

*Wildlife Damage Management, Internet Center for  
The Handbook: Prevention and Control of  
Wildlife Damage*

---

University of Nebraska - Lincoln

Year 1994

---

Preface and Table of Contents

# Prevention and Control of Wildlife Damage

Editors:

**Scott E. Hygnstrom**

**Robert M. Timm**

**Gary E. Larson**

University of Nebraska Cooperative Extension  
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

1994

This publication was made possible in part by a grant from the US Department of Agriculture-Animal and Plant Health Inspection Service-Animal Damage Control and through the cooperation of the Natural Resources and Rural Development Unit, Extension Service, US Department of Agriculture, Washington, DC.

**Library of Congress Cataloging in Publication Data**

Main entry under title:

Prevention and control of wildlife damage.

Includes indexes.

1. Wildlife management - North America. 2. Wildlife damage - North America. I. Hygnstrom, Scott E., Timm, Robert M., and Larson, Gary E. II. University of Nebraska Cooperative Extension. US Department of Agriculture-Animal and Plant Health Inspection Service-Animal Damage Control. Great Plains Agricultural Council - Wildlife Committee.

SF94.4.P74 1994 632'.660973

94-060758

ISBN 0-9613015-1-1 Book

ISBN 0-9613015-2-X CD-ROM

ISBN 0-9613015-3-8 Book and CD-ROM

**Printed in the United States of America**

**First Printing**

**1994**

# PREFACE

This handbook is a comprehensive reference of North American vertebrate species that can cause economic damage to resources or become a nuisance at various times and places. It is intended for use by extension agents and specialists, wildlife biologists, animal control officers, public health personnel, pest control operators, teachers and students of wildlife biology, and others who deal with wildlife damage problems.

Wildlife damage management is an essential part of contemporary wildlife management. During the past decade there has been significant research and development in this field. This publication is a condensation of current, research-based information on wildlife that cause problems and the control of damage that they cause. While it emphasizes prevention of damage as being desirable when possible, it does not neglect the necessity of population reduction in those cases where animals must be removed to solve problems. It stresses an integrated approach to damage management and includes treatment of materials and techniques such as exclusion, habitat modification, repellents, frightening stimuli, toxicants, fumigants, trapping, shooting, and others. All of the major vertebrate pesticides that are currently federally registered are included. Since pesticide registrations change from time to time and new materials become available, users are advised to check with appropriate federal and state authorities for updated information.

The handbook was originated by F. Robert Henderson at Kansas State University in the late 1960s. It originally was intended as a reference for extension agents in county offices, who received many inquiries regarding vertebrate pests and had little written information at their

disposal. The handbook was well received, and in 1978 it was revised and made available as a regional publication of the Great Plains Agricultural Council through the assistance of the Kansas Cooperative Extension Service. In 1984, the handbook was substantially revised by Robert M. Timm at the University of Nebraska-Lincoln. Over 8,900 copies of the latest addition were sold and it became the leading reference in the field of wildlife damage management.

This 1994 edition is again a significant revision of the previously available edition. In most cases, previously existing chapters were revised by their original authors. Twenty-three new authors were requested to revise chapters for which retirement, change of position, or other factors precluded original authors from participating. Seventeen new species chapters were added to expand the scope of the handbook to include all North American wildlife species that cause damage and nuisance problems. The sections on federally registered vertebrate pesticides, pesticide labels, and supplies and materials were completely revised to provide the most current information available. The handbook is now available as a two volume set in three-ring binder format and also on CD-ROM to provide adequate storage of the information and yet facilitate photocopying and reprinting.

Inclusion of any product or company names does not constitute endorsement by the University of Nebraska Cooperative Extension, US Department of Agriculture-Animal and Plant Health Inspection Service-Animal Damage Control (USDA-APHIS-ADC), Great Plains Agricultural Council, or organizations represented by individual authors. Similarly, exclusion of any product or company name does not constitute criticism.

We thank the Wildlife Committee of the Great Plains Agricultural Council for the opportunity to serve as editors of this edition. It has been a pleasure to work with all of the authors, who have contributed generously of their time and expertise. We thank each of them, as well as the organizations and agencies they represent, for helping make this revised edition a reality. We are grateful to **James E. Miller** of the Natural Resources and Rural Development Unit of the Extension Service, US Department of Agriculture, Washington, DC, for his assistance in obtaining funding for development of this revision. Thanks are due to **Bobby R. Acord** of USDA-APHIS-ADC, which funded a major portion of the costs of developing this revision.

**Sarah K. Disbrow** served as assistant editor and spent hundreds of hours helping to smooth rough edges on the chapter manuscripts and ensure consistency of style.

**Anne M. Moore** typeset the handbook, squeezing this large additional chore into her regular duties in the Department of Communications and Computing Services at the University of Nebraska. We appreciate her efforts and are grateful for her patience in dealing with what seemed to be endless corrections, additions, and revisions.

**Jan R. Hygnstrom, Dallas R. Virchow, Kurt C. VerCauteren, and Susan B. Lembezeder** spent many hours reviewing the early drafts of the handbook chapters. Thanks are also due to the USDA-APHIS-ADC employees and other specialists who reviewed individual chapters at the request of the authors or editors.

The late **Charles W. Schwartz** graciously allowed us to use the wildlife illustrations from his books *The Wild Mammals of Missouri* revised edition, and *Charles W. Schwartz*:

*Wildlife Drawings*. His illustrations are copyrighted by the Missouri Department of Conservation and/or the University of Missouri Press. His unique talents will be greatly missed.

**René J. Lanik and Clint E.**

**Chapman** contributed their artistic talents by providing illustrations for several chapters, the binder cover design, and advertising layout.

**Emily Oseas Routman** provided several illustrations in 1984 that were used again in this most recent edition. She also drew the prairie dog that appears on the cover of the handbook and most advertising materials.

**David A. Thornhill** developed all species distribution maps and provided illustrations for several chapters.

**Diane K. Gronewald and Diana J. Smith** handled most of the telephone calls and correspondence associated with marketing the handbook. In addition, they assisted with all sorts of miscellaneous tasks such as proofreading, preparing correspondence to authors, suggesting editorial changes, and

handling orders for the handbook.

As in any such publication, there is always room for additions and changes. We invite the users of this handbook to contribute suggestions for improvement so that the next revision will be even more useful.

**Scott E. Hygnstrom**

Department of Forestry,  
Fisheries and Wildlife  
University of Nebraska  
Lincoln, NE  
68583

**Robert M. Timm**

Hopland Field Station  
University of California  
Davis, CA  
95449

**Gary E. Larson**

Eastern Region Office  
USDA-APHIS-ADC  
Brentwood, TN  
37027

# Prevention and Control of Wildlife Damage

## Table of Contents

**i** [Preface](#)

Scott E. Hygnstrom, Robert M. Timm, and  
Gary E. Larson

## **Damage Identification**

- |      |   |  |
|------|---|--|
| A-1  | Identification and Assessment of Wildlife Damage:<br>an Overview                  | Richard A. Dolbeer, Nicholas R. Holler, and<br>Donald W. Hawthorne |
| A-19 | Obtaining Assistance to Control Wildlife Damage                                   | Philip S. Gipson and Russel F. Reidinger, Jr.                      |
| A-25 | Wildlife Diseases and Humans  | Robert G. McLean   |
|      | Procedures for Evaluating Predation on<br>Livestock and Wildlife                  | Dale A. Wade and James E. Bowns                                    |
|      | Identifying and Managing Aquatic Rodents<br>in Texas: Beaver, Nutria and Muskrats | Dale A. Wade and Charles W. Ramsey                                 |

## **Rodents**

- |       |  |  |
|-------|--|--|
| B-1   | Beavers  | James E. Miller and Greg K. Yarrow                 |
| B-13  | Chipmunks  | David E. Williams and Robert M. Corrigan           |
| B-17  | Gophers, Pocket  | Ronald M. Case and Bruce A. Jasch                  |
| B-31  | Mice, House  | Robert M. Timm                                     |
| B-47  | Mice, White-footed and Deer  | Robert M. Timm and Walter E. Howard                |
| B-53  | Mountain Beavers   | Dan L. Campbell                                    |
| B-61  | Muskrats   | James E. Miller                                    |
| B-71  | Nutria   | Dwight J. LeBlanc                                  |
| B-81  | Porcupines   | Sanford D. Schemnitz                               |
| B-85  | Prairie Dogs   | Scott E. Hygnstrom and Dallas R. Virchow           |
| B-97  | Rats, Cotton   | Donald W. Hawthorne                                |
| B-101 | Rats, Kangaroo   | Volney W. Howard, Jr.                              |
| B-105 | Rats, Norway   | Robert M. Timm                                     |
| B-121 | Rats, Polynesian   | Mark E. Tobin                                      |
| B-125 | Rats, Roof   | Rex E. Marsh                                       |
| B-133 | Woodrats   | Terrell P. Salmon and W. Paul Gorenzel             |
| B-137 | Rodent-proof Construction  | Rex O. Baker, Robert M. Timm, and Gerald R. Bodman |
| B-151 | Squirrels, Belding's, California, and Rock Ground                              | Rex E. Marsh                                       |
| B-159 | Squirrels, Franklin, Richardson, Columbian,<br>Washington, and Townsend Ground | Leonard R. Askham                                  |
| B-165 | Squirrels, Thirteen-lined Ground   | Edward C. Cleary and Scott R. Craven               |

## **Rodents (continued)**

- B-171 Squirrels, Tree
- B-177 Voles
- B-183 Woodchucks

Jeffrey J. Jackson  
John M. O'Brien  
Rene M. Bollengier, Jr.

## **Carnivores**

- C-1 Badgers
- C-5 Bears, Black
- C-17 Bears, Grizzly/Brown
- C-25 Bears, Polar
- C-35 Bobcats
- C-45 Cats, Feral House
- C-51 Coyotes
  
- C-77 Dogs, Feral
- C-83 Foxes
- C-89 Mink
- C-93 Mountain Lions
- C-101 Raccoons
- C-109 River Otters
- C-113 Skunks
- C-119 Weasels
- C-123 Wolves

Fred C. Lindzey  
Scott E. Hygnstrom  
Charles J. Jonkel  
Peter L. Clarkson and Ian Stirling  
Dallas R. Virchow and Denny Hogeland  
William D. Fitzwater  
Jeffrey S. Green, F. Robert Henderson, and  
Mark D. Collinge  
Jeffrey S. Green and Philip S. Gipson  
Robert L. Phillips and Robert H. Schmidt  
Edward K. Boggess  
James E. Knight  
Edward K. Boggess  
Edward P. Hill  
James E. Knight  
F. Robert Henderson  
William J. Paul and Philip S. Gipson

## **Other Mammals**

- D-1 Armadillos
- D-5 Bats
- D-25 Deer
- D-41 Elk
- D-51 Moles
- D-59 Opossums
- D-65 Pigs, Wild
- D-71 Pronghorn Antelope
- D-75 Rabbits, Cottontail
- D-81 Jackrabbits
- D-87 Shrews

Donald W. Hawthorne  
Arthur M. Greenhall and Stephen C. Frantz  
Scott R. Craven and Scott E. Hygnstrom  
David S. deCalesta and Gary W. Witmer  
F. Robert Henderson  
Jeffrey J. Jackson  
Reginald H. Barrett  
Sanford D. Schemnitz  
Scott R. Craven  
James E. Knight  
Robert H. Schmidt

## **Birds**

|       |                                       |  |
|-------|---------------------------------------|--|
| E-1   | Birds at Airports                     | Alfred J. Godin  |
| E-5   | Bird Damage at Aquaculture Facilities | W. Paul Gorenzel, Fred S. Conte, and Terrell P. Salmon |
| E-19  | Bird Dispersal Techniques             | Thurman W. Booth                                       |
| E-25  | Blackbirds                            | Richard A. Dolbeer                                     |
| E-33  | Crows, American                       | Ron J. Johnson   |
| E-41  | Eagles                                | Bart W. O'Gara   |
| E-49  | Gulls                                 | Victor E. F. Solman                                    |
| E-53  | Hawks and Owls                        | Scott E. Hygnstrom and Scott R. Craven                 |
| E-63  | Horned Larks                          | Jerry P. Clark and Scott E. Hygnstrom                  |
| E-67  | House Finches (Linnits)               | Jerry P. Clark and Scott E. Hygnstrom                  |
| E-71  | Jays, Scrub (California)              | Jerry P. Clark and Scott E. Hygnstrom                  |
| E-75  | Kites, Mississippi                    | William F. Andelt                                      |
| E-79  | Magpies                               | Thomas C. Hall   |
| E-87  | Pigeons (Rock Doves)                  | David E. Williams and Robert M. Corrigan               |
| E-97  | Sparrows, Crowned                     | Jerry P. Clark and Scott E. Hygnstrom                  |
| E-101 | Sparrows, House                       | William D. Fitzwater                                   |
| E-109 | Starlings                             | Ron J. Johnson and James F. Glahn                      |
| E-121 | Swallows                              | W. Paul Gorenzel and Terrell P. Salmon                 |
| E-129 | Waterfowl                             | Edward C. Cleary                                       |
| E-139 | Woodpeckers                           | Rex E. Marsh   |

## **Reptiles, Amphibians, etc.**

|      |                      |   |
|------|----------------------|---|
| F-1  | Alligators           | Allan R. Woodward and Dennis N. David         |
| F-7  | Crayfish             | James F. Fowler, Wendell Lorio, and Greg Lutz |
| F-9  | Frogs and Toads      | Paul E. Moler                                 |
| F-13 | Salamanders          | James L. Byford                               |
| F-15 | Snakes, Nonpoisonous | James L. Byford                               |
| F-21 | Rattlesnakes         | Walter E. Howard                              |
| F-27 | Turtles              | James F. Fowler and Jimmy L. Avery            |

## **Vertebrate Pesticides**

|      |                                   |                   |
|------|-----------------------------------|-------------------|
| G-1  | Registered Vertebrate Pesticides  | William W. Jacobs |
| G-23 | Description of Active Ingredients | Robert M. Timm    |
| G-24 | Acrolein                          |                   |
| G-25 | Aluminum Phosphide                |                   |
| G-26 | Anticoagulants                    |                   |
| G-30 | Avitrol®                          |                   |
| G-32 | Bone Tar Oil                      |                   |
| G-33 | Bromethalin                       |                   |
| G-34 | Capsaicin                         |                   |

- G-35 Alpha-Chloralose
- G-36 Chloropicrin
- G-37 Cholecalciferol
- G-38 Denatonium Saccharide
- G-39 Egg Solids, Putrescent
- G-40 Fatty Acids (various compounds)
- G-41 Fenthion
- G-42 Gas Cartridges
- G-43 Methyl Anthranilate
- G-44 Methyl Bromide
- G-46 Naphthalene
- G-47 Red Squill
- G-48 Sodium Cyanide
- G-49 Sodium Fluoroacetate
- G-52 Starlicide®
- G-54 Strychnine
- G-56 Thiram
- G-57 Zinc Phosphide
- G-60 Ziram

**G-63 Poison Control Centers**

Blain (Jess) Benson

**G-67 Sample Labels of Representative Products**

Scott E. Hygnstrom

- G-69 Avitrol®
- G-70 ReJeX-iT™ AG-36
- G-71 ReJeX-iT™ TP-40
- G-72 ReJeX-iT™ AP-50
- G-73 Tanglefoot® Bird Repellent
- G-74 Alpha-Chloralose
- G-78 Rid-A-Bird® Perch 1100 Solution
- G-79 Purina™ Starlicide™ Complete
- G-80 Compound DRC-1339 Concentrate - Feedlots
- G-82 Compound DRC-1339 98% Concentrate - Pigeons
- G-84 1339 Gull Toxicant 98% Concentrate
- G-85 Compound DRC-1339 98% Concentrate - Livestock Depredations
- G-87 Hinder® Deer and Rabbit Repellent
- G-89 Millere® Hot Sauce® Animal Repellent
- G-90 Ro-pel® Animal, Rodent and Bird Repellent
- G-91 Ro-pel® Garbage Protector™
- G-92 Bonide® Dogzix Dog and Cat Repellent
- G-93 Sudbury™ Chaperone® Squirrel and Bat Repellent
- G-94 Eaton's® 4 the Squirrel™ Repellent
- G-95 Deer-Away® Big Game Repellent
- G-96 Gustafson Thiram 42-S
- G-98 NOTT Chew-Not Animal Repellent
- G-99 F & B® Rabbit & Dog Chaser
- G-100 Earl May® Rabbit Scat
- G-101 Talon®-G Rodenticide Bait Pack (Pellets)
- G-102 Contrac® Rodenticide
- G-103 Maki® Mini-Block
- G-104 Purina™ Mouse-A-Rest™ Pellets
- G-105 Eaton's® AC90™ Rodenticide
- G-106 Rozol® Rat and Mouse Killer

|              |   |                    |
|--------------|---|--------------------|
| G-107        | Rozol® Pocket Gopher Bait   |                    |
| G-108        | Ditrac® Tracking Powder   |                    |
| G-109        | Ditrac® Rat & Mouse Bait  |                    |
| G-110        | Eaton's® All-Weather Bait Blocks®   |                    |
| G-111        | Liqua-Tox II®   |                    |
| G-112        | Ramik® Green  |                    |
| G-113        | Rodere Paraffinized Rat Bait  |                    |
| G-114        | Eaton's® Answer™ for Pocket Gophers   |                    |
| G-115        | Eaton's® A-C 50™ Rodenticide  |                    |
| G-116        | Final® Rat & Mouse Bait   |                    |
| G-117        | Purina™ Rat Control Pellets   |                    |
| G-118        | Rodex™ Blox™-1  |                    |
| G-119        | Purina™ Assault Rat Place Pack  |                    |
| G-120        | Quintox® Rat and Mouse Bait   |                    |
| G-121        | M-44 Cyanide Capsules   |                    |
| G-122        | Sodium Fluoroacetate (Compound 1080) Livestock Protection Collar                |                    |
| G-123        | 0.5% Strychnine S.R.O. Pocket Gopher Bait                                       |                    |
| G-124        | Petersens Pocket Gopher Killer I  |                    |
| G-125        | Wilco Gopher Getter AG Bait   |                    |
| G-126        | Bonide® Moletox II  |                    |
| G-127        | Bonide® Orchard Mouse Bait  |                    |
| G-128        | Ridall-Zinc™ Tracking Powder  |                    |
| G-129        | Roban II Ag   |                    |
| G-130        | Zinc Phosphide on Wheat for Mouse Control                                       |                    |
| G-132        | Zinc Phosphide Concentrate for Muskrat and Nutria Control                       |                    |
| G-134        | Zinc Phosphide Prairie Dog Bait   |                    |
| G-135        | ZP® Rodent Bait AG  |                    |
| G-136        | ZP® Rodent Bait Place Pack  |                    |
| G-137        | ZP® Tracking Powder   |                    |
| G-138        | Phostoxin®  |                    |
| G-140        | Chlor-o-pic®  |                    |
| G-141        | Chloropicrin  |                    |
| G-142        | Brom-o-gas®   |                    |
| G-145        | The Giant Destroyer®  |                    |
| G-147        | Gas Cartridge for Woodchucks, Ground Squirrels, Prairie Dogs and Pocket Gophers |                    |
| G-148        | Gas Cartridge for Coyotes   |                    |
| G-149        | Snake-A-Way® Snake Repellent  |                    |
| <b>G-151</b> | <b>Index, Chemical and Trade Names</b>  | Scott E. Hygnstrom |
| <b>G-155</b> | <b>Index, Target Species</b>  | Scott E. Hygnstrom |

## **Supplies and Materials**

|            |                                      |                                      |
|------------|--------------------------------------|--------------------------------------|
| <b>H-1</b> | <b>Supplies and Materials</b>        | Scott E. Hygnstrom and Dale J. Hafer |
| <b>H-2</b> | <b>Bird Damage Control</b>           |                                      |
| H-2        | Exclusion                            |                                      |
| H-4        | Frightening Devices                  |                                      |
| H-8        | Repellents                           |                                      |
| H-9        | Toxicants                            |                                      |
| H-9        | Traps (Live-catch)                   |                                      |
| H-10       | Stupefying Agents (alpha-chloralose) |                                      |

## **Supplies and Materials (continued)**

### **H-10 Mammal Damage Control**

H-10 Exclusion

H-13 Frightening Devices

H-13 Repellents

H-15 Toxicants

H-20 Fumigants

H-21 Bait Application Devices and Materials

H-22 Traps

### **H-33 Index, Manufacturers and Suppliers**

Scott E. Hygnstrom

### **H-39 Index, Product and Trade Names**

Scott E. Hygnstrom