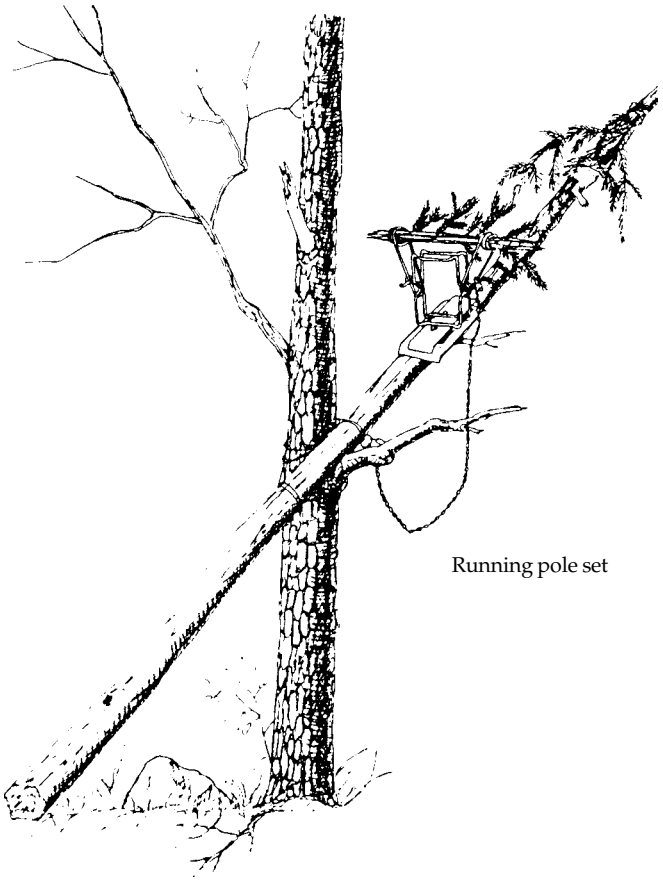
that it will place its foot on the trap. Place bait such as cheese, or slightly spoiled meat, fish, or fruit in the dirt hole or cubby to attract the animal. Using fruit instead of meat will reduce the chance of catching cats, dogs, or skunks.

A medium-sized body-gripping (kill type) trap will catch and kill opossums. Place bait behind the trap in such a way that the animal must pass through the trap to get it. Body-gripping traps kill the captured animal quickly. To reduce chances of catching pets, set the trap above ground on a running pole (Fig. 6).

Fig. 6. Body-gripping trap and running pole set.




Body-gripping trap (set position)



Running pole set

## Shooting

A rifle of almost any caliber or a shotgun loaded with No. 6 shot or larger will effectively kill opossums. Use a light to look for opossums after dark. If an opossum has not been alarmed, it will usually pause in the light long enough to allow an easy shot. Once alarmed, opossums do not run rapidly. They will usually climb a nearby tree where they can be located with a light. Chase running opossums on foot or with a dog. If you lose track, run to the last place where you saw the animal. Stop and listen for the sound of claws on bark to locate the tree the animal is climbing.

Sometimes opossums can be approached quietly and killed by a strong blow with a club, but they can be surprisingly hard to kill in this manner. They can be taken alive by firmly grasping the end of the tail. If the animal begins to "climb its tail" to reach your hand, lower the animal until it touches the ground. This will distract the opossum and cause it to try to escape by crawling. Opossums can carry rabies, so wear heavy gloves and be wary of bites.

Euthanize unwanted animals humanely with carbon dioxide gas, or release them several miles from the point of capture.

## Economics of Damage and Control

No data are available; however, it is usually worthwhile to remove a particular animal that is causing damage.

## Acknowledgments

Much of the information on habitat, food habits, and general biology comes from J. J. McManus (1974) and A. L. Gardner (1982). The manuscript was read and improved by Jim Byford and Robert Timm.

Figures 1, 2a, 2c, and 3 from Schwartz and Schwartz (1981).

Figure 2b by Jill Sack Johnson.

Figures 4, 5, and 6 by Michael D. Stickney, from the New York Department of Environmental Conservation publication "Trapping Furbearers, Student Manual" (1980), by R. Howard, L. Berchielli, C. Parsons, and M. Brown. The figures are copyrighted and are used with permission.

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# RACCOONS

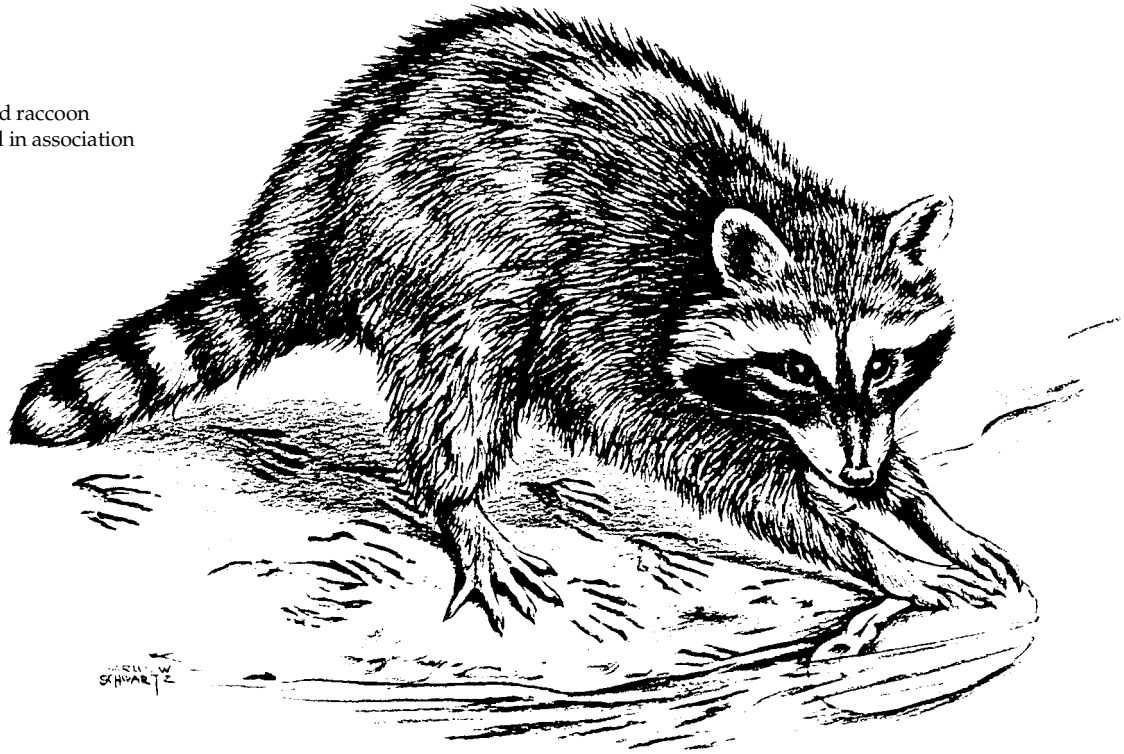



Fig. 1. The distinctively marked raccoon (*Procyon lotor*) is usually found in association with water.

## Damage Prevention and Control Methods

### Exclusion

Usually the best method for coping with almost all types of raccoon damage.

### Habitat Modification

Remove obvious sources of food or shelter around the premises; usually not practical as a sole method of controlling damage.

### Frightening

Several methods may be effective, but only for a short time.

### Repellents, Toxicants, and Fumigants

None are registered.

### Trapping

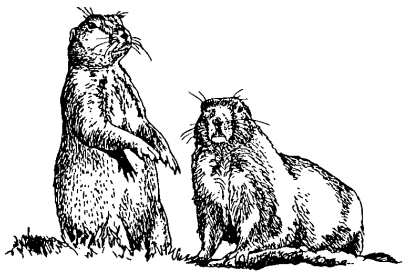
Cage traps, body-gripping, and foothold traps are very effective, especially in conjunction with exclusion and/or habitat modification.

### Shooting

Can be very effective, particularly if trained hounds are used to tree the raccoons. Local regulations may apply.

## Identification

The raccoon (*Procyon lotor*), also called "coon," is a stocky mammal about 2 to 3 feet (61 to 91 cm) long, weighing 10 to 30 pounds (4.5 to 13.5 kg) (rarely 40 to 50 pounds [18 to 22.5 kg]). It is distinctively marked, with a prominent black "mask" over the eyes and a heavily furred, ringed tail (Fig. 1). The animal is a grizzled salt-and-pepper gray and black above, although some individuals are strongly washed with yellow. Raccoons from the prairie areas of the western Great Plains are paler in color than those from eastern portions of the region.



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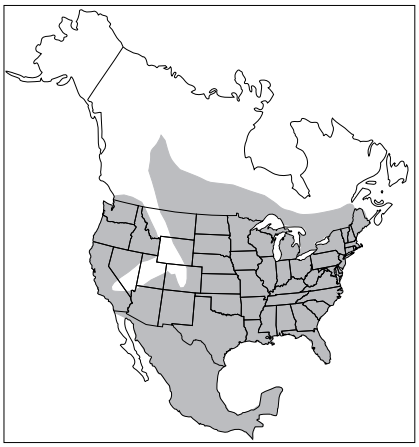


Fig. 2. Distribution of the raccoon in North America.

## Range

The raccoon is found throughout the United States, with the exception of the higher elevations of mountainous regions and some areas of the arid Southwest (Fig. 2). Raccoons are more common in the wooded eastern portions of the United States than in the more arid western plains.

## Habitat

Raccoons prefer hardwood forest areas near water. Although commonly found in association with water and trees, raccoons occur in many areas of the western United States around farmsteads and livestock watering areas, far from naturally occurring bodies of permanent water. Raccoons den in hollow trees, ground burrows, brush piles, muskrat houses, barns and abandoned buildings, dense clumps of cattail, haystacks, or rock crevices.

## General Biology, Reproduction, and Behavior

Raccoons are omnivorous, eating both plant and animal foods. Plant foods include all types of fruits, berries, nuts, acorns, corn, and other types of grain. Animal foods are crayfish, clams, fish, frogs, snails, insects, turtles and their eggs, mice, rabbits, muskrats, and the eggs and young of ground-nesting birds and waterfowl. Contrary to popular myth, raccoons do not always wash their food before eating, although they frequently play with their food in water.

Raccoons breed mainly in February or March, but matings may occur from December through June, depending on latitude. The gestation period is about 63 days. Most litters are born in April or May but some late-breeding females may not give birth until June, July, or August. Only 1 litter of young is raised per year. Average litter size is 3 to 5. The young first open their eyes at about 3 weeks of age. Young raccoons are weaned sometime between 2 and 4 months of age.

Raccoons are nocturnal. Adult males occupy areas of about 3 to 20 square miles (8 to 52 $km^2$), compared to about 1 to 6 square miles (3 to 16 $km^2$) for females. Adult males tend to be territorial and their ranges overlap very little. Raccoons do not truly hibernate, but they do "hole up" in dens and become inactive during severe winter weather. In the southern United States they may be inactive for only a day or two at a time, whereas in the north this period of inactivity may extend for weeks or months. In northern areas, raccoons may lose up to half their fall body weight during winter as they utilize stored body fat.

Raccoon populations consist of a high proportion of young animals, with one-half to three-fourths of fall populations normally composed of animals less than 1 year in age. Raccoons may live as long as 12 years in the wild, but such animals are extremely rare. Usually less than half of the females will breed the year after their birth, whereas most adult females normally breed every year.

Family groups of raccoons usually remain together for the first year and the young will often den for the winter with the adult female. The family gradually separates during the following spring and the young become independent.

## Damage and Damage Identification

Raccoons may cause damage or nuisance problems in a variety of ways, and their distinctive tracks (Fig. 3) often provide evidence of their involvement in damage situations.

Raccoons occasionally kill poultry and leave distinctive signs. The heads of adult birds are usually bitten off and left some distance from the body. The crop and breast may be torn and chewed, the entrails sometimes eaten, and bits of flesh left near water. Young poultry in pens or cages may be killed or injured by raccoons reaching through the wire and attempting to pull the birds back through the mesh. Legs or feet of the young birds may be missing. Eggs may be removed completely from nests or eaten on the spot with only the heavily cracked shell remaining. The lines of fracture will normally be along the long axis of the egg, and the nest materials are often disturbed. Raccoons can also destroy bird nests in artificial nesting structures such as bluebird and wood duck nest boxes.

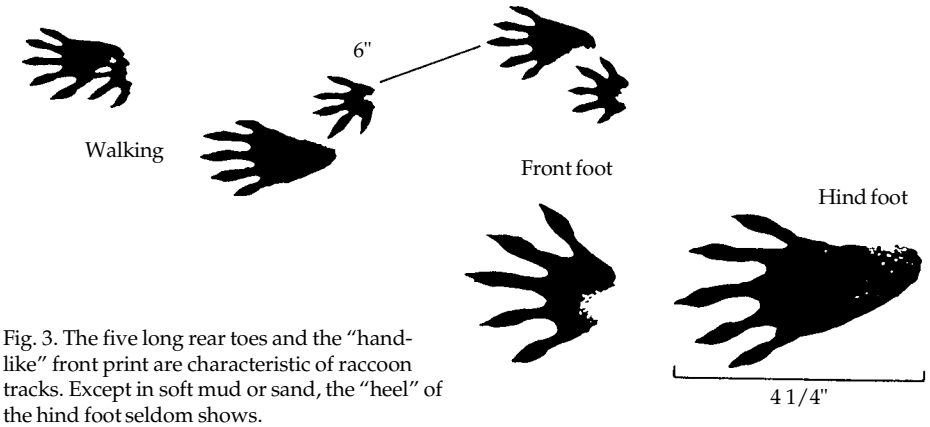



Fig. 3. The five long rear toes and the "hand-like" front print are characteristic of raccoon tracks. Except in soft mud or sand, the "heel" of the hind foot seldom shows.

Raccoons can cause considerable damage to garden or truck crops, particularly sweet corn. Raccoon damage to sweet corn is characterized by many partially eaten ears with the husks pulled back. Stalks may also be broken as raccoons climb to get at the ears. Raccoons damage watermelons by digging a small hole in the melon and then raking out the contents with a front paw.

Raccoons cause damage or nuisance problems around houses and outbuildings when they seek to gain entrance to attics or chimneys or when they raid garbage in search of food. In many urban or suburban areas, raccoons are learning that uncapped chimneys make very adequate substitutes for more traditional hollow trees for use as denning sites, particularly in spring. In extreme cases, raccoons may tear off shingles or facia boards in order to gain access to an attic or wall space.

Raccoons also can be a considerable nuisance when they roll up freshly laid sod in search of earthworms and grubs. They may return repeatedly and roll up extensive areas of sod on successive nights. This behavior is particularly common in mid- to late summer as young raccoons are learning to forage for themselves, and during periods of dry weather when other food sources may be less available.

The incidence of reported rabies in raccoons and other wildlife has increased dramatically over the past 30 years. Raccoons have recently been identified as the major wildlife host of rabies in the United States, primarily due to increased prevalence in the eastern United States.

## Legal Status

Raccoons are protected furbearers in most states, with seasons established for running, hunting, or trapping. Most states, however, have provisions for landowners to control furbearers that are damaging their property. Check with your state wildlife agency before using any lethal controls.


Fig. 4. Electric fencing can be very effective at excluding raccoons from sweet corn or other crops. Two wires are recommended, but one wire 6 inches above the ground may be sufficient. Electric fence chargers are available at farm supply dealers. The fence can be activated at dusk and turned off after daybreak.

## Damage Prevention and Control Methods

### Exclusion

Exclusion, if feasible, is usually the best method of coping with raccoon damage.

Poultry damage generally can be prevented by excluding the raccoons with tightly covered doors and windows on buildings or mesh-wire fences with an overhang surrounding poultry yards. Raccoons are excellent climbers and are capable of gaining access by climbing conventional fences or by using overhanging limbs to bypass the fence. A "hot wire" from an electric fence charger at the top of the fence will greatly increase the effectiveness of a fence for excluding raccoons.

Damage to sweet corn or watermelons can most effectively be stopped by excluding raccoons with a single or double hot-wire arrangement (Fig. 4). The fence should be turned on in the evening before dusk, and turned off after daybreak. Electric fences should be used with care and appropriate caution signs installed. Wrapping filament tape around ripening ears of corn (Fig. 5) or placing plastic bags over the ears is an effective method of reducing raccoon damage to sweet corn. In general, tape or fencing is more effective than bagging. When using tape, it is important to apply the type with glass-yarn filaments embedded within so that the

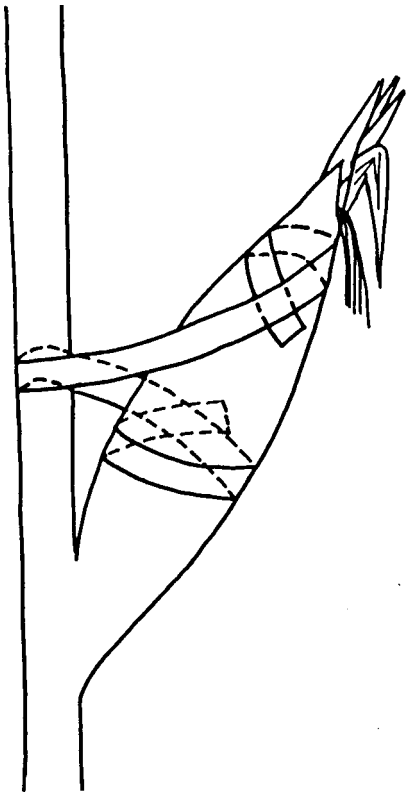


Fig. 5. Wrapping a ripening ear of sweet corn with reinforced filament tape as shown can reduce raccoon damage by 70% to 80%. It is important that each loop of the tape be wrapped over itself so that it forms a closed loop that cannot be ripped open by the raccoon.

raccoons cannot tear through the tape. Taping is more labor-intensive than fencing, but may be more practical and acceptable for small backyard gardens.

Store garbage in metal or tough plastic containers with tight-fitting lids to discourage raccoons from raiding garbage cans. If lids do not fit tightly, it may be necessary to wire, weight, or clamp them down to prevent raccoons from lifting the lid to get at garbage. Secure cans to a rack or tie them to a support to prevent raccoons from tipping them over.

Prevent raccoon access to chimneys by securely fastening a commercial cap of sheet metal and heavy screen over the top of the chimney (Fig. 6). Raccoon access to rooftops can be limited by removing overhanging branches and by wrapping and nailing sheets of slick metal at least 3 feet (90 cm) square around corners of buildings. This prevents raccoons from being able to get a toehold for climbing (Fig. 7). While this method may be practical for outbuildings, it is unsightly and generally unacceptable for homes. It is more practical to cover chimneys or other areas attracting raccoons to the rooftop or to remove the offending individual animals than to completely exclude them from the roof.

Homeowners attempting to exclude or remove raccoons in the spring and summer should be aware of the possibility that young may also be present. Do not complete exclusion procedures until you are certain that all raccoons have been removed from or have left the exclusion area. Raccoons frequently will use uncapped chimneys as natal den sites, raising the young on the smoke shelf or the top of the fireplace box until weaning. Homeowners with the patience to wait out several weeks of scratching, rustling, and chirring sounds will normally be rewarded by the mother raccoon moving the young from the chimney at the time she begins to wean them. Homeowners with less patience can often contact a pest removal or chimney sweep service to physically remove the raccoons. In either case, raccoon exclusion procedures should be completed immediately after the animals have left or been removed.

**Habitat Modification**

There are no practical means of modifying habitat to reduce raccoon depredations, other than removing any obvious sources of food or shelter which may be attracting the raccoons to the premises. Raccoons forage over wide areas, and anything other than local habitat modification to reduce raccoon numbers is not a desirable technique for reducing damage.

Raccoons sometimes will roll up freshly laid sod in search of worms or grubs. If sodded areas are not extensive, it may be possible to pin the rolls

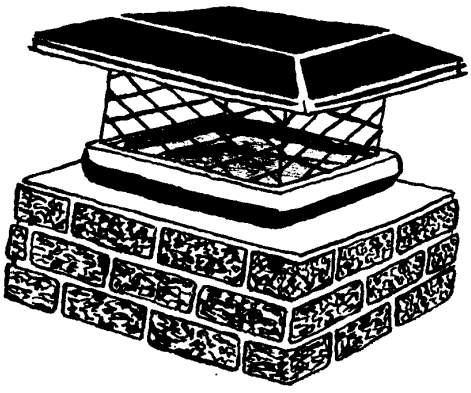


Fig. 6. A cap or exclusion device will keep raccoons and other animals out of chimneys. These are available commercially and should be made of heavy material. Tightly clamp or fasten them to chimneys to prevent raccoons from pulling or tearing them off.

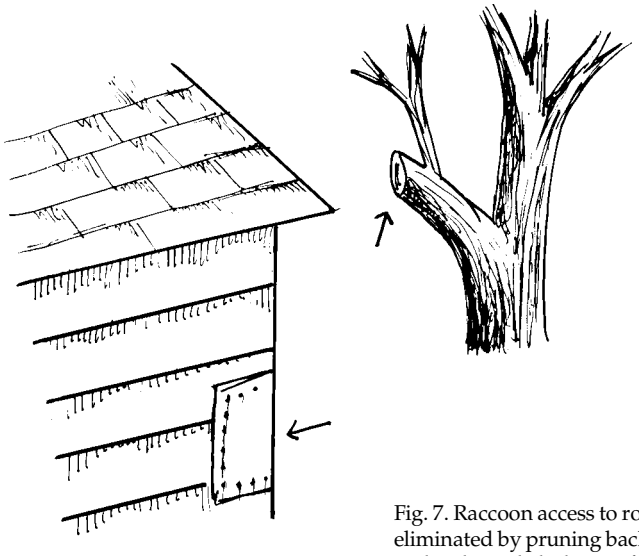


Fig. 7. Raccoon access to rooftops can be eliminated by pruning back overhanging limbs and tacking slick sheets of metal at least 3 feet square around corners of buildings.

down with long wire pins, wooden stakes, or nylon netting until the grass can take root, especially if the damage is restricted to only a portion of the yard, such as a shaded area where the grass is slower to take root. In more rural areas, use of electric fences may be effective (see section on exclusion). Because the sod-turning behavior is most prevalent in mid- to late summer when family groups of raccoons are learning to forage, homeowners may be able to avoid problems by having the sod installed in spring or early summer. In most cases, however, removal of the problem raccoons is usually necessary.

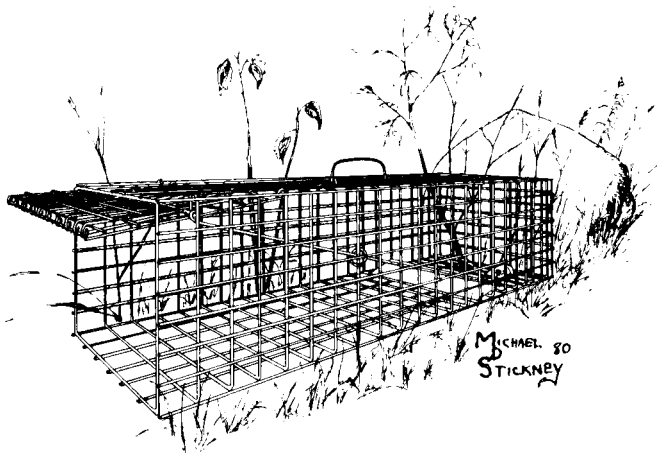



Fig. 8. A cage-type live trap, although bulky and expensive, is often the best choice for removing raccoons near houses or buildings where there is a likelihood of capturing dogs or cats.

**Frightening**

Although several techniques have been used to frighten away raccoons, particularly in sweet corn patches, none has been proven to be effective over a long period of time. These techniques have included the use of lights, radios, dogs, scarecrows, plastic or cloth streamers, aluminum pie pans, tin can lids, and plastic windmills. All of these may have some temporary effectiveness in deterring raccoons, but none will provide adequate long-term protection in most situations.

**Repellents, Toxicants, and Fumigants**

There are no repellents, toxicants, or fumigants currently registered for raccoon control.

**Trapping**

Raccoons are relatively easy to catch in traps, but it takes a sturdy trap to hold one. For homeowners with pets, a live or cage-type trap (Fig. 8) is usually the preferable alternative to a leghold trap. Traps should be at least 10 x 12 x 32 inches (25.4 x 30.5 x 81.3 cm) and well-constructed with heavy materials. They can be baited with canned fish-flavored cat food, sardines, fish, or chicken. Place a pile of bait behind the treadle and scatter a few small bits of bait outside the opening of the trap and just inside the entrance. Traps with a single door should be placed with the back against a wall, tree, or other object. The back portion of the trap should be tightly screened with one-half inch (1.3 cm) or smaller mesh wire to prevent raccoons from reaching through the wire to pull out the bait.

Conibear®-type body-gripping traps are effective for raccoons and can be used in natural or artificial cubbies or boxes. Because these traps do not allow for selective release of nontarget catches, they should not be used in areas where risk of nontarget capture is high. Box or leghold traps should be used in those situations instead. It is possible, however, to use body-gripping traps in boxes or on leaning poles so that they are inaccessible to dogs (Figs. 9 and 10). Check local state laws for restrictions regarding use of Conibear®-type traps out of water.

Raccoons also can be captured in foothold traps. Use a No. 1 or No. 1 1/2 coilspring or stoploss trap fastened to a drag such as a tree limb 6 to 8 feet (1.8 to 2.4 m) long. For water sets, use a drowning wire that leads to deep water. The D-P trap and Egg trap are new foot-holding devices that are highly selective, dog-proof, and show promise for reducing trap-related injury. They are available from trapping supply outlets.

The "pocket set" is very effective for raccoons, and is made along the water's edge where at least a slight bank is present (Fig. 11). Dig a hole

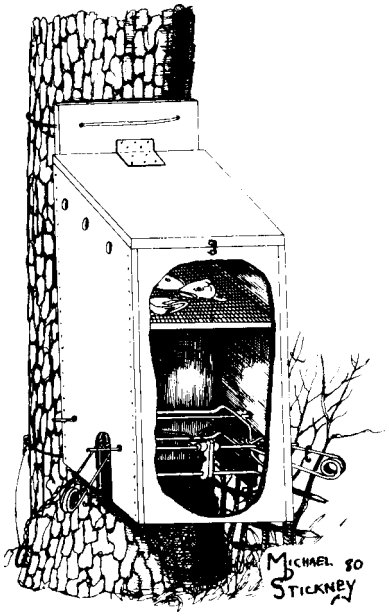
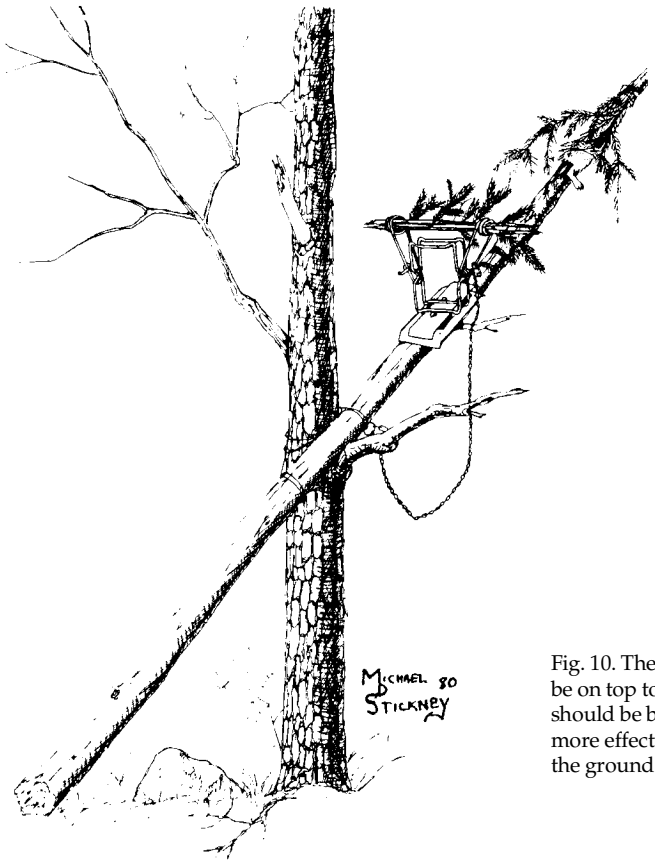



Fig. 9. A "raccoon box" is suspended 6 inches above the ground and is equipped with a Conibear®-type trap. Suspended at this level, this set is dog-proof.



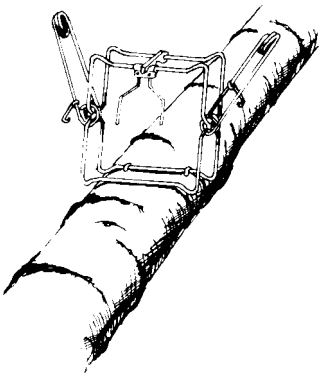



Fig. 10. The leaning-pole set for raccoons is another dog-proof set. The trigger should be on top to prevent the trap from being sprung by squirrels or chipmunks. Bait should be beyond the trap and covered so that it cannot be seen by birds. The set is more effective if a few drops of fish oil or other lure are placed along the pole from the ground level up to the trap.

3 to 6 inches (7.6 to 15.2 cm) in diameter horizontally back into the bank at least 10 to 12 inches (25.4 to 30.5 cm). The bottom 2 inches (5.1 cm) of the hole should be below the water level. Place a bait or lure (fish, frog, anise oil, honey) in the back of the hole, above the water level. Set the trap (a No. 1 or 1 1/2 coilspring, doublejaw or stoploss is recommended) below the water level in front of or just inside the opening. The trap should be tied to a movable drag or attached with a one-way slide to a drowning wire leading to deep water.

Dirt-hole sets (Fig. 12) are effective for raccoons. Place a bait or lure in a small hole and conceal the trap under a light covering of soil in front of the hole. A No. 1 or 1 1/2 coilspring trap is recommended for this set. It is important to use a small piece of clean cloth, light plastic, or a wad of dry grass to

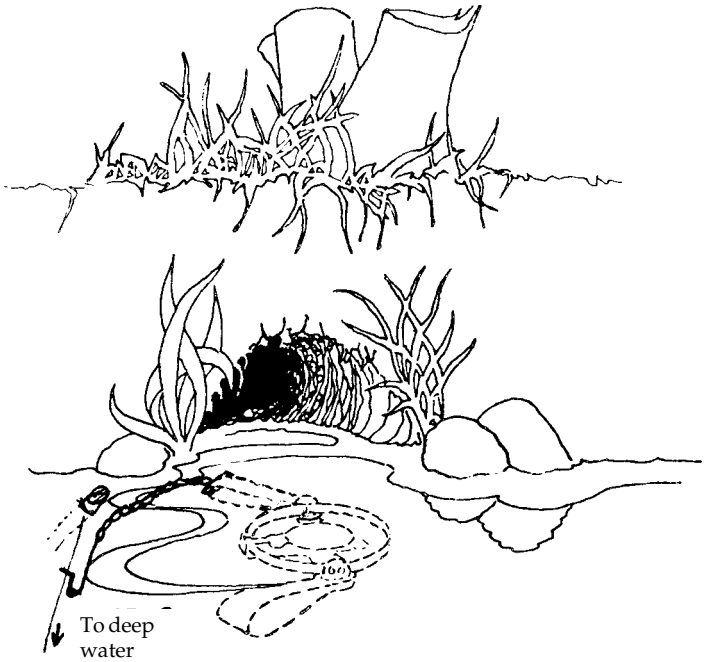



Fig. 11. The pocket set is very effective for raccoons and mink. Place a bait in the back of the hole above the water level and attach the trap to a one-way slide on a drowning wire leading to deep water, or to a movable drag such as a large rock or a section of tree limb 5 to 6 feet long and 3 to 5 inches in diameter.

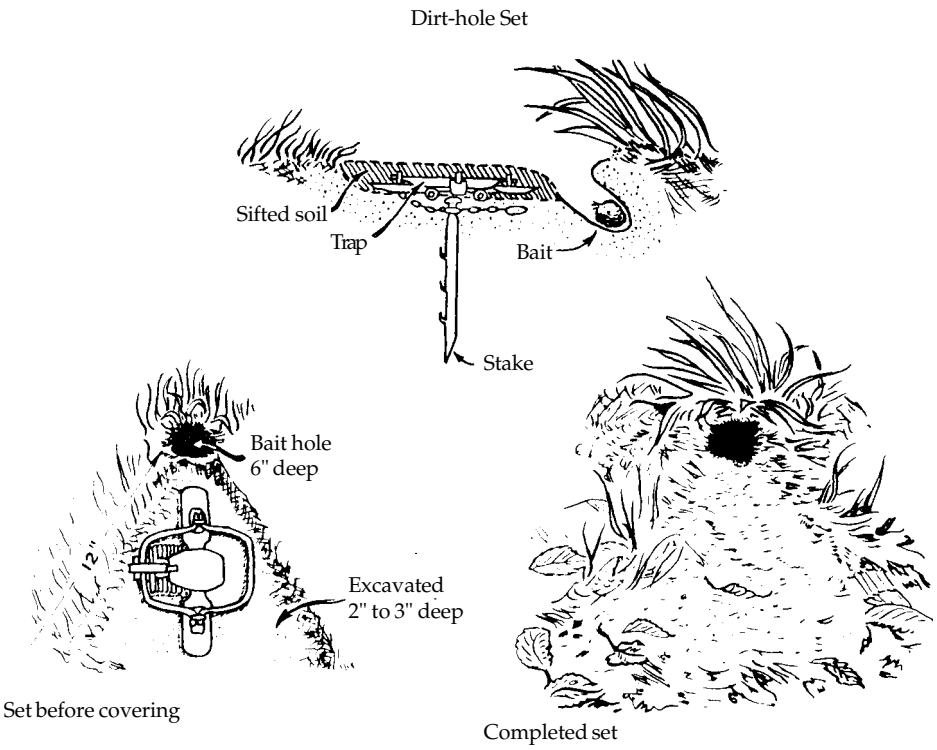



Fig. 12. The dirt-hole set is effective for all species of terrestrial furbearers, including raccoons. The bait is placed in the hole and should be lightly covered with soil so that it is not visible.

prevent soil from getting under the round pan of the trap and keeping it from going down. If this precaution is not taken, the trap may not go off.

### Shooting

Raccoons are seldom seen during the day because of their nocturnal habits. Shooting raccoons can be effective at night with proper lighting. Trained dogs can be used to tree the raccoons first. A .22-caliber rifle will effectively kill treed raccoons.

Many states have restrictions on the use of artificial light to spot and shoot raccoons at night, and shooting is prohibited in most towns and cities. It is advisable to check with state and local authorities before using any lethal controls for raccoons.

## Economics of Damage and Control

Statistics are unavailable on the amount of economic damage caused by raccoons, but the damage may be offset by their positive economic and aesthetic values. In 1982 to 1983, raccoons were by far the most valuable furbearer to hunters and trappers in the United States; an estimated 4.8 million raccoons worth $88 million were harvested. Raccoons also provide recreation for hunters, trappers, and people who enjoy watching them. Although raccoon damage and nuisance problems can be locally severe, widespread raccoon control programs are not justifiable, except perhaps to prevent the spread of raccoon rabies. From a cost-benefit and ecological standpoint, prevention practices and specific control of problem individuals or localized populations are the most desirable alternatives.

## Acknowledgments

Although information for this section came from a variety of sources, I am particularly indebted to Eric Fritzell of the University of Missouri, who provided a great deal of recently published and unpublished information on raccoons in the central United States. Information on damage identification was adapted from Dolbeer et al. 1994.

Figures 1 through 3 from Schwartz and Schwartz (1981).

Figures 4, 6, and 7 by Jill Sack Johnson.

Figure 5 from Conover (1987).

Figures 8, 9, and 10 by Michael D. Stickney, from the New York Department of Environmental Conservation publication *Trapping Furbearers, Student Manual* (1980), by R. Howard, L. Berchielli, G. Parsons, and M. Brown. The figures are copyrighted and are used with permission.

Figure 11 by J. Tom Parker, from *Trapping Furbearers: Managing and Using a Renewable Natural Resource*, a Cornell University publication by R. Howard and J. Kelly (1976). Used with permission.

Figure 12 adapted from *Controlling Problem Red Fox* by F. R. Henderson (1973), Cooperative Extension Service, Kansas State University, Manhattan.

## For Additional Information

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# BATS

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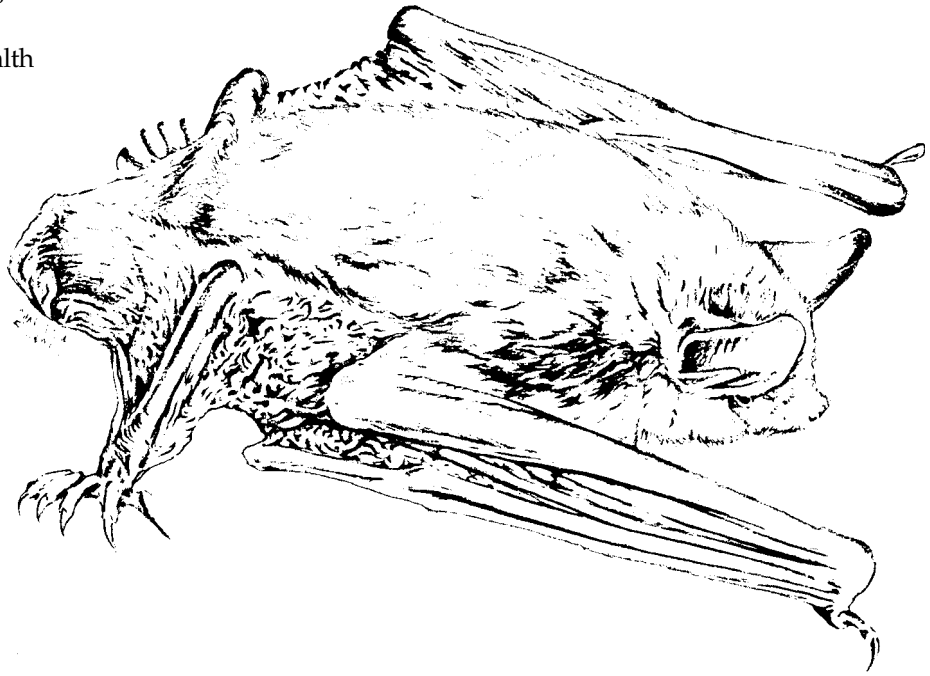


Fig. 1. Little brown bat, *Myotis lucifugus*

## Damage Prevention and Control Methods

**Exclusion**

Polypropylene netting checkvalves simplify getting bats out.

Quality bat-proofing permanently excludes bats.

Initiate control before young are born or after they are able to fly.

**Repellents**

Naphthalene: limited efficacy.

Illumination.

Air drafts/ventilation.

Ultrasonic devices: not effective.

Sticky deterrents: limited efficacy.

**Toxicants**

None are registered.

**Trapping**

Available, but unnecessarily complicated compared to exclusion and bat-proofing.

**Other Methods**

Sanitation and cleanup.

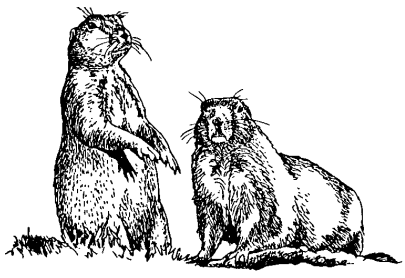
Artificial roosts.

**Removal of Occasional Bat Intruders**

When no bite or contact has occurred, help the bat escape (otherwise submit it for rabies testing).

**Conservation and Public Education**

Information itself functions as a management technique.



**PREVENTION AND CONTROL OF WILDLIFE DAMAGE — 1994**

**Cooperative Extension Division**
**Institute of Agriculture and Natural Resources**
**University of Nebraska - Lincoln**

**United States Department of Agriculture**
**Animal and Plant Health Inspection Service**
**Animal Damage Control**

**Great Plains Agricultural Council**
**Wildlife Committee**

## Introduction

### Conservation and Public Education

Despite their ecological value, bats are relentlessly and unjustifiably persecuted. Bats are often killed because they live near people who needlessly fear them. These actions emphasize the need to educate the public on the reasons for bat conservation and why it is important to use safe, nondestructive methods to alleviate conflicts between people and bats. General sources of information on bats include states' Cooperative Extension Services, universities, government environmental conservation and health departments, and Bat Conservation International (Austin, Texas). Except where control is necessary, bats should be appreciated from a distance — and not disturbed.

## Identification and Range

Bats, the only mammals that truly fly, belong to the order Chiroptera. Their ability to fly, their secretiveness, and their nocturnal habits have contributed to bat folklore, superstition, and fear. They are worldwide in distribution and include about 900 species, second in number only to Rodentia (the rodents) among the mammals.

Among the 40 species of bats found north of Mexico, only a few cause problems for humans (note that vampire bats are not found in the United States and Canada). Bats congregating in groups are called colonial bats; those that live a lone existence are known as solitary bats.

The colonial species most often encountered in and around human buildings in the United States are the little brown bat, (*Myotis lucifugus*, Fig. 2), the big brown bat (*Eptesicus fuscus*, Fig. 3), the Mexican free-tailed bat (*Tadarida brasiliensis*, Fig. 4), the pallid bat (*Antrozous pallidus*), the Yuma myotis (*Myotis yumanensis*), and the evening bat (*Nycticeius humeralis*).

Solitary bats typically roost in tree foliage or under bark, but occasionally are found associated with buildings, some only as transients during migration.

Fig. 2. Little brown bat, *Myotis lucifugus*

Fig. 3. Big brown bat, *Eptesicus fuscus*

Fig. 4. Mexican free-tailed bat, *Tadarida brasiliensis*

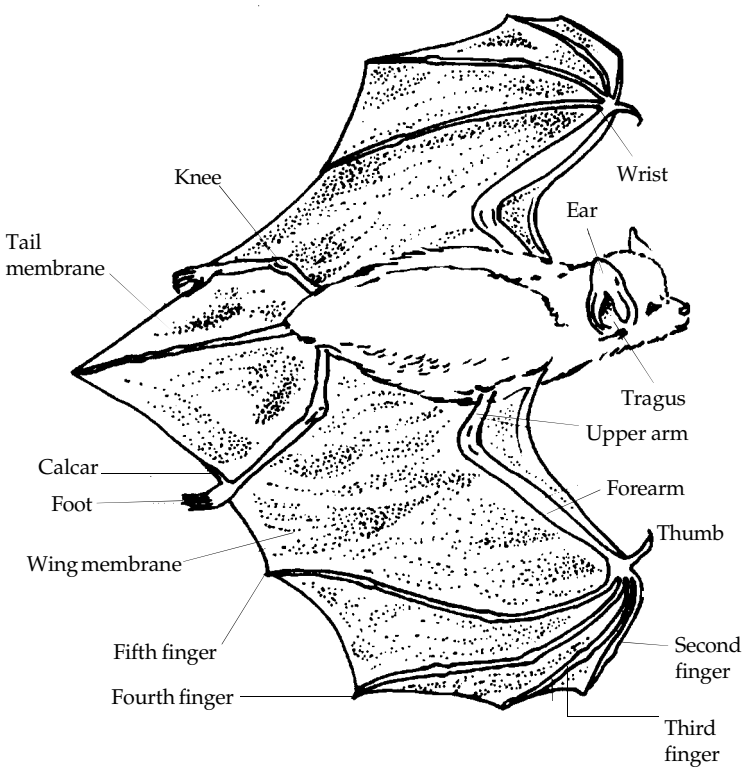



Fig. 5. Anatomy of a typical bat

These include Keen's bat (*Myotis keenii*), the red bat (*Lasiurus borealis*), the silver-haired bat (*Lasionycteris noctivagans*), and the hoary bat (*Lasiurus cinereus*). Excellent illustrations of all bats discussed herein can be found in Barbour and Davis (1979), Tuttle (1988), Geluso et al. (1987), and Harvey (1986).

Several species of bats have been included here, with significant interspecific differences that need to be clarified if well-planned, comprehensive management strategies are to be developed. Any problems caused by bats are limited to species distribution; thus animal damage control personnel need not be concerned with every species.

Colonial and solitary bats have obvious differences that serve to separate the species into groups (refer to Fig. 5). Much of the descriptive material that follows is adapted from Barbour and Davis (1979).

## Colonial Bats

### Little brown bat *(Myotis lucifugus)*

*Recognition*

forearm — 1.34 to 1.61 inches (3.4 to 4.1 cm)
wingspan — 9.02 to 10.59 inches (22.9 to 26.9 cm)
ears — 0.55 to 0.63 inches (1.4 to 1.6 cm)
foot — approximately 0.39 inches (1.0 cm); long hairs on toes extend beyond claws.

*Distribution* (Fig. 6a)

*Color*

Pale tan through reddish brown to dark brown, depending on geographic location. The species is a rich dark brown in the eastern United States and most of the west coast. Fur is glossy and sleek.

Confusion may occur with a few other "house" bat species. In the East, it may be confused with Keen's bat (*M. keenii*), which has longer ears [0.69 to 0.75 inches (1.7 to 1.9 cm)] and a longer, more pointed tragus (the appendage at the base of the ear). In the West, it resembles the Yuma myotis (*M. yumanensis*), which has dull fur and is usually smaller. However, the Yuma myotis and little brown may be indistinguishable in some parts of the northwestern United States where they may hybridize.

*Habits*

This is one of the most common bats found in and near buildings, often located near a body of water where they forage for insect prey. Summer colonies are very gregarious, commonly roosting in dark, hot attics and associated roof spaces where maternity colonies may include hundreds to a few thousand individuals. Colonies may also form beneath shingles and siding, in tree hollows, beneath bridges, and in caves. Litter size is 1 in the Northeast; twins occasionally occur in some other areas. The roost is often shared with the big brown bat (*E. fuscus*) though the latter is less tolerant of high temperatures; *M. keenii* may also share the same site. Separate groups of males tend to be smaller and choose cooler roosts within attics, behind shutters, under tree bark, in rock crevices, and within caves.

In the winter, little brown bats in the eastern part of their range abandon buildings to hibernate in caves and mines. Such hibernacula may be near summer roosts or up to a few hundred miles (km) away. Little is known of the winter habits of *M. lucifugus* in the western United States.

The life span of little brown bats has been established to be as great as 31 years. The average life expectancy, however, is probably limited to only a few years.

### Big brown bat (*Eptesicus fuscus*)

*Recognition*

forearm — 1.65 to 2.01 inches (4.2 to 5.1 cm)
wingspan — 12.80 to 13.78 inches (32.5 to 35.0 cm)
ears — with rounded tragus

*Distribution* (Fig. 6b)

*Color*

From reddish brown, copper colored, to a dark brown depending on geographic location. This is a large bat without distinctive markings.

Confusion may occur with the evening bat (*Nycticeius humeralis)* though the latter is much smaller.

*Habits*

This hardy, rather sedentary species appears to favor buildings for roosting. Summer maternity colonies may include a dozen or so and up to a few hundred individuals, roosting behind chimneys, in enclosed eaves, in hollow walls, attics, barns, and behind shutters and unused sliding doors. They also form colonies in rock crevices, beneath bridges, in hollow trees, and under loose bark. Litter size is 2 in the East to the Great Plains; from the Rockies westward 1 young is born. *E. fuscus* frequently shares roosts with *M. lucifugus* in the East, and with *M. yumanensis, Taderida*, and *Antrozous* in the West. Males typically roost in smaller groups or alone during the summer.

The big brown bat is one of the most widely distributed of bats in the United States and is probably familiar to more people than any other species. This is partially due to its large, easy-to-observe size, but also to its ability to overwinter in buildings (attics, wall spaces, and basements). Its close proximity to humans, coupled with its tendency to move about when temperature shifts occur, often brings this bat into human living quarters and basements in summer and winter. Big browns also hibernate in caves, mines, storm sewers, burial vaults, and other underground harborage. While *E. fuscus* will apparently travel as far as 150 miles (241 km) to hibernacula, the winter quarters of the bulk of this species are largely unknown.

Big brown bats may live as long as 18 years.

### Mexican free-tailed bat (*Tadarida brasiliensis*)

*Recognition*

forearm — 1.42 to 1.81 inches (3.6 to 4.6 cm)
wingspan — 11.42 to 12.80 inches (29.0 to 32.5 cm); long narrow wings
tail (interfemoral) membrane — does not enclose the lower one-third to one-half of the tail, hence the name free-tailed
foot — long, stiff hairs as long as the foot protrude from the toes.

*Distribution* (Fig. 6c)

*Color*

Dark brown or dark gray. Fur of some individuals may have been bleached to a pale brown due to ammonia fumes from urine and decomposing guano.

Confusion is not likely to occur with other species that commonly inhabit human buildings.

***Habits***

*T. brasiliensis* forms the largest colonies of any warm-blooded animal, establishing sizable colonies in buildings, particularly on the West Coast and in the Gulf states from Texas east. Hundreds to thousands may be found in buildings or under bridges. It is primarily a cave bat in Arizona, New Mexico, Oklahoma, and Texas; buildings are used as temporary roosts during migrations. Litter size is 1.

*Taderida* often share roosts with other species. In the West, for example, they may be found in buildings with *A. pallidus, M. yumanensis,* and *E. fuscus*. Some males are always present in the large maternity colonies, but they tend to segregate in separate caves.

A few *Taderida* may overwinter in buildings as far north as South Carolina in the East and Oregon in the West. Most of this species migrate hundreds of miles to warmer climes (largely to Mexico) for the winter.

**Pallid bat (*Antrozous pallidus*)**

***Recognition***

forearm — 1.89 to 2.36 inches (4.8 to 6.0 cm)
wingspan — 14.17 to 15.35 inches (36.0 to 39.0 cm)
ears — large; widely separated and more than half as broad as long. The ears are nearly half as long as the combined length of the bat's head and body.
eyes — large

***Distribution*** (Fig. 6d)

***Color***

pale, upper parts are light yellow, the hairs tipped with brown or gray. Underparts are pale creamy, almost white. This large, light-colored bat is relatively easy to recognize.

Confusion with other species that commonly inhabit human buildings is not likely to occur.

***Habits***

Maternity colony size ranges from about 12 to 100 individuals. Roost sites include buildings, bridges, and rock crevices; less frequently, tree cavities, caves, and mines. Litter size is most commonly 2. The roost is frequently shared with *T. brasiliensis* and *E. fuscus* in the West. While groups of males tend to segregate during the nursery period (sometimes in the same building), other males are found within the maternity colony.

An interesting feature of pallid bats is that they fly close to the ground, may hover, and take most prey on the ground, not in flight. Prey includes crickets, grasshoppers, beetles, and scorpions. They will also forage among tree foliage.

Pallid bats are not known to make long migrations, though little is known of their winter habits.

**Yuma myotis (*Myotis yumanensis*)**

***Recognition***

forearm — 1.26 to 1.50 inches (3.2 to 3.8 cm)
wingspan — about 9.25 inches (23.5 cm)
ears — 0.55 to 0.59 inches (1.4 to 1.5 cm)
foot — 0.39 inches (1.0 cm)

***Distribution*** (Fig. 6e)

***Color***

Light tan to dark brown; underside is whitish to buffy.

Confusion may occur in the West with *M. lucifugus*, though the latter tends to have longer, glossier fur, and is larger. In the Northwest, hybridization occurs with *M. lucifugus*, making the species indistinguishable.

***Habits***

Maternity colonies, up to several thousand individuals, form in the summer in attics, belfries, under bridges, and in caves and mines. Litter size is 1. Males typically segregate during the nursery period and roost as solitary individuals in buildings and other suitable harborage.

*M. yumanensis* is more closely associated with water than is any other North American bat species. Nearly all roosts have open water nearby. This species is not as tolerant as *M. lucifugus* of high roost temperatures and will move to cooler niches within a building when temperatures rise much above 100° F (37.8° C).

*M. yumanensis* abandons maternity colonies in the fall, but its winter habitat is not known.

**Evening bat (*Nycticeius humeralis*)**

***Recognition***

forearm — 1.30 to 1.54 inches (3.3 to 3.9 cm)
wingspan — 10.24 to 11.02 inches (26.0 to 28.0 cm)
ears — with short, curved, and rounded tragus

Confusion may occur with the big brown bat (*E. fuscus*), which can be readily distinguished by its larger size. It bears some resemblance to the somewhat smaller little brown bat (*M. lucifugus*) but can be identified by its characteristic blunt tragus.

***Distribution*** (Fig. 6f)

***Color***

Medium brown with some variation to yellow-brown in subtropical Florida. No distinctive markings.

***Habits***

Summer maternity colonies in buildings may consist of hundreds of individuals. Litter size is usually 2. Colonies also form in tree cavities and under loose tree bark. In the Southeast, *T. brasiliensis* commonly inhabits the same building with *N. humeralis*. This is one of the most common bats in towns throughout the southern coastal states. Very little is known about this species, and virtually nothing is known of its winter habitat except that it almost never enters caves.

## Solitary Bats

### Keen's bat (*Myotis keenii*)

*Recognition*

forearm — 1.26 to 1.54 inches (3.2 to 3.9 cm)
wingspan — 8.98 to 10.16 inches (22.8 to 25.8 cm)
ears — 0.67 to 0.75 inches (1.7 to 1.9 cm); with a long, narrow, pointed tragus

*Distribution* (Fig. 6g)

*Color*

Brown, but not glossy; somewhat paler in the East.

Confusion may occur with *M. lucifugus,* which has glossy fur, shorter ears, and does not have the long, pointed tragus.

*Habits*

Excluding small maternity colonies (up to 30 individuals are on record), *M. keenii* are generally found singly in the East. Roosting sites include: behind shutters, under wooden shingles, sheltered entryways of buildings, in roof spaces, in barns, and beneath tree bark. In the West, this bat is known as a solitary species, roosting in tree cavities and cliff crevices. Litter size is probably 1. The roost is sometimes shared with *M. lucifugus*. The sexes probably segregate during the nursery period. In winter, these bats hibernate in caves and mines.

### Red Bat (*Lasiurus borealis*)

*Recognition*

forearm — 1.38 to 1.77 inches (3.5 to 4.5 cm)
wingspan — 11.42 to 13.07 inches (29.0 to 33.2 cm); long, pointed wings
ears — short rounded
tail membrane — heavily furred on upper surface, with a distinctive long tail.

*Distribution* (Fig. 6h)

*Color*

Bright orange to yellow-brown; usually with a distinctive white mark on the shoulders.

Confusion may occur with the hoary bat (*L. cinereus*), which is frosted-gray in appearance and larger.

*Habits*

Red bats live solitary lives, coming together only to mate and migrate. Few people are familiar with this species. They typically spend summer days hidden in the foliage of deciduous trees. The number of young ranges from 1 to 4, averaging 2.3.

These bats often chase insects that are attracted to lights, such as street lamps. It is this behavior that most likely brings them in close proximity to people.

*L. borealis* is well-adapted for surviving drastic temperature fluctuations; it does not hibernate in caves, but apparently in trees. Some migrate long distances. During migration, red bats have been known to land on high-rise buildings and on ships at sea.

### Silver-haired bat (*Lasionycteris noctivagans*)

*Recognition*

forearm — 1.46 to 1.73 inches (3.7 to 4.4 cm)
wingspan — 10.63 to 12.20 inches (27.0 to 31.0 cm)
ears — short, rounded, hairless
tail membrane — upper surface is sparsely furred on the anterior one-half.

*Distribution* (Fig. 6i)

*Color*

Usually black with silver-tipped fur; some individuals with dark brown, yellowish-tipped fur.

Confusion sometimes occurs with the larger hoary bat (*Lasiurus cinereus*), which has patches of hair on the ears and wings, heavy fur on the entire upper surface of the tail membrane, and has a distinctive throat "collar."

*Habits*

The silver-haired bat roosts in a wide variety of harborages. A typical roost might be behind loose tree bark; other sites include tree hollows and bird nests. This species is solitary except when with young. Additionally, there are unconfirmed reports that it is sometimes colonial (Dalquest and Walton 1970) and may roost in and on buildings. The litter size is 2. The sexes segregate through much of the summer range.

*L. noctivagans* hibernates in tree crevices, under loose bark, in buildings (including churches, sky scrapers, and wharf houses), hulls of ships, rock crevices, silica mines, and non-limestone caves. It also may migrate, during which time it is encountered in buildings (they favor open sheds, garages, and outbuildings rather than enclosed attics), in lumber piles, and on ships at sea.

### Hoary bat (*Lasiurus cinereus*)

*Recognition*

forearm — 1.81 to 2.28 inches (4.6 to 5.8 cm)
wingspan — 14.96 to 16.14 inches (38.0 to 41.0 cm)
ears — relatively short, rounded, edged with black, and with fur
tail membrane — completely furred on upper surface

*Distribution* (Fig. 6j)

*Color*

Dark, but many hairs are tipped in white, giving it a frosted appearance. This bat also has a yellowish or orangish throat "collar."

Confusion may sometimes occur with the much smaller silver-haired bat (*Lasionycteris noctivagans*), which lacks the fur patches and markings on the ears, markings on the throat, and has a tail membrane that is only lightly furred on the upper surface.

*Habits*

Hoary bats generally spend summer days concealed in tree foliage (often in evergreens), rarely enter houses, and are not commonly encountered by people. *L. cinereus* at their day roosts are usually solitary except when with young. The litter size is 2. The sexes segregate through most of the summer range.

This is one of the largest bats in North America, a powerful flier, and an accomplished migrant. Records indicate that some *L. cinereus* may hibernate in northern parts of their range.

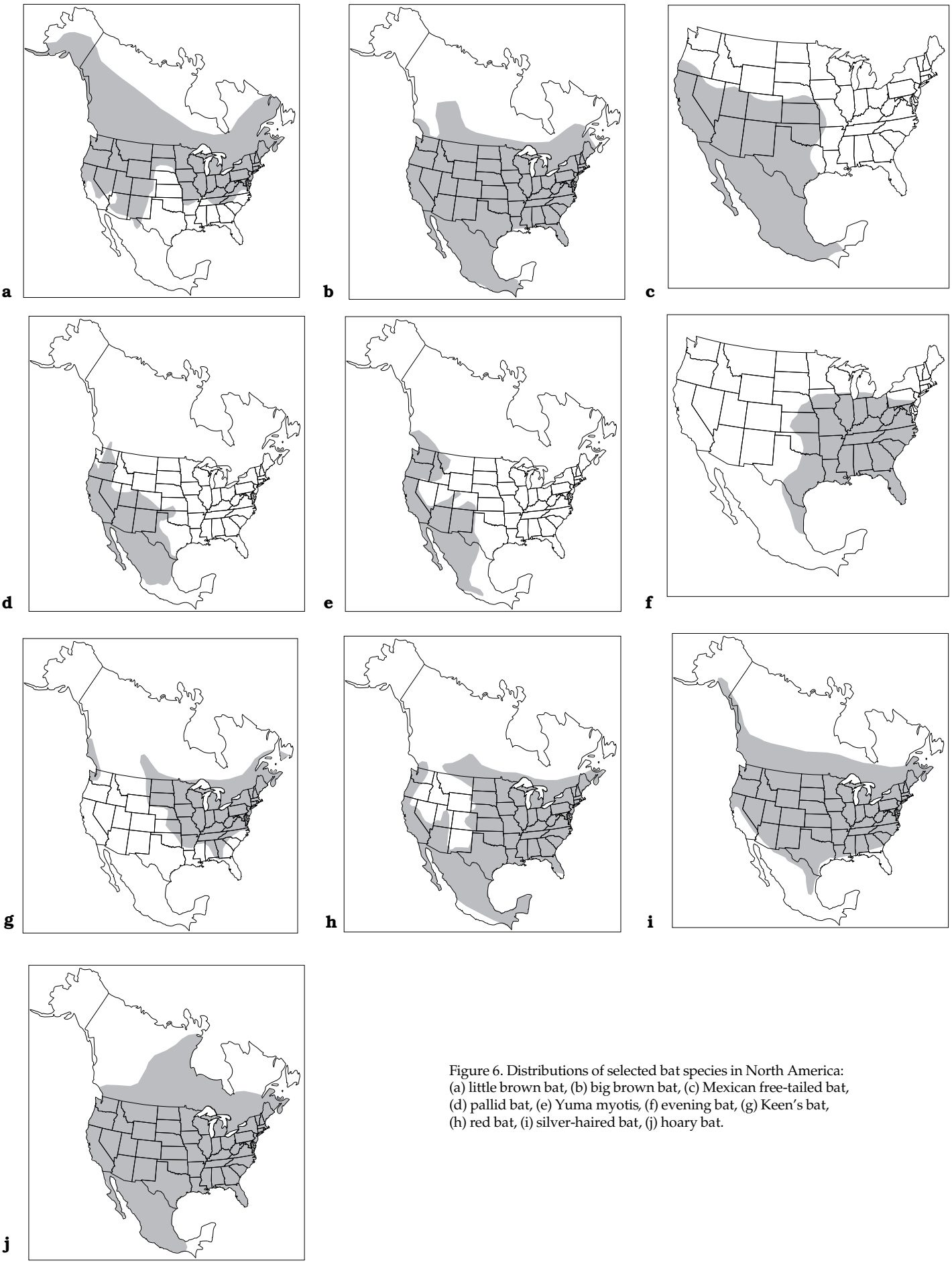



Figure 6. Distributions of selected bat species in North America: (a) little brown bat, (b) big brown bat, (c) Mexican free-tailed bat, (d) pallid bat, (e) Yuma myotis, (f) evening bat, (g) Keen's bat, (h) red bat, (i) silver-haired bat, (j) hoary bat.

## Food Habits

Bats in North America are virtually all insectivorous, feeding on a variety of flying insects (exceptions among house bats were noted previously). Many of the insects are harmful to humans. While there must be some limitations based on such factors as bats' body size, flight capabilities, and jaw opening, insectivorous bats apparently consume a wide range of prey (Barbour and Davis 1979). The little brown bat's diet includes mayflies, midges, mosquitoes, caddis flies, moths, and beetles. It can consume insects equal to one-third of its body weight in 1/2 hour of foraging. The big brown bat may fill its stomach in about 1 hour (roughly 0.1 ounce per hour [2.7 g/hr]) with prey including beetles, moths, flying ants, true bugs, mayflies, caddis flies, and other insects. The nightly consumption of insects by a colony of bats can be extremely large.

## General Biology, Reproduction, and Behavior

Most North American bats emit high frequency sounds (ultrasound) inaudible to humans and similar to sonar, in order to avoid obstacles, locate and capture insect prey, and to communicate. Bats also emit audible sounds that may be used for communication between them.

Bats generally mate in the fall and winter, but the female retains the sperm in the uterus until spring, when ovulation and fertilization take place. Pregnant females may congregate in maternity colonies in buildings, behind chimneys, beneath bridges, in tree hollows, caves, mines, or other dark retreats. No nests are built. Births typically occur from May through July. Young bats grow rapidly and are able to fly within 3 weeks. Weaning occurs in July and August, after which the nursery colonies disperse.

Bats prepare for winter around the time of the first frost. Some species migrate relatively short distances, whereas certain populations of the Mexican free-tailed bat may migrate up to 1,000 miles (1,600 km). Bats in the northern United States and Canada may hibernate from September through May. Hibernation for the same species in the southern part of their range may be shorter or even sporadic. Some may fly during warm winter spells (as big brown bats may in the northeastern part of the United States). Bats often live more than 10 years.

In response to a variety of human activities, direct and indirect, several bat species in the United States have declined in number during the past few decades. Chemical pesticides (particularly the use of persistent and bioaccumulating organic pesticides) have decreased the insect supply, and contaminated insects ingested by bats have reduced bat populations. Many bats die when people disturb summer maternity roosts and winter hibernacula. Vandals and other irresponsible individuals may deliberately kill bats in caves and other roosts. Even the activities of speleologists or biologists may unintentionally disturb hibernating bats, which depletes fat reserves needed for hibernation.

Modification and destruction of roost sites has also decreased bat numbers. Sealing and flooding of mineshafts and caves and general quarrying operations may inadvertently ruin bat harborages. Forestry practices have reduced the number of hollow trees available. Some of the elimination of natural bat habitat may contribute to bats roosting in buildings.

## Damage and Damage Identification

### Bat Presence

Bats often fly about swimming pools, from which they drink or catch insects. White light (with an ultraviolet component), commonly used for porch lights, building illumination, street and parking-lot lights, may attract flying insects, which in turn attract bats. Unfortunately, the mere presence of a bat outdoors is sometimes beyond the tolerance of some uninformed people. Information is a good remedy for such situations.

Bats commonly enter buildings through openings associated with the roof edge and valleys, eaves, apex of the gable, chimney, attic or roof vent, dormers, and siding (see Fig. 7). Other

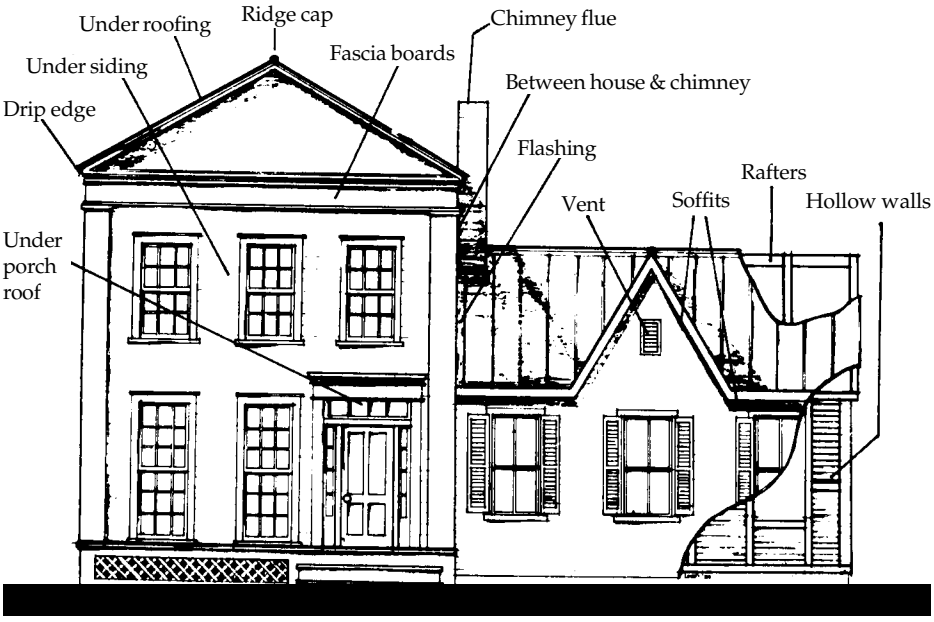



Fig. 7. Common points of entry and roosting sites of house bats.

openings may be found under loose-fitting doors, around windows, gaps around various conduits (wiring, plumbing, air conditioning) that pass through walls, and through utility vents.

Bats are able to squeeze through narrow slits and cracks. For purposes of bat management, one should pay attention to any gap of approximately 1/4 x 1 1/2 inches (0.6 x 3.8 cm) or a hole 5/8 x 7/8 inch (1.6 x 2.2 cm). Such openings must be considered potential entries for at least the smaller species, such as the little brown bat. The smaller species require an opening no wider than 3/8 inch (0.95 cm), that is, a hole the diameter of a US 10-cent coin (Greenhall 1982). Openings of these dimensions are not uncommon in older wood frame structures where boards have shrunk, warped, or otherwise become loosened.

The discovery of one or two bats in a house is a frequent problem. In the Northeast, big brown bats probably account for most sudden appearances (see Figs. 3 and 8). Common in urban areas, they often enter homes through open windows or unscreened fireplaces. If unused chimneys are selected for summer roosts, bats may fall or crawl through the open damper into the house. Sometimes bats may appear in a room, then disappear by crawling under a door to another room, hallway, or closet. They may also disappear behind curtains, wall hangings, bookcases, under beds, into waste baskets, and so forth. Locating and removing individual bats from living quarters can be laborious but is important. If all else fails, wait until dusk when the bat may appear once again as it attempts to find an exit. Since big brown bats may hibernate in the cooler recesses of heated buildings, they may suddenly appear (flying indoors or outdoors) in midwinter during a warm spell or a cold snap as they move about to adjust to the temperature shift.

**Roosting Sites**

Bats use roosting niches that are indoors (human dwellings, outbuildings, livestock quarters, warehouses), semi-enclosed (loading docks, entrance foyers), partially sheltered (porches, carports, pavilions, highway underpasses, bridges), and open structural areas (window shutters, signs). Once there, active bats in and on buildings can have several economic and aesthetic effects, often intertwined with public health issues (Frantz, 1988). Unusual roosting areas include wells, sewers, and graveyard crypts. Before considering control measures, verify that bats are actually the cause of the problem.

**Rub Marks**

Surface areas on walls, under loose woodwork, between bricks and around other bat entryways often have a smooth, polished appearance. The stained area is slightly sticky, may contain a few bat hairs, and is yellow-brown to blackish brown in color. The smooth gloss of these rub marks is due to oils from fur and other bodily secretions mixed with dust, deposited there as many animals pass repeatedly for a long period over the same surface. Openings marked in this way have been used heavily by bats.

**Noise**

Disturbing sounds may be heard from vocalizations and grooming, scratching, crawling, or climbing in attics, under eaves, behind walls, and between floors. Bats become particularly noisy on hot days in attics, before leaving the roost at dusk, and upon returning at dawn. Note that rustling sounds in chimneys may be caused by birds or raccoons and scratching and thumping sounds in attics and behind walls may indicate rats, mice, or squirrels.

**Guano and Urine**

Fecal pellets indicate the presence of animals and are found on attic floors, in wall recesses, and outside the house at its base. Fecal pellets along and inside walls may indicate the presence of mice, rats, or even roaches. Since most house bats north of Mexico are insectivorous, their droppings are easily distinguished from those of small rodents. Bat droppings tend to be segmented, elongated, and friable. When crushed, they become powdery and reveal shiny bits of undigested insect remains. In contrast, mice and rat droppings tend to taper, are unsegmented, are harder and more fibrous, and do not become powdery when crushed (unless extremely aged).

The droppings of some birds and lizards may occasionally be found along with those of bats. However, bat droppings never contain the white chalky material characteristic of the feces of these other animals.

Bat excrement produces an unpleasant odor as it decomposes in attics, wall spaces, and other voids. The pungent, musty, acrid odor can often be detected from outside a building containing a large or long-term colony. Similar odor problems occur when animals die in inaccessible locations. The odor also attracts arthropods which may later invade other areas of a building.

Bat guano may provide a growth medium for microorganisms, some of which are pathogenic (histoplasmosis, for example) to humans. Guano accumulations may fill spaces between walls, floors, and ceilings. It may create a safety hazard on floors, steps, and ladders, and may even collapse ceilings. Accumulations also result in the staining of ceilings, soffits, and siding, producing unsightly and unsanitary conditions.

Bats also urinate and defecate in flight, causing multiple spotting and staining on sides of buildings, windows, patio furniture, automobiles, and other objects at and near entry/exit holes or beneath roosts. Bat excrement may also contaminate stored food, commercial products, and work surfaces.

Bat urine readily crystallizes at room temperature. In warm conditions under roofs exposed to sun and on chimney walls, the urine evaporates so quickly that it crystallizes in great accumulations. Boards and beams saturated with urine acquire a whitish powderlike coating. With large numbers of bats, thick and hard stalactites and stalagmites of crystallized bat urine are occasionally formed.

Although the fresh urine of a single bat is relatively odorless, that of any moderate-sized colony is obvious, and the odor increases during damp weather. Over a long period of time urine may cause mild wood deterioration (Frantz and Trimarchi 1984). As the urine saturates the surfaces of dry wood beams and crystallizes, the wood fibers expand and separate. These fibers then are torn loose by the bats crawling over such surfaces, resulting in wood fibers being mixed with guano accumulations underneath.

The close proximity of bat roosts to human living quarters can result in excreta, animal dander, fragments of arthropods, and various microorganisms entering air ducts as well as falling onto the unfortunate residents below. Such contaminants can result in airborne particles of public health significance (Frantz 1988).

### Ectoparasites and other Arthropods

Several arthropods (fungivores, detritivores, predators, and bat ectoparasites) are often associated with colonies of bats in buildings. Their diversity depends on the number of bats, age and quantity of excreta deposits, and season. Arthropods such as dermestid beetles (*Attagenus megatoma)* contribute to the decomposition of guano and insect remnants, but may also become a pest of stored goods and/or a nuisance within the living quarters. Cockroaches (for example, *Blatta orientalis*) attracted to guano may invade other parts of a building. Bat bugs (*Cimex* spp.) are sometimes found crawling on the surface of beams or around holes leading to secluded recesses used by bats. Bat ectoparasites (ticks, mites, fleas, and bugs) rarely attack humans or pets and quickly die in the absence of bats. Ectoparasites may become a nuisance, however, following exclusion of large numbers of bats from a well-established roost site. Area fumigation with a total release pyrethrum-based aerosol may be an appropriate solution for arthropod knockdown within an enclosed space, but only after bats have departed. For long-term arthropod control, lightly dust appropriate surfaces (affected attic beams, soffits) with boric acid powder or diatomaceous earth; carefully read all product labels before using any pesticide. Note that neither rabies nor Lyme disease is transmitted by any arthropods associated with bats.

### Public Health Issues

**Rabies—*General Epidemiology.*** Bats are distinct from most vertebrate pests that inhabit human dwellings because of the potential for transmitting rabies — a viral infection of mammals that is usually transmitted via the bite of an infected animal. Rabies does not respond to antibiotic therapy and is nearly always fatal once symptoms occur. However, because of the long incubation period (from 2 weeks to many months), prompt vaccination following exposure can prevent the disease in humans. Dogs, cats, and livestock also can be protected by periodic vaccinations.

Bats are not asymptomatic carriers of rabies. After an incubation period of 2 weeks to 6 months, they become ill with the disease for as long as 10 days. During this latter period, a rabid bat's behavior is generally not normal—it may be found active during the daytime or on the ground incapable of flying. Most human exposures are the result of accidental or careless handling of grounded bats. Even less frequently, bats in this stage of illness may be involved in unprovoked attacks on people or pets (Brass, pers. commun.; Trimarchi et al. 1979). It is during this stage that the rabid bat is capable of transmitting the disease by biting another mammal. As the disease progresses the bat becomes increasingly paralyzed and dies as a result of the infection. The virus in the carcass is reported to remain infectious until decomposition is well advanced.

***Significance.*** Rabies is the most important public health hazard associated with bats. Infection with rabies has been confirmed in all 40 North American species of bats that have been adequately sampled in all of the contiguous United States and in most provinces of Canada. Figure 8 shows the frequency of bat species submitted for rabies testing in New York State over the last 12 years. While not a nationwide measure of human encounters with bats, Figure 8 illustrates that bat species are not encountered equally. Note that bats submitted for testing are often ill and/or easily captured. The numbers and species encountered will vary with the region of the country; data are generally available from local and state health authorities.

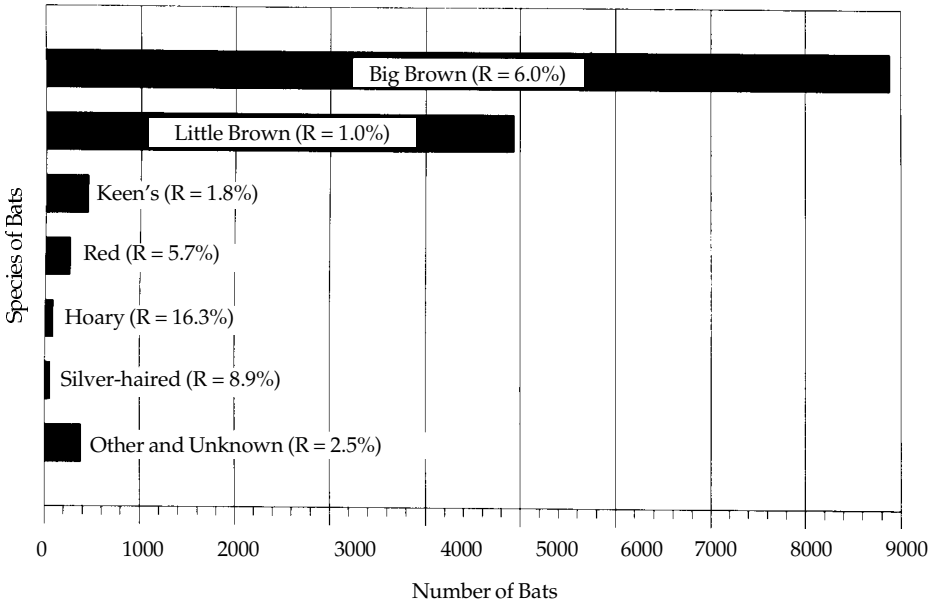



Fig. 8. Profile of bat species submitted to the New York State Rabies Laboratory, 1981-1992.

Random sampling of bats (healthy and ill) indicates an overall infection rate of less than 1%. Finding a rabid bat in a colony does not imply that the remaining animals are rabid. In fact, the probability of immediately finding more than one additional infected bat in that colony is small.

Bats rank third (behind raccoons and skunks) in incidence of wildlife rabies in the United States (Krebs et al. 1992). In the last 20 years, however, there have been more human rabies cases of bat origin in the United States than of any other wildlife group. Furthermore, the disease in bats is more widely distributed (in all 48 contiguous states in 1989) than in any other species. In Canada, bats also rank third (behind foxes and skunks) in the incidence of wildlife rabies. Therefore, every bat bite or contact must be considered a potential exposure to rabies. While aerosol transmission of the rabies virus from bats in caves to humans and some other mammals has been reported, this is not a likely route of infection for humans entering bat roosts in buildings in temperate North America. Note that vampire bats are not a threat north of Mexico.

**Histoplasmosis—*General Epidemiology.*** Histoplasmosis is a very common lung disease of worldwide distribution caused by a microscopic fungus, *Histoplasma capsulatum. Histoplasma* exists in nature as a saprophytic mold that grows in soil with high nitrogen content, generally associated with the guano and debris of birds (particularly starlings, *Sturnus vulgaris*, and chickens) and bats. Wind is probably the main agent of dispersal, but the fungus can survive and be transmitted from one site to another in the intestinal contents of bats, and also in the dermal appendages of both bats and birds. The disease can be acquired by the casual inhalation of windblown spores, but infections are more likely to result from visits to point sources of growth of the fungus. Relative to bats, such sources include bat roosts in caves, barns, attics, and belfries, and soil enriched with bat guano.

Numerous wild and domestic animals are susceptible to histoplasmosis, but bats (and perhaps the armadillo) are the only important animal vectors. Unlike bats, birds do not appear to become infected with the fungus. Both the presence of guano and particular environmental conditions are necessary for *H. capsulatum* to proliferate. In avian habitats, the organism apparently grows best where the guano is in large deposits, rotting and mixed with soil rather than in nests or in fresh deposits. Specific requirements regarding bats have not been described, though bat roosts with long-term infestation are often mentioned in the literature.

While histoplasmosis in the United States is particularly endemic to the Ohio-Mississippi Valley region (which is also an area with the greatest starling concentration) and areas along the Appalachian Mountains, it is also found in the lake and river valleys of other states. Outside areas with "appropriate" environmental conditions, there also occur scattered foci with high infection rates usually associated with caves inhabited by bats or birds.

***Significance.*** When soil or guano containing *H. capsulatum* is physically disturbed, the spores become airborne. Persons at particular risk of histoplasmosis of bat origin include spelunkers, bat biologists, pest control technicians, people who clean out or work in areas where bats have habitually roosted, and people in contact with guano-enriched soil — such as around the foundation of a building where guano has sifted down through the walls.

Infection occurs upon inhalation of spores and can result in a variety of clinical manifestations; severity partially depends on the quantity of spores inhaled. The infection may remain localized in the lungs where it may resolve uneventfully; this is the case for about 95% of the 500,000 infections occurring annually in the United States. Such infections are identified only by the presence of a positive histoplasmin skin test and/or calcified lesions on routine radiographs. Other individuals may have chronic or progressive lung disease requiring treatment. Less severe forms of these infections may be accompanied by fever, cough, and generalized symptoms similar to a prolonged influenza. Resolution of the disease confers a degree of immunity to reinfection. In addition, resolution confers varying degrees of hypersensitivity to *H. capsulatum*; as a consequence, massive reinfection in highly sensitized lungs may result in a fatal acute allergic reaction.

In a small percentage of chronic histoplasmosis cases, the fungus disseminates to involve multiple organ systems and may be fatal. This form is usually seen in young children (1 year or older) and in immunocompromised adults. In recent years, systemic infections have been increasing in frequency globally as an opportunistic infection of AIDS patients.

## Legal Status

The lethal control of bats, even when there is a proven potential danger to humans, often is subjected to careful scrutiny and interagency coordination. A survey of federal legislative actions, court decisions, and agency interpretations concerning bats can be found in *Bat Management in the United States* (Lera and Fortune 1979).

Some states have laws that specifically mention bats, either providing or denying protection. Others have legislation that applies to bats only by interpretation, since bats may be considered nongame wildlife or indigenous state mammals. Some bats have protection as either federal or state-listed endangered species, but the same state may not protect other species of bats. Enforcement and public education must accompany legislation to accomplish the intended goal of protecting the public and saving endangered bats. Familiarity with the appropriate federal and state laws should precede any nuisance management activities.

## Damage Prevention and Control Methods

### Premanagement Considerations

***Bat Watch for Infestation Confirmation.*** To confirm that bats are actually roosting in or on a building, look for bats flying in and out of a site and/or for signs of infestation. A bat watch can be conducted by two people (more may be necessary to observe large or complex sites) posted at opposite corners of a structure. An evening watch begins about 30 minutes before dark and a morning watch begins about 1 hour before dawn. Observations should continue for approximately 1 hour.

Such observations can indicate exit/entry points and the number of bats. With practice, distinguishing some bat species may also be possible. For example, compared to the big brown bat, the little brown bat is noticeably smaller in size, and its flight has more rapid wing beats, and more rapid turning and darting.

It may be necessary to watch for more than one night to compensate for weather conditions, bats' sensitivity to observers, noisy or inexperienced observers, and improper use of light. Observations can be enhanced with a standard flashlight, but be certain to keep the bright part of the beam as far as possible away from the exit hole being observed. Bright light will increase bats' reluctance to exit and may result in an incomplete exit of the colony. A valuable observation aid is a powerful, rechargeable flashlight equipped with a plastic, red pop-off filter (similar to the Kodak Wratten 89B). Also, an electric headlamp, supplied with rechargeable batteries and fitted to a climbing or spelunking helmet, allows hands-off illumination outdoors as well as indoors when exploring roost locations. Bats are sensitive to light intensity and can visually discriminate shapes and patterns in extremely low light situations. They can only see in black and white; hence, the low-contrast illumination and soft shadows produced by red light has little effect on bats.

***Locating the Roost(s).*** It is not always possible or convenient to conduct a bat watch. Thus, a detailed inspection inside the building for bats or bat sign may be necessary to find specific roosts. Daytime is best, especially during the warmer part of the day. Bats roost in the most varied kinds of buildings and in every part from cellar to attic. Some types of buildings appear preferable (older houses, churches, barns, proximity to water) as do certain roost locations therein, especially areas with little disturbance, low illumination, little air circulation, and high temperatures. Often it is easy to locate bats, especially in warm weather in attics or lofts, where they may hang in clusters or side-by-side from the sloping roof lath, beams, and so forth. However, bats have the ability to find crevices and cavities, and if disturbed may rapidly disappear into the angles between converging beams, behind such beams or wallboards, into mortise holes on the underside of beams, and into the multilayered wall and roof fabrications. If bats cannot be openly observed, usually there are various interior and exterior signs of their presence. Often there are multiple roost sites within or on a single building.

***Problem Assessment.*** Once it has been confirmed that bats are present, one must determine if there is damage, if there is a health risk, and if some intervention is warranted. There are circumstances in which "no action" is the correct action because of the beneficial role of bats. In cases where there is risk of contact, damage from excreta accumulations, stains, and so on, intervention may be necessary.

***Timing.*** With the exception of disease treatment and removal of the occasional bat intruder, timing becomes an important planning consideration. Management procedures must not complicate an already existing problem and should emphasize bat conservation. Therefore, all interventions should be initiated before the young are born or after they are weaned and able to fly. Thus, the annual opportunity extends from about mid-August to mid-May for much of North America. Treatments might otherwise result in the unnecessary death of animals (especially young unable to fly) trapped inside, offensive odors, and attraction of arthropod scavengers.

### Disease Considerations

**Rabies — *Preventive Measures.*** It should be noted that newspapers, television, and other mass media sometimes misrepresent the role of rabid bats as a risk to humans. However, the unfortunate recent (1983 to 1993) deaths of a 22-year-old man in Texas, a 30-year-old bat scientist in Finland, a university student in British Columbia, a 5-year-old girl in Michigan, a man in Arkansas, an 11-year-old girl in New York, and a woman in Georgia amply underscore the need to pay prompt attention to bat bites and other exposures.

Many rabies exposures could be avoided if people simply refrained from handling bats. Adults and children should be strongly cautioned never to touch bats with bare hands. All necessary measures should be taken to ensure that bats cannot enter living quarters in houses and apartments. Pet cats and dogs should be kept up-to-date in rabies vaccinations. This is also true for pets confined indoors, because contact with bats frequently occurs indoors. Valuable livestock also should be vaccinated if kept in buildings harboring bats or if in a rabies outbreak area (NASPHV 1993). While transmission of rabies from bats to terrestrial mammals apparently is not common, such incidents have been reported (Reid-Sanden et al. 1990, Trimarchi 1987). Dogs, cats, and livestock that have been exposed to a rabid or suspected-rabid animal, but are not currently vaccinated, must be either quarantined or destroyed.

Lastly, pest control technicians, nuisance wildlife control personnel, wildlife biologists, and other individuals at particular risk of contact with rabid bats (or other wildlife) should receive a rabies pre-exposure vaccination. This effective prophylaxis involves only three injections of rabies vaccine, which are administered in the arm during a month's time.

**Rabies — *Treatment for Exposure.*** If a person is bitten or scratched by a bat, or there is any suspicion that bat saliva or nervous tissue has contaminated an open wound or mucous membrane, wash the affected area thoroughly with soap and water, capture the bat without damaging the head, and seek immediate medical attention. The incident should be reported promptly to local health authorities in order to arrange rabies testing of the bat.

If the bat is captured and immediate transportation to the testing laboratory is possible, and if immediate testing can be arranged, postexposure treatment may be delayed several hours until the test results are known. Postexposure prophylaxis must be administered immediately, however, if the bat cannot be captured, if prompt transportation to the laboratory is not possible, if the specimen is not suitable for reliable diagnosis, or if the test results prove positive for rabies.

The prophylaxis has little resemblance to that of many years ago. Today, it consists of one dose of rabies immune globulin (human origin) and one dose of rabies vaccine (human diploid cell) administered preferably on the day of exposure, followed by additional single doses of rabies vaccine on days 3, 7, 14, and 28 following the initial injection. This treatment is normally safe, relatively painless, and very effective.

**Histoplasmosis — *Preventive Measures.*** Histoplasmosis can most easily be prevented by avoiding areas that harbor *H. capsulatum*. Since this is not practical for individuals who must work in and around active/inactive bat roosting sites, other measures can be recommended to reduce the risk of infection during cleaning, field study, demolition, construction, and other activities.

Persons working in areas known or suspected to be contaminated with *H. capsulatum* should always wear protective masks capable of filtering out particles as small as 2 microns in diameter or use a self-contained breathing apparatus. In areas known to be contaminated, wear protective clothing and gloves that can be removed at the site and placed in a plastic bag for later decontamination via formalin and washing. Also, clean footwear before leaving the site to prevent spore dissemination in cars, the office, at home, and elsewhere.

Guano deposits and guano-enriched soils should not be unnecessarily disturbed. Dampening with water or scheduling outdoor work at a time when the ground is relatively wet will minimize airborne dust. Chemically decontaminate known infective foci with a spray of 3% formalin (see CDC 1977). To protect the environment, decontamination must be conducted in accordance with state and local regulations. Chemical decontamination of an "active" bat roost should be conducted only after the bats have been excluded or after bats have departed for hibernation.

**Histoplasmosis — *Treatment.*** Most infections in normally healthy individuals are benign and self-limiting and do not require specific therapy (George and Penn 1986; Rippon 1988). Treatment with an antifungal agent may be prescribed in more severe cases; amphotericin B and/or oral imidazole ketoconazole are typically recommended depending on the specific nature of the infection.

**Removal of Occasional Bat Intruders**

A bat that has blundered into the living quarters of a house will usually find its way out by detecting air movement. When no bite or contact with people or pets has occurred, the simplest solution for "removing" the bat is to try to confine it to one room, then open windows and doors leading outdoors and allow it to escape. If the bat is present at night, the lights should be dimmed to allow the animal to find open doors and windows; some light is necessary if an observer is to insure that the bat finds its way out. If bright lights are kept on, the bat may become confused and may seek refuge behind shelving, curtains, hanging pictures, or under furniture.

Healthy bats normally will not attack people even when chased. Chasing a flying bat with a folded newspaper, tennis racket, or stick will cause the bat to take evasive action, and a bat's flight reversal to avoid a wall is often misinterpreted as an attack. These flailings, often futile, will cause a bat to seek safety wherever possible, making escape more difficult for the bat and more frustrating for the human.

If the bat has difficulty escaping, it can be captured in a hand net (for example, an insect net [Fig. 9]). Otherwise,

Fig. 9. Using an insect net to remove a bat from a building.

wait for it to come to rest, quickly cover it with a coffee can or similar container, and slide a piece of cardboard or magazine under the can to trap the bat inside (NYSDH 1990). Take the captured bat outdoors and release it away from populated areas, preferably after dark. Note that reasonably thick work gloves should be worn at all times when trying to capture a bat. Also, if a bite or physical contact occurs, capture the bat without damaging its head and immediately contact a physician (see previous section regarding rabies treatment). Management of problems involving bat colonies require more complicated procedures and a greater time commitment.

**Exclusion**

***Preventive Aspects.*** The most satisfactory and permanent method of managing nuisance bats is to exclude them from buildings. Locate bats and their points of exit/entry through bat watches or other inspection methods. This is a tedious process to locate all openings in use, and bats may switch to alternate ones when normal routes become unavailable. Thus, consider "potential" as well as "active" points of access.

Often it is apparent where bats might gain entrance even when such openings are not directly observable. By standing in various locations of a darkened attic during daylight hours, one often can find leaks of light at the extreme parts of eaves, in layers of subroofing, and below chimney flashings. Seal all gaps of 1/4 x 1 1/2 inches (0.6 x 3.8 cm) and openings 5/8 x 7/8 inch (1.6 x 2.2 cm) or greater.

Bats will also use some of the same obscure holes in buildings through which heat (or cooled air) is lost; thus, bat-proofing often conserves energy. Simple, homemade devices can be used to locate air leaks. Bathroom tissue or very thin plastic film bags can be taped to a clothes hanger. When placed in front of an area with an air leak (for example, around window frames and sashes where caulking or weatherstripping are needed), the tissue or plastic will wave and flutter from air movements (Fig. 10). Indoor air leaks can be found easily by the use of an air flow indicator (Fig. 11). Small-volume smoke generators can be used to locate openings in the floor, ceiling, attic, and basement. Obscure openings also may be located from outside the house by activating smoke candles or smoke bombs (as within an attic), which will produce easily observed dense smoke. Be careful of any fire hazards.

The easiest time to seal bats out of buildings in northern latitudes is during the cooler part of the year when colonies are not resident. During this period, many homeowners need to be reminded that bats, and bat problems, return each summer. Basic carpentry, masonry, and tinsmith skills are valuable in bat exclusion and other pestproofing interventions.

Fig. 10. Using a clothes hanger/plastic film combination to detect air leaks.

***Devices and Methods.*** Exclusion becomes "denial of reentry" once the bats have returned to establish maternity colonies (and before the young are born), usually from April through mid-May in the Northeast. Denial of reentry is also appropriate anytime after mid-August when young are capable of flying, as long as bats continue to utilize the roost.

The traditional way to exclude bats from an occupied roost involves five basic steps: (1) identify and close all indoor openings through which bats might gain access to human living quarters; (2) close most confirmed and all unused potential exterior exits, leaving only a few major openings (it's best to complete this within 1 to 2 days); (3) at night shortly after the bats

Fig. 11. Smoke from the Sensidyne Air Indicator makes it possible to visually determine the directional pattern of air currents.

have departed to feed, temporarily close the few remaining, major exits; (4) check the roost for presence of bats and, if any remain, unplug the temporarily closed exits early the next evening to allow the bats to escape, then temporarily replug the exits (it may be necessary to repeat this step more than once); and (5) when the bats are all out, permanently seal the holes (Frantz and Trimarchi 1984, Greenhall 1982).

Patience and timing are very important in this process. Much of this work can be done during daylight hours except steps 3 and 4, which require climbing on ladders and roofs at night, sometimes with bats flying nearby. The danger of such work is obvious and discouraging.

Some of these difficulties have been overcome by use of the Constantine one-way valvelike device which is installed in the last exit(s) during the day, and permits bats to leave after dark but prevents their reentry (Constantine 1982). Eventually the valve should be removed and the hole(s) sealed. Another device, the EX-100 Hanks Bat Excluder, consists of a piece of nylon window screening, a wooden plate with a hole in the middle to which is attached a one-way plastic flappervalve, and a rigid plastic mesh cone (Anon. 1983). The screening, to which the wooden plate is attached, is used to cover an opening that bats use to exit a building. Both devices are designed to be used on the last few exit points. Installation instructions are available, and properly applied they will undoubtedly exclude bats from relatively small, discrete openings.

The devices of Constantine and Hanks involve a one-way, self-closing valve feature and can be readily installed during daylight hours. Such devices are not readily adaptable to situations with large, diffuse and/or widely distributed entryways. Also, bats can be inadvertently trapped inside if an important exit hole is mistakenly identified as a minor one and is sealed in an attempt to limit the number of holes requiring an exclusion device.

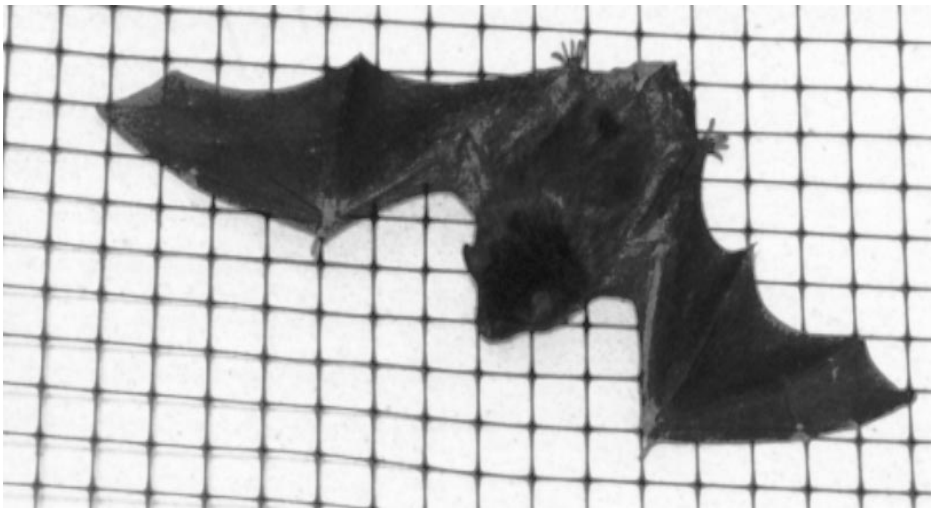


Fig. 12. Bat on birdnetting showing size relationships.

To overcome difficulties with exclusion devices, Frantz' checkvalve was developed using netting made of durable black polypropylene resin (Frantz 1984, 1986). Quality of product is important since the netting should not fray or become misshapen under hot summer conditions. Use only structural grade material that has openings no larger than 1/2 x 1/2 inch (1.3 x 1.3 cm), weighs about 1.3 ounces per square yard (44 g/$m^2$) and is flexible yet stiff enough to maintain the shape of the checkvalve fabricated (Fig. 12). Waterproof duct tape, common staples, and/or wooden lath strips are used to attach the netting to metal, slate, brick, wood, asphalt shingle, or other surfaces. Note that duct tape may stain or discolor painted/enameled surfaces if kept in contact for long periods of time.

Application of checkvalves follows the same two initial steps as traditional bat exclusion. Close interior openings, then close exterior openings except a few major exits. These latter openings will have been confirmed as important via bat watches, and it is here that checkvalves will be fitted during the daylight.

The basic design is to attach the netting around an exit hole except at the bottom where the bats will escape (see Frantz 1986, for details). The width and shape of checkvalves is highly variable so as to embrace the necessary exit point — a single hole, a series of holes, or a long slitlike opening (Fig. 13). Designs must be open enough not to impede the exiting bats. The top can be much larger than the bottom. It is probably best to restrict the bottom opening to no larger than about 1.6 x 1.6 feet (0.5 x 0.5 m). The length of a checkvalve, that is, the distance from the lowest enclosed point of egress to the bottom of the netting, should be about 3.3 feet (1 m).

The above specifications usually are sufficient to abort bats' reentry attempts. If netting is applied while young are still in the roost, the "evicted" mothers may be motivated to chew holes in the netting to reenter the roost. Applied at the correct time of year, however, netting will allow all bats to exit at dusk and thereafter deny them reentry.

Checkvalves should be kept in place for 3 to 5 days. It is best to verify (conduct a bat watch) that bats no longer exit at dusk before the checkvalves are dismantled and the holes are sealed permanently. As in any exclusion intervention, the excluded animals will go elsewhere. This shift may be to an alternative roost already in use such as a night roost, or one used in previous years.

***Supplemental Materials and Methods.*** While specifications for Frantz' checkvalve have been

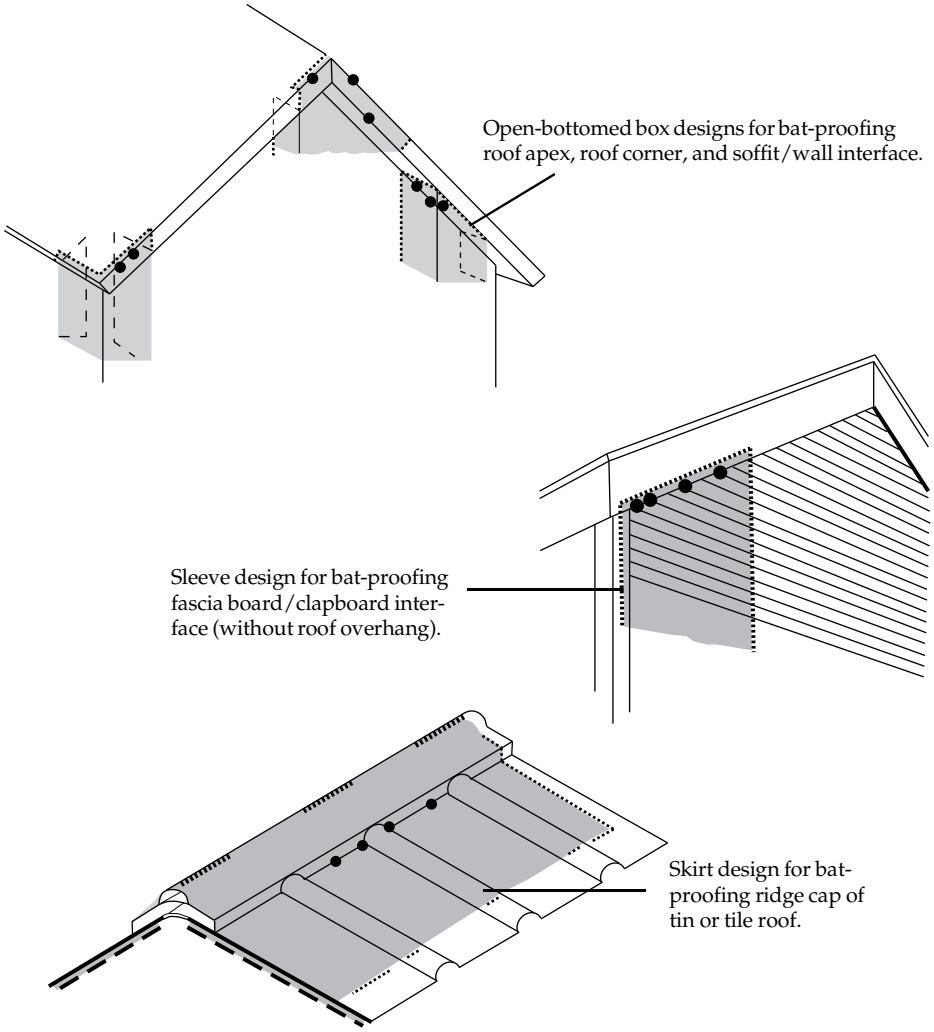



Fig. 13. Sample configurations for Frantz' checkvalve (Key: ▭ = birdnetting; ..... = attaching to structure; • = exit/entry holes of bats).

provided, additional caulking, flashing, screening, and insulation materials often are needed. The combination of materials used will depend on the location, size, and number of openings, and the need for ventilation. Greenhall (1982) provides many details of bat-proofing methods and materials and is a practical guide. Weatherstripping, knitted wire mesh (Guard-All®, Stuf-fit®), waterproof duct tape, stainless steel wool, and wood lath may be used to block long, narrow openings. Caulk-ing compounds will seal cracks and crevices that develop in a house as it ages, and are best applied during dry periods when wood cracks are widest. Caulks that may be applied with a caulking gun (in gaps up to about 0.4 inch [1 cm] wide) include latex, butyl, and acrylic, which last about 5 years. Elastomeric caulks, such as silicone rubber, will last indefinitely, expand and contract, do not dry or crack, and tolerate temperature extremes. Oakum packs easily and firmly into small cracks. Other fillers include sponge rubber, glass fiber, knitted wire mesh, and quick-setting putty. Self-expanding polyurethane foam applied from pressurized containers can be used for openings larger than 3 inches (>7.5 cm). It must be applied with caution so as to not lift clapboards, shingles, and other surfaces. Exposed surfaces should be sealed with epoxy paint to prevent insect infestation and ultraviolet degradation.

Conventional draft sweeps (metal, rubber) and other weatherstripping supplies (felt, vinyl, metal) will seal the space between a door bottom and the threshold or around windows (Fig. 14). Remember to treat attic and basement doors whenever the gap exceeds 1/4 inch (0.6 cm). Flashing may be used to close gaps wherever joints occur; for example, where the roof meets a chimney. Materials commonly used include galvanized metal, copper, aluminum, and stainless steel. Self-adhesive stainless steel "tape" is also available. Insulation will provide some degree of barrier to bat movements. It is available in a number of forms and types including fiberglass, rock wool, urethane, vermiculite, polystyrene, and extruded polystyrene foam. Inorganic materials are fire and moisture resistant; the safest appear to be fiberglass and rock wool.

The mesh size of screening must be small enough to prevent access of bats and other species, where desired. Hardware cloth with 1/4-inch (0.6-cm) mesh will exclude bats and mice; screening with 16 meshes per inch (2.5 cm) will exclude most insects. Soffits (underside of overhanging eaves) usually have ventilators of various shapes and sizes. Regardless of type, the slots should not exceed 1/4 x 1 inch (0.6 cm x 2.5 cm) and should be covered inside with insect mesh. To prevent bats from entering chimney flues, completely enclose the flue discharge area with rust-resistant spark arresters or pest screens, secured to the top of the chimney. These should not be permanently attached (for example, with screws) in case they must be rapidly removed in the event of a chimney fire. Review fire codes before installing flue covers. Dampers should be kept closed except in the heating season.

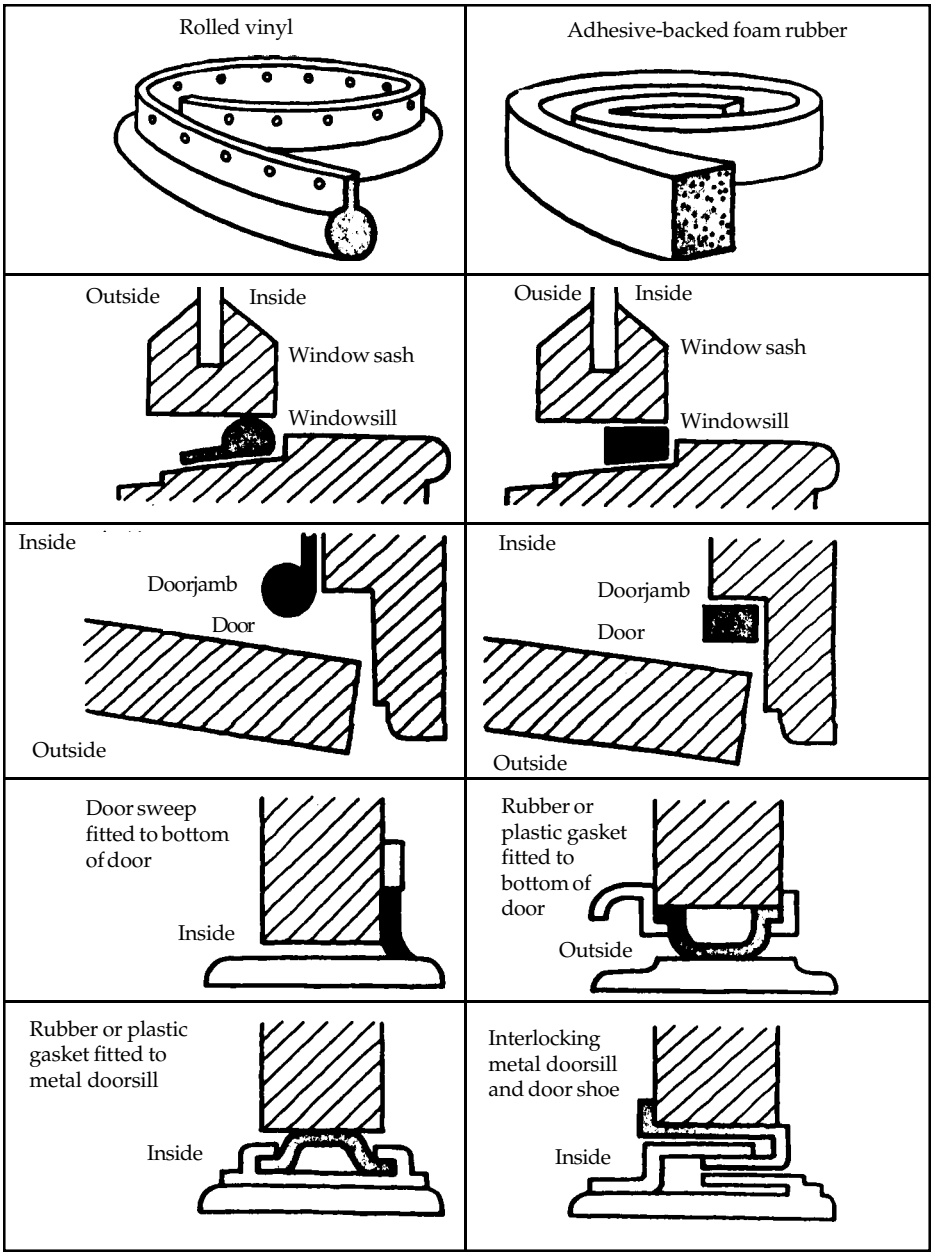



Fig. 14. Weatherstripping and door sweeps are very useful bat-proofing measures.

Fig. 15. Open ends of tile roofs may allow bat entry and provide roosting sites.

**Roof Problems.** Bats, particularly the Mexican free-tailed bat, often roost under Spanish or concrete tile roofing by entering the open ends at the lowermost row or where the tiles overlap (Fig. 15). Tight-fitting plugs are difficult to make due to the variation in opening sizes and thermal expansion and contraction. A solution was found by Constantine (1979) in which a layer of coarse fiberglass batting was laid under the tiles so that bats entering holes would contact the fiberglass and be repelled. A layer of knitted wire mesh would undoubtedly work well for this purpose (and would not hold moisture). Bats also may be excluded from the tiles if rain gutters are installed directly under the open ends. Gaps under corrugated and galvanized roofing may be closed with knitted wire mesh, self-expanding foam (avoid causing roofing to lift), or with fiberglass batting (may retain moisture).

**Wall Problems.** Fiberglass or rock wool insulation blown into wall spaces that are used by bats may be a deterrent, especially when it forms a physical barrier to passage. Such work must be done when bats are absent to avoid their entrapment.

**Temporary Roosts.** Bats will sometimes temporarily roost on porches and patios, in garages, and behind shutters, shingles, and roof gutters. Roosting behind shutters may also be long-term in duration. Actual control measures may not be necessary unless bat droppings become a problem or the risk of human contact is significant. Coarse fiberglass batting tacked to the surfaces where bats prefer to hang sometimes discourages them. A potentially useful intervention for the wall-ceiling interface is the application of a wide 45° molding strip to eliminate the 90° angle corner and force the bats to roost in a more exposed area.

### Repellents

While many chemical aromatics and irritants have been proposed and tested for bat repellency, efficacy has been very limited thus far.

Naphthalene crystals and flakes are the only repellents registered by the US Environmental Protection Agency (EPA) for indoor bat control and are to be applied in attics or between walls. Sometimes the chemical may be placed in loose-mesh cloth bags and suspended from the rafters. About 2.5 pounds per 1,000 cubic feet (1.2 kg/30 $m^3$) is recommended to chronically repel bats as the chemical vaporizes. Dosages of 5 pounds per 1,000 cubic feet (2.4 kg/30 $m^3$) may dislodge bats in broad daylight. Bats will return, however, when the odor dissipates. The prolonged inhalation of naphthalene vapors may be hazardous to human health.

Illumination has been reported to be an effective repellent. Floodlights strung through an attic to illuminate all roosting sites may cause bats to leave. Large attics may require many 100-watt bulbs or 150-watt spotlights to be effective. Fluorescent bulbs may also be used. In some situations such lighting is difficult, costly, and may result in an electrical hazard. Where possible, the addition of windows to brighten an attic will help to reduce the desirability of the roost site and is not likely to introduce additional problems.

Air drafts have successfully repelled bats in areas where it is possible to open doors, windows, or create strong breezes by use of electric fans. Addition of wall and roof vents will enhance this effort, as well as lower roost temperature. These measures will increase the thermoregulatory burden on the bats, thus making the roost less desirable. In a similar fashion, colonies located in soffits, behind cornices, and other closed-in areas can be discouraged by opening these areas to eliminate dark recesses. Discourage bats from roosting behind shutters by removing the shutters completely or by adding small blocks at the corners to space them a few inches away from the wall.

Ultrasonic devices have been tested under natural conditions, both indoors and outdoors, to repel little brown and big brown bats either in the roost or as they fly toward an entrance hole (Frantz, unpublished data). The results have not been promising. Numerous ultrasonic devices have been removed from clients' homes because the bats remained in the roost after the devices were activated. Hurley and Fenton (1980) exposed little brown bats to ultrasound in seminatural roosts with virtually no effect. Largely because of this lack of known scientific efficacy for ultrasonic devices, the New York State Consumer Protection Board has cautioned against the use of such devices (NYSCPB 1988). Part of the concern is that such devices will provide consumers with a false sense of security and, thus, may prevent them from taking effective preventive actions.

Distress cries of bats recorded on tape and rebroadcast can be used to attract other bats to nets or traps, but they do not serve as an effective repellent. Little brown and big brown bats respond to their own distress cries but not to the cries of other species.

Contact repellents, such as sticky-type bird repellents and rodent glues, have been used successfully in situations where roost surfaces and bat accesses may be coated. Apply masking tape to the surface first if you desire to remove the repellent after treatment is finished. Replenish contact repellents occasionally, since dust accumulation causes them to lose their tackiness. Also, caution must be exercised so as to apply coatings that will be sticky, but will not entrap the bats.

**Toxicants (not recommended)**

No toxicants are registered for controlling bats. In 1987 the Centers for Disease Control, United States Department of Health and Human Services, voluntarily withdrew the last registration for DDT use against bats in the United States. Thus, DDT is no longer registered for any use in this country.

Although federally registered for rodents, chlorophacinone (RoZol ) tracking powder, an anticoagulant, is not registered for bats. Furthermore, it can no longer be registered by individual states for restricted use under Section 24(c) of the Federal Insecticide, Fungicide, and Rodenticide Act D-18 (FIFRA). Lipha Tech, Inc. (the manufacturer of RoZol ) has voluntarily cancelled its registration for "RoZol Tracking Powder for Control of Nuisance Bats" — effective December 16, 1991 (Fed. Reg., 1991).

**Trapping**

Kunz and Kurta (1988) reviewed an extensive variety of efficient methods for trapping bats from buildings and other roosting sites or foraging areas. For purposes of wildlife damage control, however, exclusion is less complicated to carry out, less time-consuming, more effective, and requires no handling of bats.

**Other Methods**

***Sanitation and Cleanup.*** Once bats have been excluded, repelled, or have departed at the end of the summer, measures must be completed to make reinfestation less likely, and to eliminate odor and problematic bioaerosols. As a prelude to such work, it is sometimes useful to apply a pyrethrum-based, total-release aerosol insecticide to eliminate unwanted arthropods.

The safe handling and removal of bat guano has been discussed previously (see the histoplasmosis section in this chapter). In addition to the more bulky accumulations of excreta, there are often diffuse deposits of guano under/among insulation materials, caked urine and guano on roof beams, and splattered urine on windows. Such clean-up work during hot summer weather may be the least desirable activity of a management program, but it is necessary.

All caked, crystallized bat urine and droppings should be scraped and wire-brushed, as necessary, from all roof and attic beams. For this procedure, workers should take the same precautions as outlined for histoplasmosis-related work. Accumulated excreta and contaminated insulation should be sealed in plastic bags and removed for disposal. Remove all remaining droppings and debris with

Fig. 16. One of five bat houses constructed to provide an alternative roost for bats excluded from nearby structures.

a vacuum cleaner, preferably one that has a water filter to reduce the amount of dust that escapes from the cleaner's exhaust.

Where possible, wash with soap and water all surfaces contaminated with urine and guano. Allow the surfaces to dry, then disinfect them by misting or swabbing on a solution of 1 part household bleach and 20 parts tap water. Ventilate the roost site to allow odors and moisture to escape. Installation of tight-fitting window screens, roof and/or wall ventilators in attics will enhance this process. Remember, sanitation and cleanup accompanies bat-proofing and exclusion measures, it does not replace them.

***Artificial Roosts.*** For more than 60 years, artificial bat roosts have been used in Europe. Only recently have they gained some popularity in the United States. Though the results are variable, it appears that artificial roosts, if properly constructed and located, can attract bats that are displaced or excluded from a structure. The Missouri Department of Conservation described a successful "bat refuge" that was quickly occupied by a displaced colony of little brown bats (LaVal and LaVal 1980). Bat houses of a similar design have been successfully used in Minnesota, New York, and elsewhere (see Fig. 16).

Development of an efficient method to relocate bats into alternative roosts after they have been excluded from buildings could be an important intervention in comprehensive bat management. Frantz (1989) found it helpful to "seed" newly constructed bat houses with several bats, a procedure that later resulted in full-scale colonization without further human interventions. Alternative roosts should be located away from human high-use areas. Thus, people can enjoy the benefits of bats without sharing their dwellings with them and with little risk of direct contact with them.

## Economics of Damage and Control

Virtually all bats are of some economic importance; those north of Mexico are beneficial because of their insectivorous diet which eliminates many insect pests of humans. The accumulated bat droppings, called guano, is rich in nitrogen and is a good organic fertilizer. At one time, bat guano was commercially mined in the Southwest; but its importance has declined due to reduced bat populations and the development of inorganic fertilizers. Bat guano is still considered a valuable fertilizer resource in some parts of the world (such as Thailand and Mexico).

No figures are available to determine the extent of damage caused by nuisance bats or the cost for their control. The problem is widespread in this and other countries.

Costs for remedial services are highly variable, depending on the nature of the problem and who will do the work. For example, to fabricate a few Frantz' checkvalves on the "average" two-story house would probably require two workers about one-half day, mostly on stepladders, and less than $50 in materials. Much more time would be required to seal up all the other active and potential bat exit/entry holes. In addition, if a deteriorated roof, eaves, or other woodwork must be replaced, the costs can increase rapidly.

It is often difficult or expensive for the public to obtain the services of reliable, licensed pest control operators (PCOs). Many PCOs have limited knowledge of basic bat biology and are apprehensive to work with bats. They may want to avoid any liabilities should bat-human contact occur. Select a qualified professional service that concentrates on the exclusion of live bats from a structure rather than on use of lethal chemicals.

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Figures 2 through 4 from Barbour and Davis (1979).

Figure 5 adapted from Harvey (1986).

Figure 6 adapted from Tuttle (1988), except *Yuma myotis* and Keen's bat (from Barbour and Davis 1979).

Figure 7 adapted from Trimarchi and Frantz (1985).

Figure 8 by R. Suss.

Figures 12, 15, and 16 by S. C. Frantz.

Figures 9, 10, 11, and 14 from Greenhall (1982)

Figure 13 by S. C. Frantz

## For Additional Information


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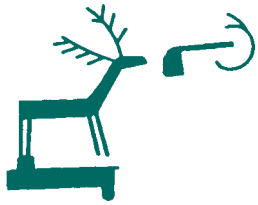
# TRAPPING AND FURBEARER MANAGEMENT

## IN NORTH AMERICAN WILDLIFE CONSERVATION



## Trapping and Furbearer Management in North American Wildlife Conservation

is a compilation of the knowledge, insights and experiences of professional wildlife biologists who are responsible for the conservation of wildlife resources throughout the United States and Canada. It is based on the original *Trapping and Furbearer Management:Perspectives from the Northeast* published in 1996 by the Northeast Furbearer Resources Technical Committee. This expanded North American edition was authored by the following subcommittee of the Northeast Furbearer Resources Technical Committee (NEFRTC): Dr. John F. Organ, Subcommittee Chairman, U.S. Fish and Wildlife Service; Thomas Decker, Vermont Department of Fisheries and Wildlife; Susan Langlois, Massachusetts Division of Fisheries and Wildlife; and Peter G. Mirick, Massachusetts Division of Fisheries and Wildlife.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**The Northeast Furbearer Resources Technical Committee**

is comprised of professional wildlife biologists from the northeastern United States and Provinces of eastern Canada, and is committed to the study and responsible management of our furbearer resources.

**The Northeast Section of The Wildlife Society**

is comprised of professional wildlife biologists and resource scientists and managers from eleven northeastern states and six eastern Canadian provinces, and is committed to excellence in wildlife stewardship through science and education.

For further information on Furbearer Management and Trapping in your state or province, contact your local Fish and Wildlife or Natural Resources Department.



Cover photo of raccoon by Bill Byrne.

Pictographs on cover portray cave drawings of methods ancient peoples used to capture wild animals.

# Introduction

The trapping of furbearers — animals that have traditionally been harvested for their fur — has been an enduring element of human culture ever since our prehistoric hunter-gatherer ancestors devised the first deadfalls, pit traps, snares and capture nets. People were dependent upon furbearers to provide the basic necessities for survival — meat for sustenance, and fur for clothing, bedding and shelter — throughout most of human history. Defining and defending territory where furbearers could be captured to acquire these critical resources united families, clans and tribes long before the invention of agriculture and animal husbandry gave rise to ancient civilizations. While modern technology and agriculture have significantly reduced human dependence on furbearers for survival, people in both rural and developed areas continue to harvest furbearers for livelihood and personal fulfillment. The taking and trading of furbearer resources remain on the economic and environmental agendas of governments throughout the world.

Trapping furbearers for their fur, meat and other natural products presumably began with our earliest ancestors on the African continent. It has a long tradition in North America, dating back to the time the first aboriginal people arrived on the continent. Several thousand years later, fur was the chief article of commerce that propelled and funded European colonization of the continent during the 17th and 18th centuries. Numerous cities and towns founded as fur trading centers during that period still bear witness to the fact that furbearer trapping had a major influence on the history of the United States and Canada.

The utilization of furbearer resources was unchallenged throughout that history until early in the 20th century, when the first organized opposition to furbearer trapping emerged. The focus of that opposition was primarily on development of more humane traps and curtailment of trapping abuses, rather than against trapping itself or continued use of furbearer resources. During the 1920s opposition magnified to challenge the use of steel jaw foothold traps and the wearing of fur.[1] In response to this development, proponents of trapping and the fur industries began organizing to defend themselves. By the 1930s, furbearer trapping had become a recurrent public issue. Since then, the pro- and anti-trapping factions have disseminated enormous amounts of generally contradictory information.

During this same period, new technologies and advances in ecology, wildlife biology, statistics and population biology allowed wildlife management to develop into a scientific profession. State, provincial and federal agencies were created to apply this science to protect, maintain and restore wildlife populations. The harvest of furbearers became a highly regulated, scientifically monitored activity. Trapping and furbearer management — one steeped in ancient tradition, the other rooted firmly in the principles of science — allowed furbearer populations to expand and flourish.

Today, as controversy over the use and harvest of furbearers continues, professional wildlife managers find themselves spending considerable time trying to clarify public misconceptions about trapping and furbearer management. The complex issues involved in that management — habitat loss, animal damage control, public health and safety, the responsible treatment of animals — cannot be adequately addressed in short news articles or 30-second radio and television announcements.

This booklet is intended to present the facts and current professional outlook on the role of trapping and furbearer management in North American wildlife conservation. It is the combined work of many wildlife scientists responsible for the successful conservation of furbearer populations in the United States and Canada.

Photo by Bill Byrne

# The Furbearer

Technically, the term **furbearer** includes all mammals, all of which, by definition, possess some form of hair. Typically, however, wildlife managers use the term to identify mammal species that have traditionally been trapped or hunted primarily for their fur. North American furbearers are a diverse group, including both carnivores (meat-eating predators) and rodents (gnawing mammals). Most are adaptable species ranging over large geographic areas. They include beaver, bobcat, badger, coyote, fisher, fox, lynx, marten, mink, muskrat, nutria, opossum, raccoon, river otter, skunk, weasels and others. A few animals that are normally hunted or trapped primarily for their meat or to reduce agricultural or property damage may also be considered furbearers if their skins are marketed.

*A magnified view of red fox fur shows the short, dense **underfur** that provides insulation and water repellent qualities, and the longer **guardhairs** that resist abrasion and protect the underfur from matting.*

Most furbearers possess two layers of fur: a dense, soft **underfur** that provides insulation and water-repellent qualities; and an outer layer of longer, glossy **guardhairs** that grow through the underfur, protecting it from matting and abrasion. A fur is said to be **prime** when the guardhairs are at their maximum length and the underfur is at its maximum thickness. Fur generally becomes prime in midwinter when the coat is fresh and fully grown; the timing for primeness may vary somewhat depending on species, location (latitude) and elevation.

Furs are generally "dressed" (tanned with the hair on), then trimmed and sewn into garments, rugs, blankets and ornaments, and sometimes dyed in a variety of colors and patterns. Furs are also used in fishing lures, fine brushes and other products. Some furs are shaved, and the hair processed into felt for hats and other garments.

Fur is a renewable (naturally replenished) resource, a product of long traditional use, valued by many for its natural beauty, durability and insulative qualities. Fur is only one of many values that people ascribe to furbearers (see page 27).

Photos by Bill Byrne

Photo by Jack Swedberg

*Furbearers are a diverse group including several rodents and numerous carnivores (meat-eaters). The muskrat (above, left), a wetland herbivore (plant-eater), is the number one furbearer in the United States and Canada based on the number of pelts harvested each year. The beaver (above, right) is the largest native rodent in North America, best known for its ability to fell trees and dam streams. Facing page, top, the fisher, a member of the weasel family, is an opportunistic predator equally at home in the trees or on the ground. Below, the red fox, like the beaver, has achieved considerable success in adapting to suburban environments.*

Photos by Bill Byrne

# Issues in Furbearer Management

**There are three major issues involving the conservation and management of furbearers today: human population growth with its inevitable degradation and destruction of wildlife habitat; increasing public intolerance of furbearers in populated areas; and opposition from animal rights activists to any harvest or use of wildlife.**

## Loss of Habitat

The first and most critical issue challenging furbearer conservation today is human population growth and the resultant degradation and destruction of wildlife habitat. Without adequate habitat, wildlife populations cannot be sustained. While no furbearer species is in immediate jeopardy due to habitat loss in North America (because furbearers are typically abundant, adaptable species often covering large geographic areas), the range of some populations has been reduced. Habitat destruction has eliminated the option to restore some species to areas where they once existed.

Among wildlife scientists, ecologists and biologists, no issue is of greater concern than the conservation of wildlife habitat. Every government wildlife agency is directing significant educational and/or financial resources to the conservation of habitat. Habitat conservation is the key to maintaining the viability of all wildlife populations and the ecosystems on which they depend. Unlike habitat destruction, regulated trapping is a sustainable use of wildlife resources, and does not, in any way, jeopardize the continued existence of any wildlife population.

Photo by Bill Byrne

*The continuing loss of wildlife habitat is the most critical issue in wildlife conservation today. Unlike regulated trapping, habitat destruction threatens the existence of wildlife populations and the ecosystems on which they depend. Further, as development encroaches on wildlife habitat, adaptable furbearer species create problems for homeowners, increasing public intolerance of these valuable wildlife resources.*

## Public Intolerance

While habitat loss is a direct threat to wildlife populations, it also has indirect consequences. As wildlife habitat continues to be fragmented and eliminated by development, wildlife managers are confronted with new challenges: coyotes killing pets, beavers cutting ornamental trees and flooding roads and driveways, raccoons invading buildings and threatening public health with diseases and parasites. These kinds of human-wildlife conflicts reduce public tolerance and appreciation of furbearers. While **Biological Carrying Capacity** (population level an area of habitat can support in the long term) for a furbearer species may be relatively high, the **Cultural Carrying Capacity** (population level the human population in the area will tolerate) may be lower.[2] Wildlife managers, responding to public concerns, have implemented furbearer damage management programs at state and federal levels.

A growing dilemma is that furbearers, while of great recreational, economic, and intrinsic value to society, are also increasingly a public liability. The challenge — magnified in and near areas of dense human population — is to satisfy various constituents with different interests and concerns while conducting sound wildlife management. Wildlife agencies typically use an integrated approach involving education, barriers, deterrents and lethal techniques to address specific problems, while fostering public tolerance for wildlife that causes damage. The combination of as many feasible options as possible provides for the most successful program. Wildlife agencies have long relied on the free services provided by the public who trap to assist landowners suffering damage caused by furbearers. Unfortunately, due to various environmental, economic and sociological factors, traditional fur trapping — which reduces animal damage at no cost to the public — tends to be a rural activity. The number of people newly involved in this cultural activity has declined in recent years, particularly in suburban and urban areas.


Photo by Bill Byrne

*Nuisance animal control is becoming a growth industry in many areas as development fragments wildlife habitat and traditional fur trapping declines. This trend is of concern to wildlife biologists, for it indicates that a growing segment of the public is losing its tolerance and appreciation for some wildlife species, viewing them as problems that should be removed and destroyed, rather than as valuable resources that should be utilized and conserved.*

With the decline of traditional fur trappers, "nuisance animal control" has become a growth industry. Businesses specializing in trapping and removal of "problem" animals are thriving in many areas. This trend is of concern to wildlife biologists, for it indicates that a growing segment of the public is coming to view furbearers as problems that should be removed and destroyed, instead of valuable resources that should be utilized and conserved. Regardless, regulated trapping provides an important and effective method to meet the public's demand for reduction of furbearer damage.

## Animal Rights

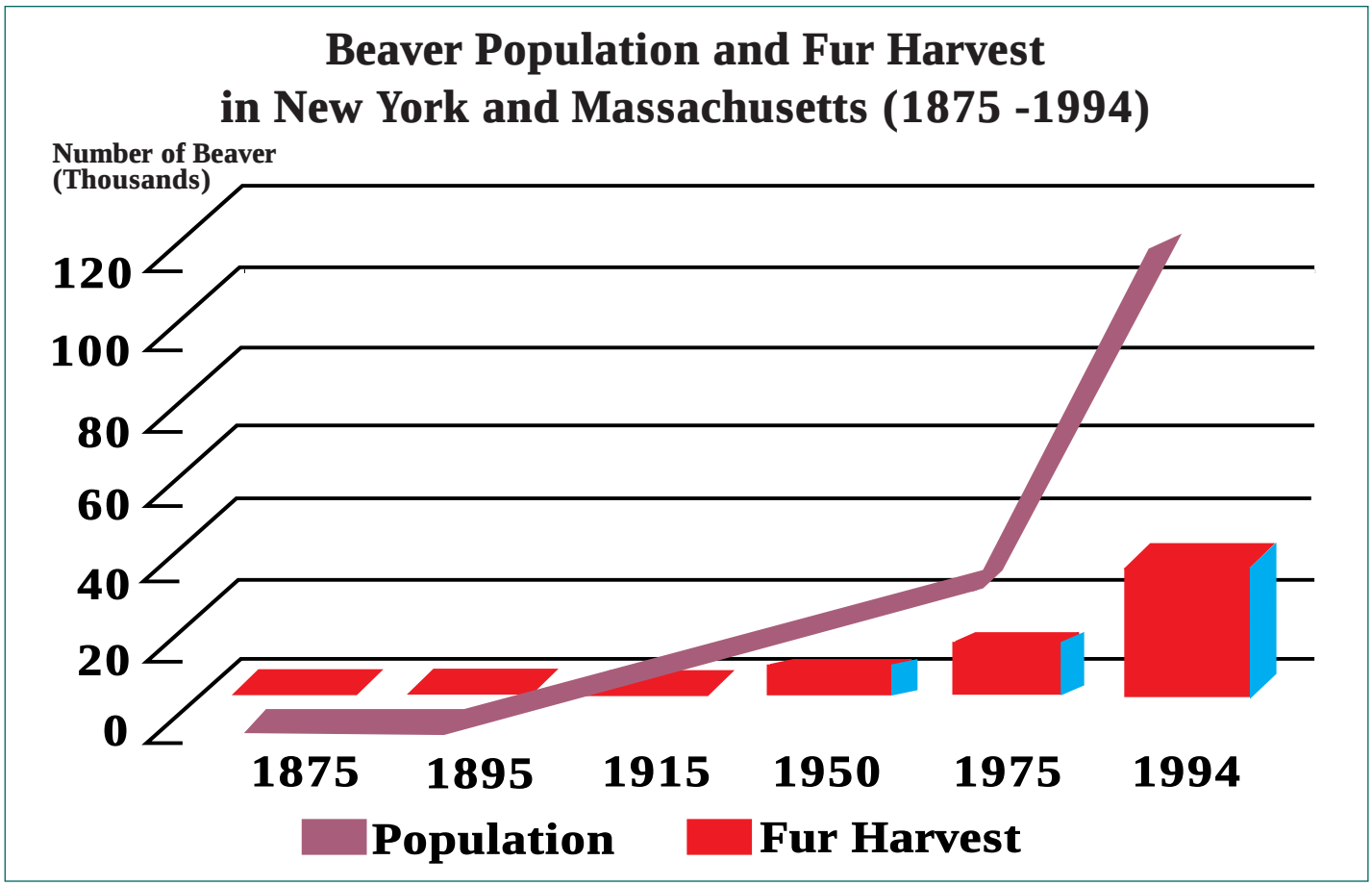
As wildlife managers are faced with having to rely more on regulated trapping for furbearer population management and damage control, animal rights activists demanding an end to trapping are appealing for public support. Those advocating "animal rights" would eliminate all trapping and use of furbearers. Without regulated trapping, the public would have far fewer reliable and economically practical options for solving wildlife damage problems associated with furbearers.

# Public Wildlife Agencies Manage Our Wildlife Resources

Furbearer management programs in the United States and Canada are primarily conducted by state and provincial wildlife agencies. Current management programs respond to and respect the diversity of people and cultures and their values toward wildlife resources. In the United States, most funding for furbearer management comes from two sources: hunting and trapping license revenues, and federal excise taxes on firearms, ammunition and archery equipment (federal aid). Most wildlife management is not funded with general tax dollars. Federal aid — now amounting to over 200 million dollars in some years among the 50 states, territories and the Commonwealth of Puerto Rico — has been provided since passage of the Federal Aid in Wildlife Restoration Act (also known as the Pittman-Robertson Act) in 1937. Federal funds and the assistance of certain federal agencies are also available for wildlife damage management programs within each state.

State and provincial wildlife agencies manage furbearer populations for the benefit of a public with diverse opinions. Wildlife managers must therefore balance many objectives simultaneously. These objectives include preserving or sustaining furbearer populations for their biological, ecological, economic, aesthetic and subsistence values, as well as for recreational, scientific and educational purposes. It is sometimes necessary to reduce furbearer populations to curtail property damage or habitat degradation, or to increase furbearer populations to restore species to areas where they have been extirpated (eliminated within an area).

Professional wildlife biologists meet the public's objectives by monitoring and evaluating the status of furbearer populations on




*Nearly extirpated prior to the start of the century, beaver populations have responded to applied wildlife management in a dramatic fashion.[3] Like many other furbearer species, the beaver has been restored to much of its former range while sustaining considerable, scientifically regulated public fur harvests.*

Photo by Bill Byrne

*Many states and provinces require that the pelts of certain species of furbearers taken by trappers must be officially examined and tagged (sealed or stamped) before they may be sold. This allows wildlife biologists to closely monitor harvest rates of some species while collecting invaluable data on population trends. When biologists need more information, regulations may be adjusted to require that trappers turn in the carcasses or certain parts of their harvested animals. This allows biologists to examine such things as reproductive rates, food habits, sex and age ratios and other information that is often useful in managing furbearer and other wildlife resources.*

a regular basis, and responding with appropriate management options. Much of the information known about furbearer populations — as well as the management of furbearer populations — has been derived from trapping. Accounting for yearly variation in the numbers, sex and age of animals caught by licensed trappers, along with variation in effort provided by trappers, is an economical way to monitor population fluctuations. In many cases, biologists acquire information directly from harvested animals. More intensive (and expensive) research projects are initiated when additional information essential to management is needed. Many jurisdictions adjust trapping regulations in response to population changes to either increase or decrease the population in response to the public's desires.

Management plans and regulations restrict trapping seasons to periods when pelts are prime and the annual rearing of young is past. Historical records demonstrate how applied wildlife management sustains regulated harvests: populations and harvests of most furbearing species have generally increased in North America during this century. Beaver, for example, were almost eliminated from the eastern United States and greatly reduced in parts of eastern Canada by the middle of the 19th century. Today they number in the millions, thriving throughout that range wherever sufficient habitat remains and the public will allow their presence. They have been restored to this level while sustaining a substantial, annual, regulated public harvest.[4]


## Multiple Uses of Furbearers

If we look back in human history, all of our ancestors once depended on furbearers for survival. Native peoples traditionally used furbearers for food, clothing, medicines, perfumes and other items. Today, many people living in rural and suburban environments throughout North America continue to live close to the land, utilizing furbearers to maintain a sense of self-reliance, remain in touch with their heritage, and participate in a favorite, challenging, outdoor activity. In a free society, such lifestyle decisions are a matter of personal choice.

Photos by Bill Byrne • Nutria dish photo courtesy of Lousianna Dept. of Wildlife & Fisheries

Wildlife managers in many states and provinces have reintroduced extirpated furbearer species. Extirpation was ultimately caused by widespread degradation and loss of habitat associated with the colonization of North America and subsequent growth of human populations. In some instances this was combined with excessive exploitation because there were no wildlife agencies to establish and enforce regulations designed to protect furbearer populations. Where habitat and public support are available, the reintroduction of extirpated furbearers has been remarkably successful. In both the United States and Canada, species such as beaver, river otter, fisher and marten have been reintroduced and restored throughout much of their historical range.

The time when furbearer species could be extirpated due to excessive, unregulated harvest is long past. Today, professional wildlife biologists are responsible for furbearer management. Most have devoted years of academic, laboratory and/or field research to the study of furbearer species. Their mission is the conservation of furbearer populations. They have been highly successful in that mission as evidenced by the restoration and current abundance of furbearer populations.

Harvested furbearers have many uses today, reflecting the utilitarian values of many of the people who harvest them. Pelts are used for clothing such as coats, hats, mittens (made by craftspeople in Maine, left) and blankets, and are also used to make moccasins, banjos, rugs, wall hangings and other forms of folk art. Fur is also used in fine art brushes, water repellent felt for hats, and high quality fishing lures. Some people use the meat of furbearers such as raccoon, beaver, nutria (prepared by a Louisiana chef, above) and muskrat for tablefare or as a food source for pets. It is delicious and nutritious, high in protein and low in fat. The glands of beaver are used in perfume, and glands and tissues from these and other furbearers are used to make leather preservatives, scent lures, and holistic medicines, salves and moisturizers. Even the bones, claws and teeth of harvested furbearers are sometimes used to make jewelery.

# Principles of Furbearer Management

The goal of furbearer management is the conservation of furbearer populations. The main tenet of conservation is this: **Native wildlife populations are natural resources — biological wealth — that must be sustained and managed for the benefit of present and future generations.** If those wildlife populations are furbearer species, one important public benefit conservation provides is the opportunity to harvest some animals for food, fur or both. The harvest of animals for these purposes is among the most ancient and universal of human practices. Today, under scientific wildlife management, harvests are controlled and regulated to the extent that the survival of furbearer populations is never threatened. No furbearer species is endangered or threatened by regulated trapping. **North American wildlife conservation programs apply three basic principles in establishing and managing harvest of wild animals: (1) the species is not endangered or threatened; (2) the harvest techniques are acceptable; and (3) the killing of these wild animals serves a practical purpose.**[5]

It is important to understand that the aim of professional wildlife management is to perpetuate and ensure the health of wildlife populations; not the survival of individuals within those populations. Wildlife management does not generally focus on individuals because individuals have short life spans. On the time scale that conservation is pledged to address, individuals do not endure. Populations *do*. Populations — provided with sufficient habitat and protected from excessive exploitation — are essentially immortal. Wildlife managers apply scientific methods to maintain

furbearer species as viable, self-sustaining populations.

## Population Dynamics

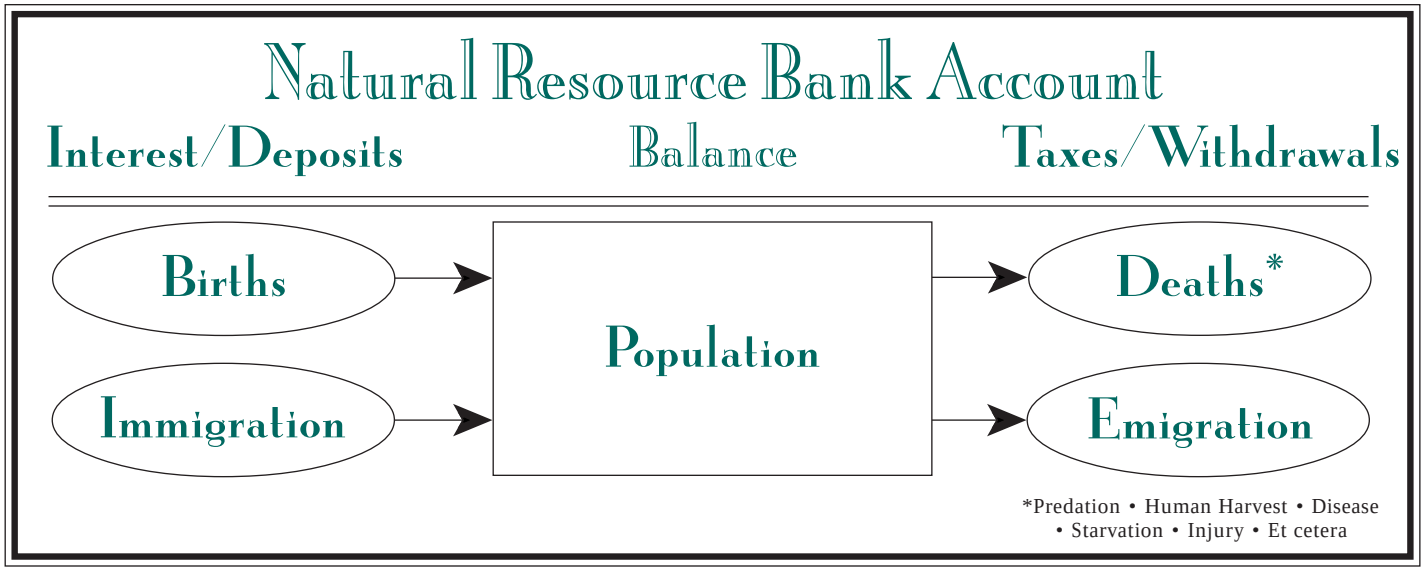
Like all populations, those of furbearers are dynamic. They are always in a state of flux, interacting directly and indirectly with other animal, plant, bacterial and viral populations. In response to these interactions and a host of other environmental factors — many of which are today related directly to human actions — furbearer populations increase and decrease in density (number of individuals in any given area) and range. Wildlife managers monitor wildlife populations to determine if they are increasing, decreasing or stable; to identify factors that affect those population trends; and to manipulate some of those factors to achieve the goals of conservation.

The laws of evolution and survival demand that the reproductive rate (the number of individuals born) of any population must equal or exceed its mortality rate (the number of individuals that die). If, over time, births do not equal or outnumber deaths, the population will become extinct. As a result, all species have evolved to produce a surplus of young during each generation. Furbearer species are no exception; many are capable of *doubling* their populations within a single year.

Because they produce a surplus of young, populations should theoretically grow continuously. The reason they do not is because as populations grow, various **limiting factors** slow or stop population growth. Resources required for survival — food, water, shelter and living space — are limiting factors. As a population grows, one or more of these resources may become scarce to the point that some members of the population fail to acquire them and therefore die, disperse or fail to reproduce. Other limiting factors include communicable diseases and predation. These are **density-dependent** factors — that is, they increase as the density of the population increases.


Photo by John Organ

*Professional wildlife biologists are responsible for furbearer management today. They have been highly successful in their mission because they use the best scientific information available to ensure the present and future health of furbearer populations.*




*In a simple example (excluding habitat-related factors such as carrying capacity), a stable furbearer population can be compared to a bank account: interest and deposits (births and immigration) increase the balance (population) every spring and summer; taxes and withdrawls (mortalities and emigration) decrease it by roughly the same amount every fall and winter. Accountants (wildlife biologists) monitor the bank statements and advise the owner (the public) on when and how much of the balance can be withdrawn (harvested) that would otherwise be lost to taxes (other forms of mortality).*

Other limiting factors are **density-independent**. These include weather extremes, habitat destruction and other catastrophic events. These reduce populations regardless of density. Some limiting factors such as road mortality (killed by vehicles) may be both density dependent *and* independent. Road mortality, for instance, is likely to increase as population density increases; however, it also will increase as more roads are built, regardless of population density.

Healthy furbearer populations cycle (increase and decrease about equally) on an annual basis. Most increase in the spring and summer with the birth of young; decrease in the fall and winter as natural mortality and emigration increase. Annual cycles are most dramatic in furbearer populations with high reproductive rates. Muskrat populations, for example, can decline by 75 percent during winter — and rebound completely by the following fall![6]

## Banking Resources

Wildlife managers normally set furbearer trapping seasons to allow use of a portion of the individuals that would otherwise be lost to disease, starvation, predation and other mortality factors. The standard regulated harvest is **compensatory** mortality: it *replaces* mortality factors that would otherwise have reduced the population by a similar amount. A scientifically regulated, annual harvest can be sustained indefinitely because it removes only the surplus, leaving sufficient reproducers to restore the surplus.

As a simplified example, imagine a stable furbearer population as a bank account. The balance (population) is a continually shuffled stack of bills (individuals). The account accumulates interest (the birth of young) every spring. Taxes (predation, disease, etc.) are always taking a few bills out of the pile. If the interest is allowed to accumulate, taxes increase dramatically every winter. However, if the interest is withdrawn (hunted or trapped) by the owners (the public), taxes do not increase. Either way, through taxes or withdrawals, the balance remains about the same from year to year. Wildlife managers are the accountants who advise the owners on when and how much interest can be withdrawn from the account.

## Furbearer Population Management

Wildlife biologists manage furbearer populations in much the same way they manage other fish and wildlife populations such as bass, deer and eagles: they monitor the populations, determine the best management goals for each population (i.e. should it be increased, decreased or stabilized in the best interests of the public and conservation), and then set harvest regulations/restrictions accordingly. Under most circumstances, the aim is to keep populations stable over time.

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Adults | 2 | 2 | 2 | 6 | 10 | 14 | 26 | 46 | 74 | 126 |
| 2 Yr Old | 0 | 0 | 4 | 4 | 4 | 12 | 20 | 28 | 52 | 92 |
| 1 Yr Old | 0 | 4 | 4 | 4 | 12 | 20 | 28 | 52 | 92 | 148 |
| Kits | 4 | 4 | 4 | 12 | 20 | 28 | 52 | 92 | 148 | 252 |
| Total | 6 | 10 | 14 | 26 | 46 | 74 | 126 | 218 | 366 | 618 |

*In the absence of limiting factors such as inadequate habitat, disease, predation and human harvest, beaver populations are capable of very high rates of growth. Regulated trapping helps control furbearer population growth and reduce furbearer damage at no cost to the public, and does not threaten the viability of furbearer populations.*

Under some circumstances — when a furbearer population is causing damage by threatening the survival of endangered species, damaging fish and wildlife habitat, or creating a hardship for landowners or agricultural producers — it may be desirable to reduce furbearer populations within some areas. In these situations, wildlife managers may adjust trapping and hunting regulations to increase the harvest beyond surplus production. When population reduction is the objective, the harvest adds to the annual mortality rate. This controlled **additive** mortality will cause the population to decline.

Conversely, there are situations when it is desirable to increase furbearer populations. These occur when efforts are being made to restore an extirpated species, or when a severe population reduction has taken place. In such cases wildlife managers might restrict or prohibit harvests for a time to encourage a rapid population increase.

The beaver is an excellent example of a furbearer that warrants intensive management. Wetlands created by beaver are highly productive systems with an abundance of water and nurients. They support a huge diversity of plants and invertebrates, and provide habitat for hundreds of fish and wildlife species. If the management objective is to maintain species abundance and diversity, it is prudent to manage beaver for its positive wetland values.

However, beaver populations often require control to reduce conflicts with humans. Although problems with beaver flooding roads and damaging property are widespread, the problems would be more intense, and the economic impacts greater, without the harvests of beaver during regulated trapping seasons. Almost half a million beaver are harvested from the states and provinces in any given year.[7] This reduction is important in controlling the growth of beaver populations and reducing property damage. It does not threaten the viability of beaver populations or their positive wetland values.

Muskrat, nutria and beaver are the only furbearers in North America that, like deer, can significantly lower the quality of their habitat (by consuming a high percentage of the vegetation) if their populations are not maintained at an appropriate level. Additionally, lowering nutria populations may be a legitimate goal in making marsh habitats more suitable for other wildlife species and in preventing erosion and the loss of marsh vegetation.

**Regulated trapping is the most efficient and practical means available to accomplish regular population reductions, and it does so at no cost to the public**.

Although the populations of some furbearer species are prone to attain high local densities, and then to "crash" dramatically as density-dependent limiting factors (e.g. food availability and disease) are activated, most furbearer

*Pitcher Plant*

species become relatively stable once their populations reach a given density. However, that density may be beyond what the human population can tolerate. If the level of human-furbearer conflicts (or conflicts with other wildlife species and habitats) becomes too great, population reduction can be a responsible management alternative.

While furbearer population reduction is not a goal for most furbearer management programs, population reductions in specific areas can control the frequency of furbearer conflicts with humans, lessen predation on rare, threatened or endangered species, or reduce negative impacts on habitats and property.

The case of the piping plover, a beach nesting bird, provides a good example of how furbearer population reductions can assist in the restoration of a rare species. The piping plover, a federally listed threatened shorebird protected by both U.S. and Canada endangered species legislation, is vulnerable to predation by foxes and other predators while nesting. Trapping in and around piping plover habitat has reduced local predator populations, allowing enhancement of the dangerously low plover population, while the predators can be utilized as valuable, renewable, natural resources.[8]

## Trapping Protects Rare & Endangered Species

Foothold traps are sometimes used to capture rare or endangered species unharmed so that the animals can be introduced into favorable habitats to reestablish healthy populations (see page 34). However, foothold traps also play an important role in protecting the health and viability of many established or newly re-established populations of rare and endangered species. Foothold traps are particularly important management tools for protecting rare or endangered species from undesirable levels of predation caused by fox and coyote.

The following is a *partial* list of endangered or threatened plant, reptile, bird and mammal species in North America which are being protected and managed through the use of modern foothold traps:

| Rare Species Under Restoration | Species Trapped to Aid Restoration |
|---|---|
| Pink Lady Slipper | Beaver |
| Pitcher Plant | Beaver |
| Desert Tortoise | Coyote |
| Sea Turtle | Raccoon |
| Alleghany Wood Rat | Raccoon |
| Aleutian Canada Goose | Arctic Fox |
| Attwater's Prairie Chicken | Coyote |
| Brown Pelican | Coyote |
| Mississippi Sandhill Crane | Coyote |
| Alabama Beach Mouse | Red Fox |
| Columbian White-tailed Deer | Coyote |
| San Joaquin Kit Fox | Coyote |
| Whooping Crane | Coyote, Red Fox |
| Least Tern | Red Fox, Raccoon, Coyote, Opossum |
| Black-footed Ferret | Coyote (taken for disease monitoring) |
| Piping Plover | Red Fox, Raccoon, Mink, Striped Skunk |

Photos by Bill Byrne

*Piping Plover*

The target animals trapped during these operations to reduce habitat damage or predation on the rare species are either removed or relocated after capture. The trapping may be carried out by federal, state or provinicial wildlife biologists and animal control agents, or by private, regulated trappers.

# Protecting America's Important Wetlands with Regulated Trapping

The coastal wetlands along the Gulf coast of Louisiana are among the most productive and important fish and wildlife habitat types found in the United States. The largest expanse of wetlands in the contiguous U.S. occurs in Louisiana, comprising 25% of the freshwater marshes and 69% of the saltwater marshes of the Gulf Coast. This translates to 15% and 40% of these important ecological areas remaining in the United States. Louisiana's wetlands provide a multitude of functions and important values including:

1. Habitat for a diverse array of fish and wildlife species including ***15 million water birds***, ***5 million wintering waterfowl***, over ***1 million alligators*** and ***11 Threatened or Endangered species***;
2. Groundwater recharge, reduction of pollution, and nutrient and sediment reduction;
3. Storm buffer, erosion control and protection from floods;
4. Commercial and recreational marine fisheries with a total economic effect of $ 3.5 billion

In the State of Louisiana over 3.6 million acres of coastal marshes now exist. However, these coastal wetlands are threatened by degradation and destruction through overpopulation of nutria, an exotic rodent found throughout these wetlands.

Nutria are large semi-aquatic rodents native to South America. The Gulf Coast nutria population originated in Louisiana during the 1930s when captured animals were released or escaped into the wild. These animals established a population and began to thrive in coastal wetlands. Nutria weigh an average of 12 pounds each, average 4-5 young per litter, and have several litters each year. Nutria are herbivores that eat wetland plants and vegetation. They will pull and eat plant roots that anchor into the marsh. High populations of nutria foraging on marsh vegetation have resulted in vast areas of marsh becoming entirely void of plants. When vegetation is removed from the surface of the marsh, the very fragile organic soils are exposed to erosion through tidal action. If damaged areas do not revegetate quickly, they will become open water as tidal scour removes soil and thus lowers elevation. Frequently, the plant root systems are also damaged, making recovery through regrowth of vegetation very slow. When a marsh is denuded of plant life by nutria, it is called an "eat-out."

The first region-wide aerial survey to estimate nutria herbivory damage was conducted in 1993 because reduced trapping resulting from lower fur prices allowed nutria, and eat-outs, to increase. Each year the

*Coastal wetlands in Louisiana are threatened by high populations of nutria, which can denude or "eat out" large areas of vegetation (below), leaving fragile marsh soils susceptible to erosion and destruction. Inset of fenced area shows what healthy marsh vegetation should look like.*

Photo courtesty Louisiana Dept. Wildlife & Fisheries

Photo courtesty Louisiana Dept. Wildlife & Fisheries

*Nutria are large, semi-aquatic rodents with prodigious appetites. Regulated trapping of nutria helps prevent erosion of fragile wetlands while providing trappers with valuable food and fur.*

number of eat-outs and severity of the damage continue to increase, with only a small portion of the damaged acres demonstrating vegetation recovery. In 2000, wetland damage in Louisiana attributable to nutria was conservatively estimated to exceed 100,000 acres. The estimate is conservative because only the worst, most obvious damage can be detected from aerial surveys. The number of acres being impacted is certainly much higher.

The long term effect of these eat-outs is permanent. Vegetation damage caused by overpopulation of nutria aggravates other erosional processes. Coastal marshes are being lost at an alarming rate as a result of erosion, subsidence (lowering of land), saltwater intrusion, and the lack of silt-laden river water available to continue the process of marsh-building. Once gone, these acres of productive marsh cannot be replaced, and all their positive benefits and values are lost with them. Nutria also cause damage to rice and sugarcane fields, as well as to drainage canal dikes and roadways. In some areas they have severely reduced success of wetland restoration efforts by feeding on planted grasses and trees.

Because of the tremendous destruction of this important habitat type that is home to literally hundreds of species of birds, mammals, reptiles and amphibians, control of nutria is among the top priorities of the Louisiana Department of Wildlife and Fisheries (LDWF). Regulated trapping is the predominant method used in management of nutria populations. Licensed trappers harvest nutria during regulated seasons. If nutria are valuable enough, licensed trapper effort — and therefore nutria harvest — increases, resulting in reduced herbivory damage to the coastal wetlands.

To enhance this economic incentive, the LDWF has taken two approaches. One has been to develop a market for nutria pelts, and the second is to develop a market for the human consumption of nutria meat. The sale of the pelt for clothing, and the additional sale of nutria meat for human consumption, can provide a valuable additional incentive to keep more licensed trappers in the marsh helping to maintain nutria populations in balance with habitat. In the past, the harvest of nutria during regulated seasons in the fall and winter months has resulted in harvests between 390,000 to over 1 million nutria annually. Such controlled and managed utilization of wildlife allows managers to protect coastal wetlands by keeping nutria populations at levels suitable with existing habitat conditions.

The importance of the regulated harvest of nutria cannot be overstated: between 1962-1981 over one million nutria were harvested each year in Louisiana. During this time there was no damage to coastal wetlands. When changing market prices result in lower nutria harvests, coastal wetland damage from nutria becomes a problem. Alternatives to using regulated trappers to control nutria can be costly (if even practical) to society.

Photo by Bill Byrne

*A red fox displays the fatal results of sarcoptic mange. The disease is density-dependent in that the mites which cause it must be spread by direct contact with an infected animal or its bedding. When population densities are high, animals come into contact more frequently, and diseases such as mange spread rapidly.*

## Disease Control

The influence of trapping on the occurrence and spread of wildlife diseases has not been established definitively, despite claims by both opponents and proponents of trapping. However, disease occurrence in wildlife populations is often associated with high densities of animals.[9] Reducing local densities of furbearer populations through harvests can reduce disease transmission and potential for human contact. While the disease may persist in the population, the intensity of outbreaks may be reduced. In a study conducted in Canada, severity of fox rabies outbreaks were reduced by heavy, government-funded trapping, while normal fur harvests showed little effect. However, it was also noted that high levels of regular trapper harvest in southern Ontario decreased the severity, if not the frequency, of rabies outbreaks in red foxes.[10] Intensive, government-funded trapping was also shown effective in controlling an epizootic of skunk rabies in Alberta.[11]

The only definitive statements that may be made on the subject of disease control at this time are that regulated trapping will not (and is not designed to) eradicate diseases; very intensive trapping may help control diseases; and the relationship of normal harvests to disease occurrence and intensity in wildlife populations is not yet well understood.

# Regulated Trapping on National Wildlife Refuges

In 1903, President Theodore Roosevelt ordered that a small shell- and mangrove-covered island in Florida's Indian River be forever protected as a "preserve and breeding grounds for native birds." Paul Kroegel, a sometime boat builder, cook and orange grower, was hired to watch over this three acre sanctuary. His mission was clear: *protect the island's pelicans from poachers and plume hunters*. With this simple promise of wildlife protection, the National Wildlife Refuge System was formed.

The System now encompasses more than 92 million acres in the United States managed by the U.S. Fish and Wildlife Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas and other designations for the protection and conservation of fish and wildlife, including those that are threatened with extinction. The mission of the National Wildlife Refuge System is:

Photo by Tom Decker

*"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."*

Regulated trapping is recognized as a legitimate activity and sustainable use of wildlife resources within the Refuge System, and has been an important tool for the accomplishment of refuge management and restoration programs for many years. A comprehensive evaluation of Refuge trapping programs conducted by the Service in 1997 documented the importance of this activity in helping Refuges meet the mission stated above. The study examined mammal trapping programs on the Refuge System that occurred between 1992 and 1996.[12] The study identified 487 mammal trapping programs on 281 National Wildlife Refuges during the 5-year period. The Service report went on to say **"This report demonstrates the importance of trapping as a professional wildlife management tool"** and **"Mammal trapping also provided important benefits for public health and safety and recreational, commercial, and subsistence opportunities for the public during the period."**

Eleven reasons for trapping on Refuges were identified in the following order (most common to least common): recreation/commercial/subsistence, facilities protection, migratory bird protection, research, surveys/monitoring, habitat protection, endangered species protection, public safety, feral animal control, population management, and disease control. A variety of trap types were used in these programs: quick-kill traps were used on 171 refuges, cage traps were used on 157 refuges, foothold traps were used on 140 refuges, snares were used on 74 refuges, and other devices were used on 66 refuges.

The variety of trap types used reflects the diversity of environmental and weather conditions; refuge-specific needs, objectives and regulations; and of course the different wildlife species which are found from the Arctic National Wildlife Refuge in Alaska to wetland areas of Gulf Coast Refuges to the forest lands of Refuges in Maine. Trapping activities on Refuges are regulated; the public who participate are required to be licensed and to follow many enforced rules to ensure that their activities are conducted appropriately and in accordance with existing laws and regulations.

Photo by Benjamin Tuller NYDEC

# The Facts on Regulated Trapping

People have continuously used furbearers in North America for clothing, food and religious ceremonies for the past 11,000 years. Fur resources had a greater influence than any other factor on European settlement and exploration of the continent. Many cities and towns in North America, including Quebec, P.Q., Albany, NY, Chicago, IL, St.Louis, MO and Springfield, MA, were founded as fur trading centers where Europeans bartered with Native Americans for furs. The trapping and trading of furbearer resources is a heritage that still continues as an important component in the lifestyles of many people in our society. Whether in an industrial, urban, rural, or remote setting, trapping and fur are still of cultural and economic importance and furbearers continue to be utilized and managed as valuable renewable natural resources.

The economic impact of managing furbearer resources is enormous: the multi-billion dollar fur industry annually generates millions of dollars to North American trapper households, wholesalers, processors, garment makers and the retail clothing industry. There are also economic values derived from reduced damage to property and agriculture; personal uses of fur, hides, meat and other products; license revenues; goods and services sold to the public who trap and hunt; and the enhancement of economic activity and the redistribution of wealth into rural communities. Many remote communities in Alaska and northern Canada are dependent on the sale of pelts.[13]Trappers in South Carolina report that 9.3 percent of their family income is derived from trapping.[14] The food value of furbearers can be equal to or greater than the market value of their pelts. Even in an industrialized state like Massachusetts, 28% of trappers report they use furbearers as a food source for themselves or their pets.[15]

In addition to economic values, trapping has many social values. In Vermont for example, gardening, child care, fire wood gathering, harvesting of wild

# Trapping is a Lifestyle

Historically, people in the United States and Canada looked to the land to secure food and provide for their households. Being independent, self-sufficient and hard working, providing for one's family, being a steward of the land — these values and lifestyles are traditionally and distinctly part of the fabric of our society and culture, and they remain present today.

Trapping is an annual seasonal activity in which many people in North America currently participate. Sociologists and other researchers have begun to document the importance of trapping in the lives of these people who still look to the land — including the utilization of wildlife — as part of their lifestyle. This lifestyle is often not understood by the larger segment of society whose members no longer hunt, trap, fish, raise their own vegetables, cut their own firewood or look to the land in other ways to provide for their households.

People who trap in the arctic and sub-arctic regions of the continent often fit our image of traditional trappers. In Canada and Alaska more than 35,000 aboriginal people participate in the trapping of furbearers. These trappers are motivated by the need to secure sustenance (food and clothing) for their families. Fur trapping can be particularly important to them due to the remoteness of their communities, and may provide an essential source of income during certain times of the year. Many of the cultural values and traditions of these people are passed along from generation to generation through the seasonal rituals of trapping. Trapping teaches their youths survival and subsistence skills and provides a meaningful fall and winter activity that helps instill a sense of responsibility to their families and communities.

The attitudes of trappers in the more developed areas of North America mirror the motives of their northern contemporaries. Approximately 270,000 families in the United States and Canada derive some income from trapping, but households that embrace a trapping lifestyle are often not apparent in suburban areas with a diverse mix of cultures. Researchers have documented and described a very vibrant trapping culture even within the urbanized northeastern United States. People who trap in this region list several motives for why they participate in trapping: lifestyle orientation, nature appreciation, wildlife management, affiliation with other people, self-sufficiency, and income (sometimes complimentary, sometimes critical, to the household budget). A universal theme expressed by many trappers is that trapping is a principal component of their lifestyle: it defines them and has deep meaning as an enduring, central life interest.

Trapping in today's society has often been referred to as "recreational" in the context of a "sport," yet as the sociological studies have revealed, the term is a misnomer. It fails to consider the motives of the hundreds of trappers surveyed. People who trap tend to express strong support for conservation programs and environmental protection. They may also cut firewood, raise their own vegetables, hunt and fish. For these people, the opportunity to harvest fish and wildlife contributes to a sense of self-reliance and independence. Studies in New England and elsewhere reveal that trappers barter furbearer pelts, products and trapping services (to remove nuisance wildlife causing property damage) in exchange for childcare, automobile repair, vegetables and other goods and services.

Whether they are aboriginal people living in Canada and Alaska, or people living in suburban or rural areas of New England, Louisiana, or industrialized southern Ontario, a common link among all trappers is that they value the capability of the land to produce wild animals and plants they can use to bring sustenance into their households (e.g. meat for food, pelts for clothing, and/or money to buy household goods). For many, trapping is an integral part of their life, a link to the land, a crucial element in their relationship to nature. With proper management of wildlife resources, people today can still choose to participate in this lifestyle as societies have done since the beginning of time. This is a unique opportunity and experience for people in the United States and Canada that can no longer be pursued throughout most of Europe or the rest of the industrialized world.[16]

## Trapping is Highly Regulated

Within the United States and Canada, state, provincial or territorial fish and wildlife agencies have legal authority and pass laws governing furbearer resources. There are various types of laws that apply to trapping within each jurisdiction, and they are enforced by local environmental police, conservation officers and/or game wardens. Laws that regulate trapping by various means include the following:

- Mandatory licensing of trappers
- Mandatory daily checking of traps
- Mandatory trapper education
- Restricted seasons for trapping
- Restrictions on the size of traps
- Restricted areas for trapping certain species
- Restrictions on the types of traps
- Mandatory tagging of traps to identify owner

Professional wildlife biologists monitor the populations of furbearing animals. Scientific studies are conducted to ensure that these species are managed properly. In addition, research focused on the traps themselves identifies which traps work best with each species, and which need improvements. New and improved traps are continually being developed.

foods, home and automobile maintenance, animal husbandry, and community volunteer work are bartered for trapping and furbearer products in some communities.[17] This "hidden economy" may have social and economic significance in many rural communities all over the continent.

Trapping, along with the heritage and self-sufficient lifestyle it represents, has a cultural and social role in today's society and is much more than a "consumptive use" of wildlife. **Trapping can instill a strong appreciation for wildlife and the environment**. Sociological studies show that trappers have an exceptional degree of factual understanding of animals and are outstanding and unusual in their knowledge of wildlife. Trappers, through their outdoor experience and use and knowledge of wildlife, are unique. The relationship they have with land and wildlife underlies a strong sense of stewardship for the environment.[18]

## Traps & Technique

The capture and harvest of furbearers has changed markedly since early times. Modern trapping is not comparable to the reckless exploitation of the 17th, 18th and 19th centuries. Today trapping is heavily regulated, involving some of the most complex laws that deal with wildlife, enforced with stiff fines and penalties that ensure the integrity of the activity. Overall, the regulations are designed to protect furbearer

Photo by Bill Byrne

*Environmental Police Officers, Conservation Officers or Game Wardens enforce trapping laws and regulations throughout the United States and Canada.*

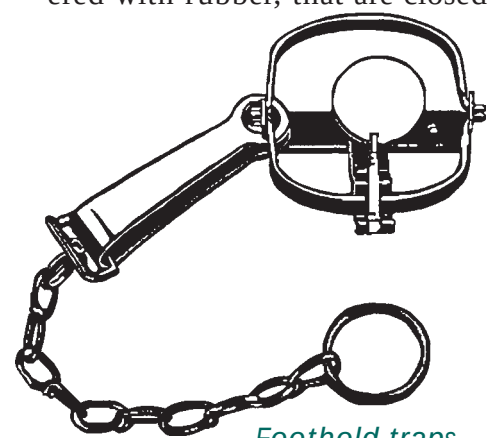
populations and make trapping as humane and efficient as possible.

Many people unfamiliar with modern trapping think of traps as big, powerful devices with jack-o'-lantern teeth on the jaws. This stereotypical image of the trap is based on the obsolete designs that were used to capture bears many years ago. Those old bear traps are collector items today. Such dangerous and destructive devices have no use in modern fur trapping. Today, sizes and types of traps and their use are regulated, and many sizes and types of traps are no longer allowed. Trappers must check their traps within specific time intervals and are restricted or prohibited from setting traps in certain areas. Most jurisdictions require that live-restraining traps be checked daily.

## Basic Trap Designs

Modern traps fall into two main categories: quick-kill type traps and live-holding traps. Kill type traps are designed to quickly kill the captured animal, much like a common mousetrap. Live-holding traps can be separated into cage traps and foothold traps. Cage traps are baited wire enclosures with one or two doors that close and lock when the animal steps on a pan or treadle. They work well for animals that are not averse to entering holes or cages, but are ineffective for capturing wary species such as foxes and coyotes. Cage traps come in a variety of sizes designed to catch animals from mice to raccoons. They are expensive though, bulky, heavy to handle, and are not practical in many trapping situations.

Foothold traps typically have two metal jaws, sometimes covered with rubber, that are closed by springs released when the animal steps on the trigger pan. Other foothold devices — most notably the specialized "EGG" trap (see box, page 24) and passive or spring-loaded snares — are also available for use in certain states and provinces.



Foothold traps

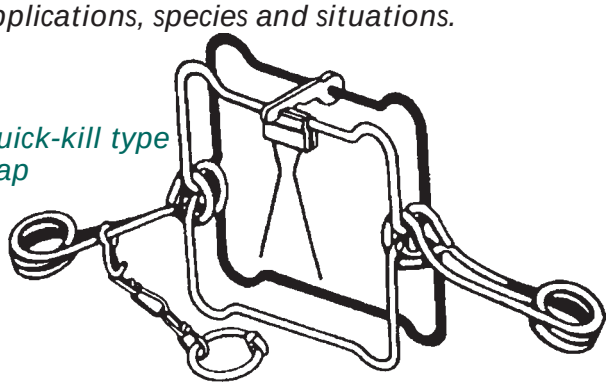
Typical foothold traps are categorized by the type of spring (e.g. coil, jump, or long spring), and are made in different sizes appropriate for catching animals as small as weasels and as large as coyotes and lynx. When set, the jaws of foothold traps range from 3 1/2 to 7 inches in spread. These traps are designed to hold an animal by gripping the toes or foot across or just above the foot pad. This prevents the captured animal from slipping the trap off its foot. As an option, foothold traps can be set submerged to drown a captured animal, and can thereby function as kill traps.

## Choosing the Appropriate Trap

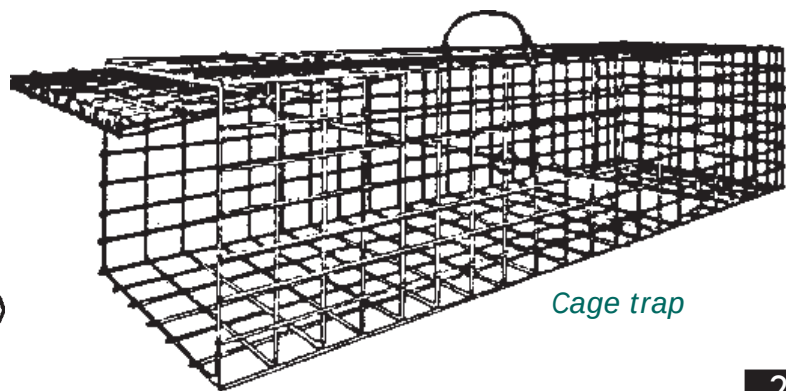
Choice of trap style depends on the specific situation and the furbearer species that is being targeted. Cage traps are an excellent choice for raccoon, skunk

**continued, page 25**

*There are three basic trap designs and many variations of each. Kill-type designs (below, left), also known as quick-killing traps, dispatch furbearers quickly with a hard blow to the head, neck or body, in the same manner that a common mouse trap kills a mouse. Foothold traps (two models above) are live-holding traps that typically have a set of spring-activated jaws designed to close on an animal's foot across or just above the foot pad. Set under water, they can also function as kill traps. Cage traps (below, right) are live holding traps that restrain an animal in a portable cage. Each design is superior to the others for certain applications, species and situations.*



Quick-kill type trap



Cage trap

# Using Science To Identify the Best Traps for Animal Welfare

## Best Management Practices

State fish and wildlife agencies are conducting a national effort to develop Best Management Practices (BMPs) for regulated trapping in the United States. This effort is being made to identify and promote the very best technology available to capture wildlife.[19] These BMPs address five specific points relative to the use and performance of traps. These components are: the welfare of animals, the efficiency of the traps, the selectivity of the traps, the safety of trappers and other members of the public, and the practical application of various types of traps.

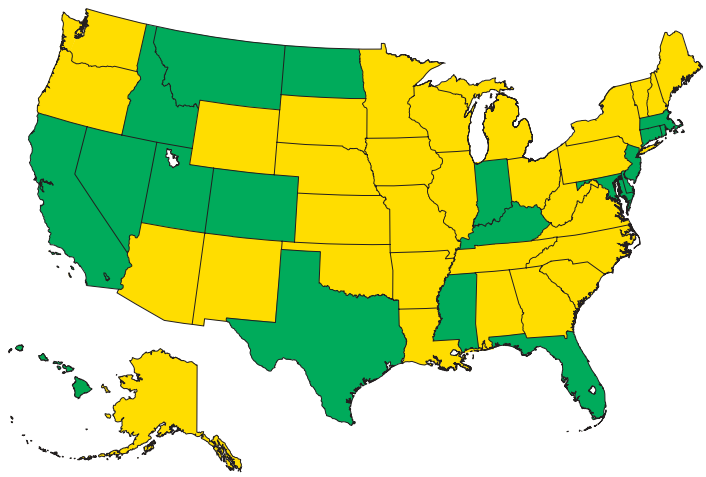
BMPs will provide the information that will help make a trap and trapper function together in a manner that is safe, humane, effective, and selective. They will describe the different types of traps and what training may be needed for people who trap with them. BMPs will be recommended to all state fish and wildlife agencies for incorporation into regulated trapping programs and trapper education.

State wildlife biologists cooperating with specially trained wildlife veterinarians are designing and conducting trap research projects to identify the best traps available. All types of traps are being tested, including cage traps, snares, foothold traps and killing type traps. Trap testing programs involving dozens of trapping systems are being conducted from Alaska to Maine to Louisiana. Since 1997, millions of dollars have been spent on trap testing programs to initiate the development of BMPs. State fish and wildlife agencies have dedicated thousands of hours of wildlife professionals' time to the successful completion of these projects. The testing is conducted under actual trapping conditions, on working trap lines, by experienced trappers accompanied by trained wildlife technicians.

Everyone — managers, biologists, veterinarians and the public who trap — is interested in using the best technology available for the responsible capture of furbearers. Working towards this goal, state wildlife agencies will persist in their trap research efforts and continue developing BMPs. Basing BMPs on sound scientific and biological data will measurably improve the welfare of captured wildlife in the United States.

## Testing Traps in Canada

Canadian wildlife authorities are understaking an approach similar to the BMPs through a cooperative effort among provincial/territorial agencies. The Canadian Trap Certification Protocol uses parameters of trap efficiency, humaneness and safety to approve traps for use in Canadian trapping and furbearer management programs. This program is coordinated by provincial wildlife agencies. Under the program, any provincial government authority may certify a trap according to the procedures prescribed in the Protocol. All traps used to capture furbearing species in Canada must be certified according to the Protocol by 2007. The provincial/territorial agencies have agreed that all other authorities will mutually recognize the certification of a trap by any one authority. As trap testing results become available, additional traps will be certified for use in capturing various species.



*Traps are subjected to intensive scientific evaluation in a continual effort to develop the best possible designs. As of 2004, 32 state fish and wildlife agencies have participated in field evaluations and trap testing for BMPs. Areas marked in yellow denote states that have participated to date. All 50 state fish and wildlife agencies support the development of trapping BMPs.*

# Research & Development

## Improving Traps with Science

Wildlife agencies, as well as the public who trap, have long been interested in developing and refining traps and trapping techniques to further improve the welfare of furbearers captured for research, damage control, fur and food. The overriding goal has been to design traps that will hold target species unharmed, or in the case of kill-type traps, dispatch them as quickly as possible. Foothold, snare, cage and kill-type trap designs have all been improved substantially in these respects since the turn of the century, and new and improved models are replacing older designs. While the production of a new trap once required little more than some imagination, engineering and marketing skills, today all trap improvements must be based on sound scientific information.

Photo courtesty Fur Institute of Canada

*Modern trap evaluation is a comprehensive process that begins with mechanical evaluation, followed by computer simulation (left). Continual research has resulted in design modifications. These include double jaws (above), offset jaws and wide-edge jaws (combined on the trap below).*

Trap performance can only be verified through a comprehensive process that evaluates all components of a trapping system. In order to ensure the scientific credibility of results, trap research programs must incorporate appropriate study designs and include rigorous multi-stage testing. Today, various stages of trap research may include: (1) mechanical evaluation of traps; (2) trap performance testing using computer simulation models; (3) study of how animals approach traps; (4) trap performance testing in fenced enclosures; (5) trap performance testing in the field; and finally (6) confirmation tests utilizing independent trappers. Many trap designs have been evaluated to this degree and tested under a variety of conditions throughout the United States and Canada. These evaluation studies have provided important contributions to animal welfare by improving the performance of trapping systems.

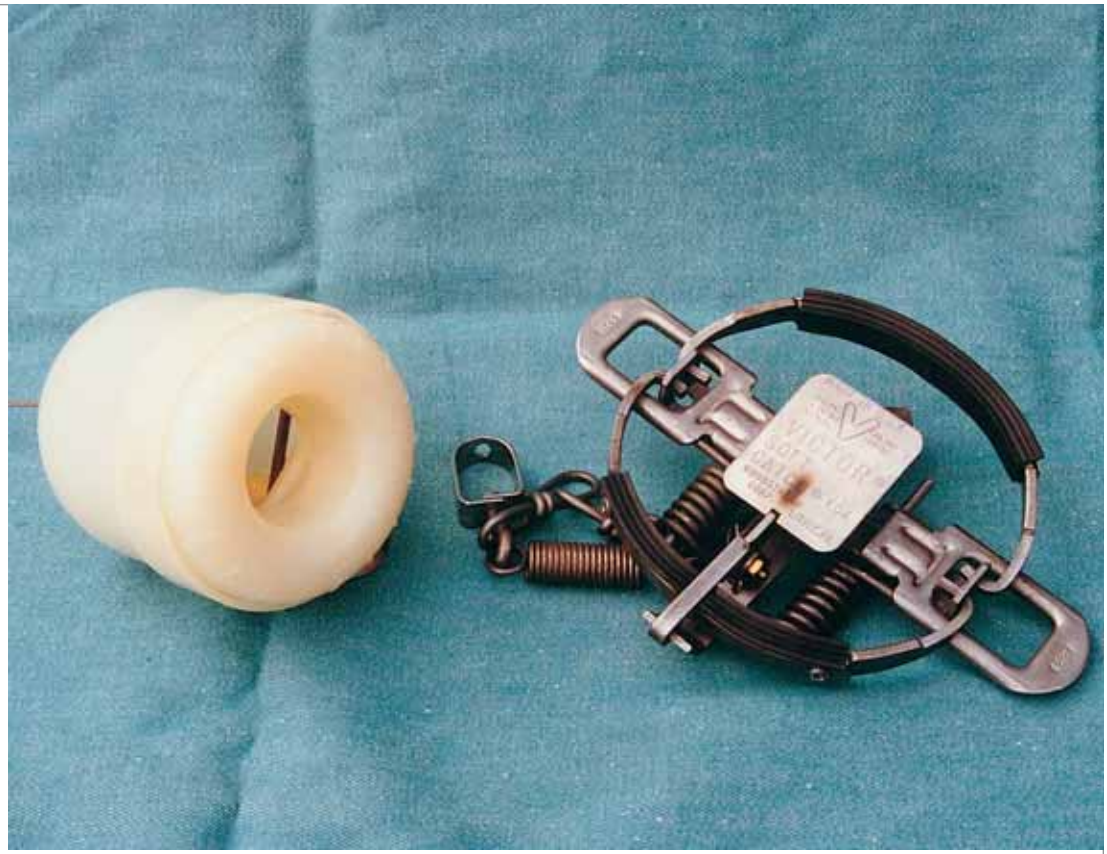


Photo by Bill Byrne

*Ongoing scientific research aimed at the development of improved traps has resulted in entirely new designs such as the EGG trap (at left in photo), a modern foothold design used specifically to take raccoons. Soft-catch (at right in photo) is a modern update of a traditional foothold design. This trap system not only incorporates specially padded jaws, but also a shock-absorbing spring and double swivels proven to reduce the chance of injury to captured animals.*

While many people and organizations talk about improving trapping, only a few have provided funding for developing new traps and improving older designs. Trap research in North America has been funded jointly by the governments of Canada and the United States, the International Fur Trade Federation, state and provincial wildlife departments, and the Fur Institute of Canada. Wildlife agencies utilize the research findings of trap studies funded by these organizations to assess and incorporate new information into trapping regulations and trapper education programs. While research has provided the information to develop and test entirely new trap designs (such as the "EGG" trap) for particular species, modifications to existing kill traps and foothold traps are also of great importance. Adjusting chain length, adding swivels to the chain, providing for adjustable pan tension, and/or replacing standard jaws with offset, laminated or padded jaws can improve the welfare of captured furbearers, and researchers continue to explore other new and innovative design possibilities. Everyone is interested in using the best technology available for the responsible capture of furbearers.

Performance evaluation and the testing of killing and restraining traps in both the United States and Canada follow methods approved by the International Organization for Standardization (ISO). These testing standards ensure that countries have internationally comparable data for evaluating trap performance. Modern trap evaluation is conducted in a framework that applies science to ensure the use of humane and safe traps whether for scientific study, animal management programs, protection of endangered species, or the sustainable utilization of wildlife resources by the public.

Trap research efforts today are well coordinated among the state and provincial wildlife agencies, cooperative Universities and federal agencies in the United States and Canada. Wildlife biologists, statisticians, engineers and specially trained wildlife technicians oversee trap-testing efforts conducted in North America. In the United States, 31 state wildlife agencies have participated in a coordinated national trap-testing program. In addition, the United States Department of Agriculture Wildlife Services program has conducted important research on improving trapping devices. In Canada, trap-performance testing, research and development is conducted by the Trap Research and Development Committee (TRDC) of the Fur Institute of Canada (FIC) with participation of provincial/territorial wildlife agencies and trappers. Much of this work is conducted at the Alberta Research Council in Vegreville Alberta, the most comprehensive and extensive trap research center in the world. Trap evaluation and testing programs under field conditions are often conducted in cooperation with provincial/territorial wildlife agencies and cooperating trappers. Research findings from the FIC-TRDC program are used both in the United States and Canada.

and opossum when trapping near residential areas in wildlife damage management situations. Quick-kill type traps — or body-gripping traps as they are sometimes called — are very effective when used for marten, mink, fisher, muskrat, otter and beaver. Kill-type traps are considered to be efficient and humane because animals rarely escape, and loss of consciousness and death are rapid. However, kill-type traps do not allow for release of "nontarget" animals (animals the trapper does not want to harvest). Also, fox and coyotes will rarely enter kill-type traps. For these species especially, foothold traps remain the most effective trap (and allow for release of nontarget animals).

Foothold traps do not have to be big and powerful in order to hold an animal. **A foothold trap of the right size, correctly set, will typically catch and hold the target animal without significant injury**.

Photo by Dan Harrison

*Foothold traps need not be large to be effective, as demonstrated by the trap used to capture this coyote. Foothold traps typically capture and hold animals without significant injury and have been used to capture river otter and gray wolves (below) for reintroduction and restoration efforts in portions of the United States. The foothold trap is the only effective device, except for snares, for capturing certain furbearers such as coyote, wolves, and foxes.*

## Trappers Are Selective

The placement of the trap in relation to the lure and/or bait (as well as the type of bait or lure) greatly affects the selectivity of the trap set. An effective trapper wants to catch the animal targeted, instead of a nontarget species. Knowledge of animal behavior allows placement of traps on the target animal's line of travel such that, in many cases, the trapper needs no bait or lure at the set (blind set). Different lures used at other sets are usually attractive only to certain species of furbearers, and can be used to draw the target animals to the set. Trappers strive for enough knowledge of the target animal's habits to allow efficient capture while avoiding nontarget animals. This is the essence and challenge of trapping. The personal satisfaction and even the economic return depend on having this knowledge and efficiency (see "Trapper Education" page 26). With the selection of the right size trap, trapping location, the correct setting of pan tension, and the proper use of the device in concert with lure and bait, trappers are extremely selective in what species their traps will capture. So, while traps as devices

Photo courtesy of U.S. Fish & Wildlife Service

Photo courtesy of New York State Dept. of Environmental Conservation

*The art of trapping is often a family tradition, handed down from generation to generation.*

have some degree of selectivity, trappers further improve that selectivity.

Concern has been expressed over the relative risks of trapping to pets. As stated above, proper trap selection and placement will minimize nontarget captures. Trappers generally seek landowner permission (required in many jurisdictions) when trapping on private land, and scout for animal sign and presence before the trapping season. Most trappers avoid areas with evidence of domestic animal use because it interferes with opportunities to capture target species. Pets that are allowed to range freely and unsupervised are at greater risk from predators, automobiles and other health threats than they are from traps. Regardless, in the few instances when pets or domestic animals are accidently caught in foothold or box traps, they can usually be released unharmed.[20]

## Trapper Education

There was a time when new or young trappers could easily find a friend or relative to teach them how to trap. To become effective, the trapper must learn animal behavior, wildlife habitat, types of traps, trap preparation, sets and lures for different animals, and care of the pelts. This knowledge allows the trapper to become efficient; that is, to be able to set the

*Acquiring the base knowledge from experienced trappers starts beginners off right. To ensure that all new trappers know the proper skills and understand the activity, its many regulations, and their role in scientific wildlife management, first-time trappers in many states and all Canadian provinces and territories are now required to complete an official trapper education program.*

Photo by Bill Byrne

Photo by Thomas Decker

*The art of trapping is a lifelong learning experience, often requiring trappers to enter habitats few people ever visit. Trapping may instill a strong appreciation toward wildlife and the environment. It typically fosters an exceptional understanding and knowledge of animals and a close relationship with the land.*

## Values* Of Furbearers

**Economic Values:**

Many people benefit economically from the use of furs and other furbearer products.

Many people suffer economic loss from damage or depredation caused by furbearers.

**Ecological Values:**

Furbearers as predators and as prey help keep ecosystems in balance.

When ecosystems become unbalanced and the existence of certain species is endangered, predation by furbearers may increase their risk of extinction.

Beaver, and to a lesser extent, muskrats, alter habitat, often to the benefit of many other wildlife species. They, along with nutria, can also degrade habitat to the detriment of fish and other wildlife.

**Cultural Values:**

Trapping is a part of our cultural heritage. Its traditional skills, including respect for and knowledge of the outdoors, are passed along in many families from generation to generation.

Some members of the public retain a cultural heritage of utilizing furbearer meat to directly sustain their families and pets. Many use furbearer products and trapping to barter for other essentials.

**Biological Values:**

Furbearers can help us better understand human health problems, such as effects of environmental pollutants.

Furbearers can pose risks to humans through exposure to diseases and parasites.

**Aesthetic Values:**

Many people enjoy fur and furbearers.

Many people enjoy observing furbearers and their works (beaver ponds).

*Values can be both positive and negative.

## Selectivity of the Trap-Trapper Unit

A trap is a mechanical device that, once set, will close only on objects heavy enough to release the trigger. Observing this, those unfamiliar with trapping may assume that traps are not selective; that they will catch anything. This is not a correct assumption unless the trapper — the person required to set the inanimate device in the first place — is removed from consideration. Trap and trapper are part of the same equation; one cannot function without the other. Once this relationship is acknowledged, it is recognized that the trap-trapper unit is actually very selective in terms of what it will catch. Regulated trappers and wildlife researchers invariably set their traps in such a way that only the species (or sometimes even only the *individual* animal) they are targeting is likely to be captured. The numerous techniques trappers use to ensure their trap sets are selective include the following:

- **Location:** Where a trap is located determines to a great extent what animals are likely to enter it. Traps may be located underwater, in trees, near den sites, travel routes and loafing areas, or within other specific habitat types where nontarget species are never found or are unlikely to be found.
- **Type of Trap:** The use of certain types of traps virtually eliminates the chance that certain species will be captured. Foxes and coyotes, for instance, will rarely enter cage or kill-type traps.
- **Size of Trap:** The size of the trap determines to some extent what size animals it will capture.
- **Pan Tension:** Pan or trigger tension is adjustable on many traps. As a result, traps are often set so that only relatively heavy animals (such as beavers or coyotes) can spring them.
- **Lure or Bait:** Specific baits and lures, often used in conjunction with trap sets, are attractive to specific species of animals. Sweet corn, for instance, is attractive to raccoons, but not to bobcats. Lures in the form of urine or scent gland extracts are particularly attractive to the species from which the scent is derived; may even repel other species.
- **Position of Trigger:** Trigger configuration on kill-type traps can be set to allow nontarget species to pass through without setting off the trap.
- **Trap Set:** How a trap is handled or placed influences what animals can be captured. Wary species will avoid any trace of human scent, while others such as raccoons and skunks may be attracted to it. Fencing or other obstructions placed around a trap can prevent some species from approaching the trap.
- **Timing:** The timing of when traps are set during the trapping season can influence which gender and what age class of animals will be captured.

These same elements, all of which make traps highly selective in terms of what animals they will capture, are used not only in fur harvest trapping, but also in the live capture of animals for research and conservation programs, and for problem animal control and property damage situations.

proper trap in the appropriate manner and catch the intended animal. Certainly trappers are continually learning, but there is a base level of knowledge that is much easier to learn from an experienced trapper than by trial and error on one's own. Trapper education programs have been instituted in many states and all Canadian provinces and territories to ensure that beginning trappers acquire this fundamental knowledge before they set traps on their own.

Trapper education programs teach basic trapping techniques in both field and classroom situations with a strong focus on the responsible treatment of animals, trapping regulations, the avoidance of nontarget animals, safety, selective trapping, trespass laws and ethical trapper behavior. Trappers are taught how to select and set the smallest and most effective traps for whatever furbearer species they wish to target. These programs are strongly supported by experienced trappers who often teach the courses in conjunction with wildlife agency personnel. The ethical and even spiritual ideals of trapping — to take every animal with dignity, admiration and respect — are widely embraced. Information taught to beginning trappers provides them with a larger view of their role and the importance of trapping in an effective, responsible, and ethical manner.

## Trapping and Public Safety

Opponents of trapping frequently charge that people, especially children, are in danger of being caught and injured in traps. These charges naturally tend to heighten public concern about trapping. However, a nationwide search for all recorded incidents of human injuries resulting from traps during the past 20 years documented only three that were associated with legal fur trapping.[21] None resulted in serious injury. Trapping does not threaten public safety because the size, placement and use of traps are regulated to ensure the safety of humans and animals (see box, page 20).

# Furbearer Management Options

The use of traps and trapping in furbearer management programs other than traditional fur harvesting can be divided into three major categories: **Wildlife Damage Management**, **Wildlife Research**, and **Reintroduction of Extirpated Wildlife**. Among these categories, which may be broad or narrow in geographic scope, there are a number of options, along with trapping, that wildlife biologists can consider to achieve the management objective. Selection of any option must take into account its practicality, effectiveness, legality, safety and cost.Typically, a combination of two or more techniques is used in most management situations in order to achieve maximum effectiveness and cost efficiency. The various technique options available to wildlife biologists for the three categories of furbearer management programs are presented below:

## Options for Wildlife Damage Management

Wildlife damage management is typically undertaken as a response to a citizen's concerns over animals causing loss or other damage to personal property or resources. Livestock predation by coyotes and foxes, flooding by beavers, and agricultural crop damage by raccoons and muskrats are common examples of wildlife damage. Several management options, both lethal and nonlethal, are available, but no single method or combination of methods is applicable in all damage situations.[22] Management options to curtail various forms of wildlife damage include the following:

### Guard Animals

Animals, such as guard dogs, llamas and donkeys, have been used to protect livestock from coyotes and other predators. Guard dogs are typically special breeds, such as Great Pyrenees and Komondor, that are imprinted after birth on the livestock breed they are assigned to protect. Neutered males are most commonly used. Success has been achieved in some areas with guard dogs, although they are expensive and last an average of only 3.3 years due to the rigors of life in the outdoors. Their effectiveness is best in a paddock situation, and diminishes on open pastures. Use of guard dogs can require a great deal of attention by the herder, particularly on an open range, where more effort is required to ensure the dog is properly fed and attended. Guard dogs may indiscriminately kill other species of wildlife (such as deer fawns) they encounter.[23]

Llamas and donkeys have an advantage over dogs in longevity and feeding, but have also been documented injuring and killing sheep. More research and experimentation is necessary before their effectiveness can be fully evaluated.[24]

Risk to humans from all types of guarding animals can increase a livestock owner's liability.

### Exclusion / Habitat Modification

There are a number of management techniques that, under the proper conditions and with adequate funding for installation and routine maintenance, can be used to prevent or reduce various types of wildlife damage:

**Water Flow Devices and Exclusionary Fencing**: Specially designed "beaver pipes" are placed in road culverts or through beaver dams to reduce water level and associated flooding. These pipes must be placed in such a manner that the beaver cannot sense the sound or flow of water (which triggers their instinct to dam the flow), or must have adequate baffles to prevent the animals from blocking the flow. In situations where the gradient allows installation and function, beaver pipes can be effective at reducing beaver flooding. The devices may be expensive, however, and require routine cleaning and maintenance. Site characteristics may nullify the effectiveness of these devices in some situations.[25]

Exclusionary fencing can be installed in front of, or around, the intake of road culverts to physically prevent beaver from plugging the culverts. Exclusionary apparatus is a preventive measure that varies markedly in expense and ease of installation, requires regular maintanance, and does not regulate water level.[26]

**Livestock Fencing**: Permanent or portable fencing, including electric fencing, can be used as a barrier to prevent predators from killing or damaging livestock. Fencing must be a minimum of 5.5 to 6 feet high and frequently maintained in order to exclude coyotes.[27] The cost of fencing has limited its application because many people who own sheep or other livestock simply cannot afford to fence an area large enough to adequately pasture their animals.

Photo by Guy Connolly USDA/APHIS

Photo by Thomas Decker

Photo by Bill Byrne

*There are many options to deal with damage caused by furbearers, but the effectiveness, efficiency, and cost associated with a particular option will determine its appropriateness for a given damage situation. When coyotes kill sheep and other livestock , farmers may resort to fencing (exclusion), but it must be tall, or it will be ineffective (above). When fencing is impractical (as it can be due to cost) specially bred guard dogs (above, right) or other guard animals are options, but these too have their drawbacks (see text). A well constructed baffle pipe (right) can help control flooding damage caused by beaver, but it requires regular maintenance and will not work in many situations.*

## Contraception

Past research has shown that hormone injections or implants can be successful in controlling the reproduction of individual animals. The technique requires repeated injections or surgery; consequently it is extremely expensive and difficult to apply to large numbers of animals. Some fish and wildlife agencies and animal welfare groups are now supporting research to develop a wildlife contraceptive that is inexpensive, relatively easy to administer, and long lasting. New advances in genetic engineering have opened the door to *immunocontraception* as a possible solution. Immunocontraception uses vaccines that target specific hormones or reproductive tissues. This research is in its infancy, and field experiments have been limited. While immunocontraception may have some value as a wildlife management tool in the future, it is not available today and will remain a rudimentary tool in the near future.[28] To put this in perspective, zoo veterinarians and reproductive biologists interested in controlling the reproduction of captive animals have not yet developed an effective contraceptive vaccine for most species. Some of the technical problems include:

- Safe and effective application requires animals to be individually vaccinated.
- Delivery systems (e.g. dart guns and blow guns) have limited range, making it necessary to get within close range of every animal targeted for the vaccine.
- Two or more boosters may be required to cause infertility.
- Application that would be extensive or effective enough to control population growth may never be possible.
- Legal hurdles of government environmental and drug regulatory agencies and assessment of overall environmental impacts may delay availability for many years.

Most wildlife damage situations require immediate control of offending animals. Immunocontraception will not eliminate damage in the short term: sterile beavers still have functional teeth and will cut trees and build dams.

### Oral Vaccines

There are several active programs developing and testing oral vaccines for the purpose of reducing the number of terrestrial mammals infected with rabies. Oral vaccines designed to prevent rabies in coyotes, raccoons and foxes have shown promising results during experimental trials in the U.S., and have been used successfully in Canada. Ongoing field tests will continue to refine our understanding of the benefits and drawbacks of oral vaccines.

Questions regarding the safety, cost, and overall effectiveness of this technique in limiting the spread of rabies still remain, but when used in conjunction with trap-vaccinate and trap-euthanize programs around local outbreaks of raccoon rabies, it appears to be effective in limiting the spread of the disease.[29]

The control of rabies and/or other communicable wildlife diseases would also remove a natural limiting factor of predator populations. This may impact prey populations (turtles and migrant songbirds for example) that may have evolved reproductive strategies to take advantage of periodic, disease-induced declines in predator density.

### Toxicants

The use of toxicants (poisons) to control wildlife damage involves killing animals causing damage with specific, Environmental Protection Agency-registered pesticides. Historically common in use, toxicants were misused widely enough to create public concern that has now greatly restricted their availability and use.[30] There is a great deal of variation in how individual states and provinces regulate and control toxicant application, in addition to federal oversight. There are some toxicants that can be applied by private citizens, but concerns over public health and safety and nontarget animal exposure restrict many applications to licensed government officials. Despite limited use, toxicants remain a valuable tool to wildlife managers for special projects and emergency situations.

### Shooting

Shooting the depredating animal or animals requires one or more shooters to stake out the area where the damage is occurring. Shooting can be a highly selective control method, provided that the shooter correctly identifies the offending animal, and is positioned for an accurate, killing shot. Shooting nocturnal animals such as coyotes, raccoons and beavers is difficult and may require expensive night vision equipment to maximize efficiency. Shooters — particularly those targeting coyotes — must also be skilled hunters: the wary nature of the animals requires a shooter to have considerable knowledge of the animal's sign and habits in order to be in position for a shot without the animal being aware of the shooter's presence. Shooting often requires several days of effort for each damage situation, making it costly and limiting the number of damage situations that can be dealt with. Where damage occurs in close proximity to roads or buildings, shooting may not be a legal option, particularly at night.

### Trapping

Use of traps to solve wildlife damage problems involves the capture of the animal or animals causing damage. The effectiveness of trapping to solve wildlife damage problems can depend on the skill and experience of the trapper. Knowledge is required to accurately determine what species is causing the damage; what trap type is required to ensure effective capture with minimal potential for injury to the animals; and where and how the trap(s) should be placed so as not to capture nontarget species. Trapping does not require the trapper to be present when the damage occurs, allowing several damage situations to be addressed simultaneously. If the species causing damage is a furbearer and the damage occurs during the legal fur trapping season, a licensed fur trapper may be willing to remove

the offending animals at no cost. If foothold or cage traps are used, the trapper has the discretion of releasing trapped animals unharmed.

Traps used by either agency personnel or registered trappers recruited to assist with programs, may be used in conjunction with other techniques to address wildlife damage problems. Trappers from Ontario have played a key role in efforts to prevent the spread of raccoon-strain rabies into Ontario.

### No Action / Tolerance

This would be a decision to let the damage occur uncontested; "live with the damage" so to speak. Such a decision would have to balance many factors. In some cases, the wetlands created by beaver provide valuable functions to society and wildlife, and these must be balanced against economic losses to individuals and communities. Rabies outbreaks that periodically reduce certain furbearer populations may temporarily reduce property damage and benefit some wildlife populations (such as birds and turtles that incur heavy nest predation by furbearers), but also present a public health threat requiring public education programs and expensive medical treatment for individuals thought to be exposed to the disease. Ultimately, society's level of tolerance towards wildlife damage will determine where no action can prevail.

An increased public understanding of wildlife natural history and behavior will often lead to a more tolerant view of wildlife. Providing information regarding wildlife species causing damage may decrease the need and urgency for corrective action. However, the magnitude and tolerance of damage is highly variable among the public. Threats to public health and safety or substantial damage to public and private property often reach unacceptable levels. When this threshold is crossed, management techniques must be employed. Wildlife managers do not want to see society's tolerance reach the point that furbearers become perceived as pests and threats, rather than as valuable natural resources that should be enjoyed, appreciated and perpetuated.[31]

Photos by Bill Byrne

*A certified trapping instructor demonstrates how to set a quick-kill beaver trap beneath the ice. This set includes a special frame that allows the trapper to raise and lower the trap to various depths.*

## Options for Wildlife Research

Research on movements, survival rates, habitat use and other life-history factors is often needed to develop management programs to ensure a population's continued existence, or to find solutions to wildlife damage problems. This may require the capture, marking, and immediate release of animals that are subsequently monitored for extensive time periods. Options for capturing wildlife include:

### Live-Trapping

**Cage Traps**: Cage traps are the largest, heaviest, and most expensive capture devices, limiting the number that can realistically be used on any given research project. Though generally less useful than foothold and kill traps, cage traps have proven effective for capturing fisher, marten, raccoon and beaver, less effective for capturing bobcat. They are ineffective for capturing coyotes, foxes, wolves and river otter, although a specially designed cage trap for beaver equipped with additional modifications has had limited success in capturing otter.[32]

**Foothold Traps**: Foothold traps have proven effective for capturing fisher, marten, bobcat, lynx, mink, raccoon, beaver, river otter, foxes, coyotes and wolves unharmed. In the Northeast, over 343 coyotes, 844 red and gray foxes, 76 bobcats, 49 fishers and 79 river otters have been live-captured with foothold traps and released unharmed during research projects conducted from 1980 to 1994.[33] Eighteen lynx and over 50 coyotes have been captured in foothold traps and released unharmed during 1999 and 2000 in an ongoing research study in Maine. The small size, light weight and relatively low cost of foothold traps makes them highly desirable for field research. Recent advances in foothold trap design and use have enhanced selectivity and minimized injuries related to capture. This includes restraining snares designed to capture and hold animals such as wolves, coyotes and bobcats by the foot or leg.

### Chemical Immobilization

Chemical immobilants have been used successfully to safely handle wild animals. In many cases the animals are restrained prior to injection of the chemicals. Restraint methods include trapping the animal or treeing it with hounds. Dart guns, powered by compressed air or powder charges, provide an effective remote delivery system for chemical immobilants, but they are much more limited in range and accuracy than conventional firearms, while having similar constraints (see *Shooting*, page 31). It is generally easier and less costly to capture animals with other techniques. Dart guns are efficient for animals that predictably gather in specific areas.

### Alternative to Capture

Techniques that do not involve capturing animals, such as track counts and aerial surveys, typically yield limited information that cannot be used in assessing life-history parameters, and may not be practical to conduct in areas without extensive snow cover. Conversely, direct observation of animals is costly, difficult, and impractical.

Ultimately, if no effort was made to capture wildlife for research or fur harvesting, wildlife biologists would have to rely on information derived from the number of road kills and damage complaints to draw inferences about furbearer population characteristics. This can be analogous to assembling a puzzle with only a few pieces. Management actions would have to be extremely conservative because available information would lack the sensitivity needed to detect shifts in population trends in a timely enough manner to allow responsive actions. An inability to capture wildlife would greatly reduce the ability of government wildlife agencies to meet their public resource protection mandates that have been established by law.

## Options for Wildlife Reintroductions

In some areas the public desires to reestablish wildlife species. Fisher, marten, river otter and beaver are some of the species that were once extirpated from many parts of North America and subsequently reintroduced by capturing individuals from areas where they are abundant, and releasing them in suitable but unoccupied habitat. These reintroductions involved the use of foothold and cage-type traps. For instance, since 1976, more than 4,000 river otters have been captured in foothold traps, relocated, and released to restore populations in 18 states.[34] If biologists did not facilitate expansion, species would have to enlarge their current ranges into unoccupied habitat on their own. The length of time necessary for this depends on species mobility and distance. In many cases range expansion is difficult or impossible due to insurmountable geographical features or human-created barriers such as major roadways and urbanized landscapes.

# Trapping for Research and Reintroduction Programs

Modern foothold traps have been — and continue to be — used successfully to capture a wide variety of wildlife species in order to study the characteristics of individuals and populations. In fact, research conducted with the use of foothold traps has provided much of the information leading to our present understanding of biological and ecological phenomena. Wildlife biologists typically use these traps to capture animals that are then instrumented with radio-collars and released unharmed. The released animals are then carefully monitored, revealing information on their movements, habitat requirements and reproduction that can be acquired in no other way. The coyote pictured on page 25 is one of many captured with foothold traps, examined and released.

The river otters pictured below were all caught with foothold traps in marshes in Louisiana where they are abundant, and were released unharmed into areas of Missouri to restore otter populations where they no longer occurred. Similar otter restoration programs have been successful in 18 other states including Alaska, Arizona, Colorado, Kentucky, Iowa and New York. Many states now have thriving river otter populations thanks to capture and reintroduction efforts made possible by the use of foothold traps. *These are the same traps used by the public to harvest furbearers.*

Foothold traps and snares are generally the only effective traps for catching elusive species such as wolves, coyotes, foxes and lynx. As a result, they are almost always the trap of choice when any of these famously wary species are targeted for capture by either the public or wildlife researchers. Lynx reintroduced in some western states were captured with foothold traps in Canada (Yukon). Another example is the ongoing, important role foothold traps are playing in the restoration of several endangered wolf populations. Red wolves are captured, examined and relocated to reestablish new populations; Mexican wolves are captured for a captive breeding program that will provide healthy animals for a reintroduction program; and stock-killing gray wolves are captured and relocated to reduce damage and maintain public support for their continuing restoration.

Photo by Jim Rathert Missouri Dept. of Conservation

*Right, live-trapped river otters are released as part of a restoration program. Foothold traps with offset jaws, above, were used to capture the animals unharmed.*

## Otter Restoration Around the Nation

| State | No. Released | Years | State | No. Released | Years |
|---|---|---|---|---|---|
| Missouri | 845 | 1982-1992 | New York | 279 | 1995-2000* |
| Tennessee | 487 | 1983-1994 | Ohio | 123 | 1986-1992 |
| Kentucky | 355 | 1991-1994 | Pennsylvania | 105 | 1982-1999* |
| Illinois | 346 | 1994-1997 | Colorado | 86 | 1976-1991 |
| Indiana | 303 | 1995-1999 | Maryland | 80 | 1990-1999* |
| North Carolina | 267 | 1990-1995 | Arizona | 46 | 1981-1983 |
| Iowa | 261 | 1985-1999* | Minnesota | 21 | 1980-1982 |
| West Virginia | 249 | 1984-1997 | Oklahoma | 20 | 1984-1985 |
| Nebraska | 159 | 1986-1991 | Kansas | 19 | 1983-1984 |

*Ongoing Releases

# Animal Welfare

The concept of "Animal Rights" is distinct from the concept of "Animal Welfare." Animal Rights is based on personal values and philosophy, while the agenda for Animal Welfare is based on science. The Animal Rights and Animal Welfare agendas represent entirely different perspectives on human/animal coexistence.[35]

Animal Welfare proponents believe that human use of animals is appropriate as long as practical measures are taken to ensure that human use does not cause any undue pain and suffering to animals. Wildlife biologists and all responsible trappers and hunters are staunch supporters of Animal Welfare.

Animal Rights proponents oppose *any* human use of animals. They believe animals have the same rights as humans, and therefore should not be used, eaten or owned by people.[36]

The primary concern of Animal Welfare advocates is the well-being of animals. The primary concern of Animal Rights advocates is the moral obligation of people. The well-being of animals is a secondary concern for Animal Rights advocates.[37]

Professional wildlife biologists advocate Animal Welfare. The International Association of Fish and Wildlife Agencies (IAFWA), noting that "the worldwide growth of the animal rights movement threatens all traditional uses of animals," adopted the following position in 1989:

"The IAFWA acknowledges that humans have an inseparable relationship with all other parts of the natural world. Furthermore, humanity is answerable to another set of laws and concepts that is uniquely a product of human society. Animals cannot be subject to those laws and concepts and therefore do not have the rights of humans. It is agreed,


Photo by Bill Heatherly Missouri Dept. of Conservation

*Adaptable and always ready to take advantage of any food sources, raccoons can reach extraordinarily high population levels in developed areas, a situation that increases public health problems, property damage and predation on other wildlife species.*

*Coyotes frequently prey on livestock and house pets throughout North America. Regulated trapping helps to minimize this depredation by removing individual problem animals, and the animals are utilized as valuable natural resources rather than destroyed as useless pests.*

Photo by Guy Connolly USDA/APHIS

nonetheless, that animal welfare is a realistic and desirable concept which we support. Humanity does have responsibilities to animals: ensure ecological integrity, preserve genetic diversity and sustain species and ecosystems. All animals use other animals for their existence. The responsible human use of animals is natural and appropriate."

Professional wildlife biologists have concerns about the implications of the Animal Rights philosophy. Human use of, and dependence on, renewable natural resources, including animals, may foster stewardship over those resources. Millions of acres of wildlife habitat have been acquired, protected and managed for wildlife by public and private natural resource management agencies. Much of this has been made possible through funds generated by licensed hunters, trappers and anglers who collectively have a stake in the perpetuation of wildlife resources. Under the Animal Rights agenda, there would be no wildlife management, and subsequently, many species of wildlife would decline or become extirpated without the protection afforded by management. Other species would explode into burgeoning populations, escalating human-wildlife conflicts.

As our society becomes more urban, we become removed from natural systems and the processes that function within them. Our understanding and appreciation of those natural processes diminishes. We no longer have to harvest our own food, and as a result, we do not see the death involved in processing meat. We do not notice the loss of habitat, pesticide use or lethal control of animals required to produce crops and livestock. We do not witness the destruction of habitat required to extract nonrenewable natural resources that are the basis for most of the synthetic materials we use.

Rural components of our society recognize the high turnover in many wild animal populations that have naturally high death rates. The death of an individual animal is not shocking when one realizes that it is a normal, natural, and regularly occurring event, and that species have adapted reproductive strategies to compensate for these natural losses. These reproductive strategies evolved over millennia under a suite of mortality factors, including human predation. When a human uses a wild animal, the death is therefore natural, and an interest in the preservation of the wild animal population is often fostered.

We should all be aware that our lifestyles — regardless of where we live, our economic status, or our degree of "environmental correctness" — are closely and inexorably linked to animals. Animals have always provided the material and spiritual sustenance that maintains us as individuals and societies. Our need and use of them for food, clothing, art, medicine and companionship are eternal, our dependence on them complete. We must continue to support conservation efforts that ensure sustainable use.

# Calamity by Design: The Prohibition of Regulated Trapping

Chelmsford, Massachusetts is located about 20 miles northwest of the city of Boston and encompasses approximately 23 square miles. The first European settlement in the area was a fur trading post, established due to the abundance of beaver in the local wetlands. Today there are still approximately 870 acres of wetlands within the town, but it is now a densely settled suburban community with over 31,000 residents (1,357 per square mile). Local government is conducted through open town meetings and administered by five elected selectmen.

During the late 1980s, a national animal rights group developed a "model" for getting trapping ban initiatives passed by town, county and state governments. The model guidelines encouraged animal rights activists to disguise regulated trapping as a public safety/animal welfare issue. Exactly in accordance with such direction, an article to ban trapping was introduced at a Chelmsford town meeting in 1988.

State wildlife experts reminded residents that regulated trapping was not a public safety issue, and warned that if regulated trapping were banned, there would be numerous undesirable consequences in the form of property damage and wildlife habitat degradation. Despite the warnings, the article was passed, and the trapping of furbearing mammals within the town was prohibited.

Prior to passage of the trapping ban, there were usually one to three complaints of beaver damage in the town each year. Following the ban, the beaver population, unchecked, began to grow rapidly, and the animals began to move into many previously unoccupied wetlands. Beaver dams began to flood houses and roadways. In 1992, state wildlife biologists working at the request of town officials investigated 25 beaver complaint sites. Two of these complaint sites were municipal wells which had been shut down (at a cost of $25,000) because of beaver flooding, and four other municipal wells were threatened. Individual landowners in town had incurred tens of thousands of dollars in damages to private wells, septic systems, lawns and roadways. The increasing beaver population and increasing property damage were directly related to the decision of the town's citizens to ban regulated trapping and allow uncontrolled beaver population growth to commence.

State wildlife officials offered the town several recommendations: (1) use water flow devices to reduce flooding in some areas, (2) get permits to breach beaver dams in other locations, and (3) rescind the trapping ban bylaw to allow beaver populations to be brought under control. The town took positive steps to implement these recommendations. The state issued permits to breach beaver dams that were disabling wells and septic systems. State wildlife personnel installed water flow devices (beaver pipes) at two sites and assisted town water department personnel with a third pipe. At a special town meeting in September, 1992, town citizens voted by a two-to-one margin to allow regulated public trapping to resume. During the regular trapping season later that fall and winter, four fur harvesters working with homeowners and town officials removed 87 beaver. Today, with public, regulated trapping restored, Chelmsford again has only one to three beaver complaints per year. These are handled as they had been prior to 1988, under an effective and responsible program incorporating state wildlife officials and local licensed trappers.

In Massachusetts, the state wildlife agency has a well developed management plan for beaver. The goals of this plan are to manage beaver resources as assets, not liabilities; perpetuate beaver populations for future generations; keep the beaver population at levels compatible with suitable habitat; minimize property damage caused by beaver; manage beaver for their positive wetland values, and allow people the sustainable use of public resources.

Chelmsford residents were confounded by animal rights activists who had promised in 1988 and again in 1992 to install water flow devices and proposed to "sterilize" beaver in the town (a technique that is not feasible on a free-roaming beaver population - see *Contraception* page 30). Over the four years of the trapping ban, the activists never acted on their promises and were never held accountable for the statements they put forth.

Photo by Bill Byrne

*Typical beaver damage*

## Epilogue - A State Ballot Referendum

The case study on the previous page was written several years ago. In November, 1996, the state of Massachusetts passed a ballot initiative that severely restricts trapping. As a result, complaints about property damage and health concerns related to beaver activity have dramatically increased. A biologist from the Massachusetts Division of Fisheries and Wildlife has provided the following update:

Subsequent to the town of Chelmsford reinstating regulated trapping as a management tool to control the beaver population, a coalition of several animal rights organizations gathered the signatures required to place a statewide anti-trapping referendum before the voters on November 5, 1996. They spent $1.2 million on an ad campaign featuring graphic images which were a misleading representation of regulated trapping in Massachusetts. The campaign further implied that traps in common use in Massachusetts had teeth and were a threat to pets and children, despite the fact that toothed traps had not been legal to use for many years, only softcatch (padded jaw) traps were allowed for use on land, and no case of an adult or child being caught or injured in a legally set trap had ever been recorded in Massachusetts.

The referendum was passed, with the result that restrictions similar to those in the original Chelmsford anti-trapping bylaw went into effect statewide. The new law dramatically changed the types of traps that the public could lawfully use to control beaver populations statewide.

The net effect of the new law maximizes the number of beavers found in Massachusetts. A maximized beaver population significantly increases property damage, threatens public health and safety in regards to drinking water supplies and road stability, and increases other beaver related problems incurred by citizens.

In short, the same conditions that were evident in Chelmsford during its trapping ban have now been expanded throughout the state. The statewide beaver population has grown significantly from an estimated 24,000 in 1996 to more than 52,000 in 1999. Citizen complaints related to beaver activity continue to increase from an average of 310 per year (1991-96) to 615 per year since the law came into effect. Beaver populations can no longer be maintained at reduced levels.

The state's beaver management program has historically been proactive – maintaining the beaver population at levels compatible with suitable wetland habitat and human needs. The new law constitutes a major change in the way beavers are managed, however, eliminating proactive, regulated management, and yielding an uncontrolled expansion of the beaver population. Like the previous Chelmsford bylaw, it only allows citizens to take reactive measures to beaver causing property damage. Instead of viewing beaver as valuable wildlife, more and more people are viewing beaver as a pest to be eliminated.

Trapping and trapping devices have been a legislative issue ever since the referendum passed. Due to the increase in the beaver population and the related increase in health and safety concerns and property damage, several bills have been introduced into the state legislature to repeal or significantly change the existing statewide law. On July 21, 2000 an amended version of the trapping law was passed. It directs local boards of health to issue permits for the use of body-gripping, cage and box traps if beavers are causing problems deemed to be a threat to the public. In addition, legislation has appropriated funds to address some of the property damage caused by increasing beaver populations. The appropriation of monies was not needed in the past when proactive management programs employed regulated trapping to control beaver populations and address property damage problems. The amended law maintains the current ban on trapping for animal population control purposes.

# A Final Word

Professional wildlife management has successfully restored, preserved and ensured the continuing viability of wild furbearer populations in North America. The harvest and utilization of some individuals within those populations by the public does not threaten the continuing survival of those populations. In fact, the harvest and use of some individuals has contributed most of the funding to study and manage those populations, including protecting the habitats and ecosystems critical for their survival.

Without regulated trapping, wildlife managers could not adequately or economically monitor furbearer populations; they could not undertake the restoration programs that have restored so many species to areas where they have not prospered for centuries; they would have fewer options to offer the public significant relief from agricultural and property damage, or to protect human health and safety; and they could not ensure the continued public use of furbearer resources.

Furbearer management is a complex scientific subject. The Wildlife Society — an international nonprofit scientific and educational organization serving professionals in all areas of wildlife ecology, conservation, and management — has published a policy on traps, trapping, and furbearer management that best represents the views of wildlife biologists.

Photo by Bill Byrne

## The Wildlife Society Position on Traps and Trapping

Internationally accepted principles of natural resources conservation stipulate that resource management activities must maintain essential ecological processes, preserve genetic diversity, and ensure the existence of species and ecosystems. Regulated trapping in North America is consistent with all three criteria and is a versatile, safe, effective, and ecologically sound method of harvesting and managing species of furbearers.

Trapping provides income, recreation, and an outdoor lifestyle for many citizens through use of a renewable natural resource. It is a part of the North American heritage. It is often vital to the subsistence or self sufficiency of peoples in remote regions who have few other economic alternatives. Trapping is a primary tool of most animal damage control programs and an important technique in wildlife research. In some situations, trapping is important in management or is effective in reducing or suppressing wildlife diseases.

Despite the values of trapping, portions of the public oppose it, or at least perceive problems with some aspects of it. Some object only to certain trapping methods, particularly the foothold trap on land, but others have moral objections to killing animals. Much of the opposition to trapping is associated with urban-oriented cultures, particularly those dominated by tertiary (service-oriented) employment. Those who approve of, practice, or benefit from trapping are primarily from rural cultures or are from areas where primary (land-based) employment predominates. This dichotomy of lifestyles and values, combined with a general lack of objective information about trapping, creates barriers to understanding and resolving the controversial issues associated with trapping.

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