

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: an Overview	Richard A. Dolbeer, Nicholas R. Holler, and 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 Livestock and Wildlife	Dale A. Wade and James E. Bowns
	Identifying and Managing Aquatic Rodents 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, 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	Jeffrey J. Jackson
B-177	Voies	John M. O'Brien
B-183	Woodchucks	Rene M. Bollengier, Jr.

Carnivores

C-1	Badgers	Fred C. Lindzey
C-5	Bears, Black	Scott E. Hygnstrom
C-17	Bears, Grizzly/Brown	Charles J. Jonkel
C-25	Bears, Polar	Peter L. Clarkson and Ian Stirling
C-35	Bobcats	Dallas R. Virchow and Denny Hogeland
C-45	Cats, Feral House	William D. Fitzwater
C-51	Coyotes	Jeffrey S. Green, F. Robert Henderson, and Mark D. Collinge
C-77	Dogs, Feral	Jeffrey S. Green and Philip S. Gipson
C-83	Foxes	Robert L. Phillips and Robert H. Schmidt
C-89	Mink	Edward K. Boggess
C-93	Mountain Lions	James E. Knight
C-101	Raccoons	Edward K. Boggess
C-109	River Otters	Edward P. Hill
C-113	Skunks	James E. Knight
C-119	Weasels	F. Robert Henderson
C-123	Wolves	William J. Paul and Philip S. Gipson

Other Mammals

D-1	Armadillos	Donald W. Hawthorne
D-5	Bats	Arthur M. Greenhall and Stephen C. Frantz
D-25	Deer	Scott R. Craven and Scott E. Hygnstrom
D-41	Elk	David S. deCalesta and Gary W. Witmer
D-51	Moles	F. Robert Henderson
D-59	Opossums	Jeffrey J. Jackson
D-65	Pigs, Wild	Reginald H. Barrett
D-71	Pronghorn Antelope	Sanford D. Schemnitz
D-75	Rabbits, Cottontail	Scott R. Craven
D-81	Jackrabbits	James E. Knight
D-87	Shrews	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	
G-151	Index, Chemical and Trade Names	Scott E. Hygnstrom
G-155	Index, Target Species	Scott E. Hygnstrom

Supplies and Materials

H-1	Supplies and Materials	Scott E. Hygnstrom and Dale J. Hafer
H-2	Bird Damage Control	
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